## Contents

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Executive Summary</td>
<td>4</td>
</tr>
<tr>
<td>1.</td>
<td>Introduction</td>
<td>8</td>
</tr>
<tr>
<td>1.1</td>
<td>The Resource Efficiency Flagship Initiative – EU Roadmap to a Resource Efficient Europe</td>
<td>8</td>
</tr>
<tr>
<td>1.2</td>
<td>The Resource Efficiency Scoreboard</td>
<td>9</td>
</tr>
<tr>
<td>2.</td>
<td>Lead indicator</td>
<td>11</td>
</tr>
<tr>
<td>2.1</td>
<td>Resources</td>
<td>11</td>
</tr>
<tr>
<td>3.</td>
<td>Dashboard indicators</td>
<td>13</td>
</tr>
<tr>
<td>3.1</td>
<td>Materials</td>
<td>13</td>
</tr>
<tr>
<td>3.2</td>
<td>Land</td>
<td>14</td>
</tr>
<tr>
<td>3.3</td>
<td>Water</td>
<td>16</td>
</tr>
<tr>
<td>3.4</td>
<td>Carbon</td>
<td>20</td>
</tr>
<tr>
<td>4.</td>
<td>Thematic Indicators</td>
<td>27</td>
</tr>
<tr>
<td>4.1</td>
<td>Transforming the economy</td>
<td>27</td>
</tr>
<tr>
<td>4.1.1</td>
<td>Turning waste into a resource</td>
<td>27</td>
</tr>
<tr>
<td>4.1.2</td>
<td>Supporting research and innovation</td>
<td>31</td>
</tr>
<tr>
<td>4.1.3</td>
<td>Getting the prices right</td>
<td>34</td>
</tr>
<tr>
<td>4.2</td>
<td>Nature and ecosystems</td>
<td>37</td>
</tr>
<tr>
<td>4.2.1</td>
<td>Biodiversity</td>
<td>37</td>
</tr>
<tr>
<td>4.2.2</td>
<td>Safeguarding clean air</td>
<td>44</td>
</tr>
<tr>
<td>4.2.3</td>
<td>Land and soils</td>
<td>47</td>
</tr>
<tr>
<td>4.3</td>
<td>Key areas</td>
<td>52</td>
</tr>
<tr>
<td>4.3.1</td>
<td>Addressing food</td>
<td>52</td>
</tr>
<tr>
<td>4.3.2</td>
<td>Improving buildings</td>
<td>53</td>
</tr>
<tr>
<td>4.3.3</td>
<td>Ensuring efficient mobility</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Appendix 1: Country codes and definitions</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>Appendix 2: Indicator challenges and definitions</td>
<td>62</td>
</tr>
</tbody>
</table>
This is the third Resource Efficiency Scoreboard report charting progress towards a resource efficient Europe (i.e. the implementation of the Europe 2020 Resource Efficient Flagship initiative). It draws on indicators and data that were available in Eurostat’s dedicated Resource Efficiency Scoreboard website in September 2015. This report provides a description of all the indicators, as well as up-to-date trends and country analyses. It follows the publication of the previous reports in 2014 and 2015. The analysis can contribute to evaluating whether the EU is using resources more efficiently, decreasing pressures on our ‘natural capital’ like biodiversity and ecosystems, addressing key sectors and shifting towards a circular economy. The 7th Environment Action Programme to 2020 ‘Living well, within the limits of our planet’ largely contributes to meeting these objectives and, together with the subsequent 2015 Circular Economy package, will have positive impacts on using resources in a more sustainable way, while fostering future competitiveness, economic growth and employment.

Resource productivity and materials

Resource productivity, which measures how efficiently the EU uses material resources to produce products and services, has steadily improved from EUR 1.52/kg in 2002 to EUR 1.95/kg in 2014 (estimate). This growth was higher than the growth rate of gross domestic product (GDP) itself during the reporting period, which suggests a decoupling of resource use from economic output. It also suggests that circular economic activity might be beginning to develop. However, the picture across Europe is not uniform and progress of individual Member States depends on many factors.

Materials use per capita in the EU decreased from 15.4 tonnes in 2002 to 13.3 tonnes in 2014. Although most Member States reduced their materials consumption, the amount varied markedly across Europe from under 10 tonnes to over 30 tonnes per capita. Looking at the amounts and types of materials consumed in 2014, non-metallic minerals dominated, consumption accounting for 47 %, biomass and fossil energy materials each represented around a quarter of materials used (although the use of fossil fuels is steadily declining), and metal ores amounted to just 4 % of consumption.

---

2 European Commission, Resource efficiency scoreboard.
3 European Commission, Resource efficiency scoreboard reports.
4 Decision N° 1386/2013/EU of the European parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 “Living well, within the limits of our planet”.
Land, nature and ecosystems

Land is a ubiquitous, yet finite, resource which is subject to many pressures. Although the majority of Member States had less than 3% of their land area covered by buildings in 2012, urbanisation continues and ‘land take’ resulted in the loss of 52,000 km² of natural or semi-natural land. That is equivalent to an area the size of Cyprus being paved over every 10 years and is not sustainable. The productivity of built-up or artificial land (measured using purchasing power standards (PPS) per km²) varies considerably across Member States from 30 million to 70 million PPS/km². This variation is due to many factors, but particularly to the predominant type of economy (service/industrial/agricultural) and how intensively land is utilised. Member States with service-based economies are inclined to be more productive and more efficient because they tend to use less of their resources to generate GDP.

However, increasing land take and greater productivity has its price, and biodiversity across Europe is under considerable pressure. Landscape fragmentation (a consequence of continuing land take and urbanisation) can contribute to the isolation, decline and loss of wildlife populations. The pressure on biodiversity is illustrated in the steady decline in common bird species (16% decline between 1980 and 2013) and especially common farmland species (57% decline over the same period). To maintain biodiversity, spatial planning must contain urban sprawl and preserve wildlife corridors so animal and plant populations can still connect with each other. Only healthy ecosystems can offer a wide array of benefits to society – including pollination, clean air and water, erosion prevention, carbon storage and flood prevention.

Soil erosion by water (often attributed to human activities) is widespread across Europe, but it is of particular concern in areas experiencing high, and thus unsustainable, rates of erosion. In some cases, up to 25% of the land area of a Member State is affected. Soil is also showing the effects of years of intensive agriculture. Although nutrient balances across Europe are falling, there are still high levels in soils that can have wider environmental impacts. Furthermore, phosphorus is beginning to cause concern as it is becoming scarcer. Better management is required as excessive fertiliser application causes pollution and eutrophication, while insufficient fertiliser (to replace losses from intensive cropping) can lead to soil degradation and loss of fertility.

However, on a positive note, there is a gradual increase in organic farming. Between 2005 and 2013, the proportion of organically farmed land for EU27 rose from under 3.6% to 5.8%, while in EU15, the rise is more marked from 4.2% to 6.4%, with a significant increase between 2009 and 2010.

Part of the reason for an increase in erosion and high nutrient balances is the amount of food produced via intensive agriculture. Overall, the EU produces and supplies more food than its population needs – producing 3,416 kcal per capita per day. This is far more than the 2,000 – 2,600 kcal per capita per day average daily energy intake requirement set by the European Food Standards Agency. In addition, the balance between vegetal and animal products has changed very little, despite vegetal products having a lower environmental footprint than meat and dairy products. Finally, not only is too much food being produced, but a significant proportion is wasted – 90 million tonnes of food (or 180 kg per capita) are wasted each year, much of it suitable for human consumption.
Water

Water is a vitally important resource throughout Europe. Although water resources appear to be able to meet the demands placed upon them, there are signs that the future may be more challenging. A number of mainly southern European Member States are experiencing varying levels of water scarcity and stress due to overuse and lack of natural sources. However, the Scoreboard does not capture the uneven distribution of water resources nor regional or river basin level water stress (due to overuse or seasonal variations in availability) experienced by a number of Member States. For many countries, water conservation needs to be prioritised to protect aquatic environments, sustainable agriculture and industries with heavy water demands, and to safeguard public supplies. This is particularly necessary in view of predicted changes in precipitation patterns due to climate change that are likely to affect ever wider areas of Europe.

Carbon and energy

Decarbonisation is an area where the EU has made significant progress – greenhouse gas (GHG) emissions have fallen from 10.5 tonnes of carbon dioxide equivalent (tCO₂e) per capita in 2000 to 8.9 tCO₂e per capita in 2012. Some of the main contributing factors have been an increasing use of renewable energy and a shift to less carbon-intensive fossil fuels. Energy productivity has also steadily improved and was 20 % better in 2013 compared to that in 2000. This improvement was possible thanks to policy measures and innovations making energy production and distribution more efficient.

However, energy dependence rose from 47.4 % in 2001 to 53.2 % in 2013 and is a concern for the future because this trend is likely to continue as production from regional energy resources (like North Sea oil and gas) continues to decline. Additional efforts to reduce energy consumption and improve energy productivity are needed if the EU is to meet its 2030 target to save 27 % of its energy compared with the business-as-usual scenario.

Renewable energy plays a major role in future energy production and shows good progress in contributing to the energy mix. All Member States steadily increased their renewable energy generation capacity between 2004 and 2013. In 2013, 15 % of the energy used by EU28 came from renewable sources and the estimate for 2014 is 15.3 %. Four Member States are already generating over 30 % of their energy from renewable sources and it is estimated that 25 Member States should have met their 2013/2014 interim 2020 renewable energy targets.

Looking at energy consumption, despite increases in population and housing, EU energy use has been declining since 2004 with per capita final energy consumption falling to 586 kg per capita of oil equivalent in 2013. This decrease has been accompanied by a shift in fuel use, with the share of petroleum products used as domestic fuel decreasing across EU28 by an average of 2.3 % per year, falling 10 percentage points between 1990 and 2013.

Air and transport

There appears to be little change in moving towards more sustainable modes of transportation. Cars are by far the most popular means of transport, being used for 83 % of passenger journeys across Europe. Overall, the share of passenger transportation by car and the share of freight transported by road have increased slightly between 2000 and 2013 (+0.8 % and +1.7 % respectively).

However, initiatives to cut CO₂ emissions/km from new cars have been successful – the 2015 EU target of 130 g CO₂/km was achieved in 2013. Provisional data for 2014 indicates a value of 125 g CO₂/km for EU27. Emissions of pollutants have also decreased – the greatest decrease has been in non-methane volatile organic compounds (NMVOCs). This is encouraging news, particularly when overall road passenger and freight kilometres have increased (albeit only slightly).

However, air pollution in urban areas still appears to be an issue for many Member States and requires further effort in terms of monitoring and policy action.

Transforming the economy

As well as the environmental benefits, resource efficiency leads to significant economic opportunities in terms of new technologies and new ‘green’ industries, together with the associated job creation. There are also opportunities from transforming the current resource-intensive, linear-based economy (extract, manufacture, use, discard) into a circular economy, where materials are re-used.

In December 2015 the European Commission adopted an ambitious new Circular Economy Package to help European businesses and consumers to make the transition to a circular economy where resources are used in a more sustainable way (which will boost global competitiveness, foster sustainable economic growth and generate new jobs). The proposed actions will contribute to “closing the loop” of product lifecycles through greater recycling and re-use, and bring benefits for both the environment and the economy.

---

7 Ibid.
The green economic sectors (such as renewable energies, energy efficiency, retrofitting green technologies, organic agriculture, waste management and recycling) have been growing over the last decade despite the economic crisis. Recent reports suggest that green jobs across the EU rose from 2.9 million to 4.3 million between 2000 and 2012 (though some estimates put the figure as high as 7 million). Member States are becoming more efficient in the way they use resources, as materials recycling has generally increased and landfilling decreased. Overall, 6.4% less waste was being generated per capita across EU28 in 2012 compared to 2004 and the landfill rate was just 29% in 2012, which indicates that over two-thirds of Europe’s waste is being re-used, recycled or recovered (the EU recycling rate for municipal waste has increased from 25% in 2000 to 42% in 2013). However, the EU economy needs to move further towards more resource efficient patterns and a circular economy. With the publication of the new circular economy package this process should accelerate.

Eco-innovation is an important component for future sustainability and to benefit from the economic opportunities that can arise. Eco-innovation performance has improved during recent years although it varies considerably across Member States – some are better able to exploit and benefit from the economic, technological and environmental changes around them. However, more investment is required to close the gap between the current state of, and the potential for, eco-innovation in the EU.

During the last decade, there has been little progress in increasing the levels of environmental taxation in order to allocate the costs of environmental pollution and resource use to industry and consumers in line with the polluter-pays principle. The share of revenue from environmental taxes (within overall taxation and social contributions) was 6.3% in 2013 – still below the level of 10% generated by the best performing Member States and suggested by the European Commission to encourage behavioural change. Energy taxes account for the highest proportion of environmental tax revenues (75%), followed by transport taxes (20%). Pollution and resources taxation makes the lowest contribution (5%), although this is the fastest growing category of taxation. More action is needed on environmental taxation by Member States to promote greater resource efficiency and improve environmental protection across Europe. A tax shift away from labour to environment could also contribute to job creation in the EU. Furthermore, the amount of energy taxation applied to different sectors is not always in proportion to energy consumption; households in some Member States can pay twice as much in energy taxes compared to the overall amount of energy used by the domestic sector in that country. In addition, the issue of whether or not energy taxation should more closely reflect the energy consumption and environmental impact of different sectors needs to be considered more widely across Europe.

Conclusions on progress towards resource efficiency in 2015

As the Scoreboard data show, some progress towards a more resource efficient Europe has been achieved. The effects of the 2008 financial crisis are visible, but even this does not mask the overall trends, many of which are heading in a more sustainable direction. There is ample evidence of the potential benefits with the creation of opportunities through increasing eco-innovation and employment in new ‘green’ industries, which are driven by environmental policy measures.

However, there is much more to be done. The pace and scope of economic and environmental change must not only be maintained, but accelerated to fully decouple resource use from economic growth to stimulate the transition towards a circular economy and improve the long-term sustainability of the European economy. Only in this way will Europeans reduce their impact on the increasingly pressured natural world around them and continue to enjoy the lifestyles to which they have become accustomed.
1 Introduction

1.1 The Resource Efficiency Flagship Initiative – EU Roadmap to a Resource Efficient Europe

A resource efficient Europe is one of the seven flagship initiatives of the Europe 2020 Strategy that aim to bring about smart, sustainable and inclusive growth. It is the EU’s main strategy, providing a long-term framework to integrate resource efficiency across the board, in policies covering the EU economy, energy, transport, industry, raw materials, construction, agriculture, fisheries, biodiversity, regional development and cohesion. It aims to support the shift towards a resource efficient, low-carbon economy with high levels of employment, productivity and social cohesion. It is also designed to increase innovation and certainty for investment, and is backed by the European Parliament and the European Council. In 2015 the European Commission adopted a EU Circular Economy Package to help European businesses and consumers make the transition to a more circular economy. The proposed actions will contribute to “closing the loop” of product lifecycles through greater recycling and reuse.

The Roadmap to a Resource Efficient Europe outlines the structural and technological changes needed up to 2050, indicating what will be required to put Europe on a path to resource efficient and sustainable growth. A vital part of the Roadmap implementation is monitoring and communicating progress. This is why the online Resource Efficiency Scoreboard was created, with the first Highlights report published in May 2014 and the first full Scoreboard report published in May 2015.

Why is resource efficiency important?

The EU economy and the wellbeing of its 508 million inhabitants ultimately depends on the resources of the natural world. Resource efficiency is concerned with using the Earth’s resources in a sustainable manner, producing more value with fewer resources, lessening our impact on the environment and consuming in a more intelligent fashion. Part of this involves transitioning from linear economic models (where products become waste after use) to a circular economy (where the value of resources is maintained, products are re-used or recycled and materials are fed back into production), as reflected in the 2050 vision of the General Union Environment Action Programme to 2020 ‘Living well, within the limits of our planet’ and addressed by its priority objective to turn the Union into a resource-efficient, green and competitive low-carbon economy.

Resource efficiency is not just about being ‘green’ for the sake of it though. Improved resource efficiency creates new economic opportunities, stimulates technological innovation, boosts employment (especially in fast-developing ‘green technology’ sectors), opens up new export markets and benefits consumers. The new Circular Economy Package aims to boost global competitiveness, foster sustainable economic growth and generate new jobs. For example, waste prevention, ecodesign, re-use and similar measures could bring net savings of €600 billion, or 8% of annual turnover, for businesses in the EU, while reducing total annual greenhouse gas emissions by 2-4%.

Europe has already seen considerable job creation in the environmental goods and services sector, with employment increasing from 2.9 million to 4.3 million between 2000 and 2012. ‘Green’ jobs even grew by an estimated 20% during the recent recession. A 2013 report estimated there were about 7.3 million jobs in the EU across the renewable energies, energy efficiency, retrofitting, organic agriculture, waste management and recycling sectors.

Therefore, resource efficiency is a vital part of Europe’s economic future as well as its environmental and social wellbeing.

---

1.2 The Resource Efficiency Scoreboard

The Resource Efficiency Scoreboard is published online by Eurostat\(^{18}\) and is compiled using the most recent statistics from Eurostat, the European Environment Agency (EEA) and other EU/international sources.

This report presents the main findings of the Scoreboard (based on data available in September 2015) in a user-friendly format. It aims to inform European citizens and stakeholders about the progress the EU Member States have made towards a resource efficient Europe.

How the Scoreboard indicators are organised

The Scoreboard was developed using a three-tiered approach which combines 32 different indicators:

1. an overall lead indicator for ‘resource productivity’;

2. a second-tier ‘dashboard’ of complementary macro indicators for materials, land, water and carbon;

3. a third tier of theme-specific indicators to measure progress towards key thematic objectives, and the actions and milestones set out in the Roadmap.

Table 1 (below) shows the indicators included in the EU Resource Efficiency Scoreboard together with the data source.

| Theme                  | Sub theme                  | Indicator                                                      | Source     | Page |
|------------------------|----------------------------|                                                               |            |      |
| Lead Indicator         | Resources                  | Resource productivity                                          | Eurostat   | 11    |
| Dashboard Indicators   | Materials                  | Domestic material consumption (DMC) per capita               | Eurostat   | 13    |
|                        | Land                       | Built-up areas                                               | Eurostat   | 14    |
|                        |                            | Productivity of artificial land                              | Eurostat   | 15    |
|                        | Water                      | Water exploitation index                                      | Eurostat, EEA | 16    |
|                        |                            | Water productivity                                           | Eurostat, EEA | 18    |
|                        | Carbon                     | Greenhouse gas emissions per capita                          | EEA        | 20    |
|                        |                            | Energy productivity                                          | Eurostat   | 22    |
|                        |                            | Energy dependence                                            | Eurostat   | 23    |
|                        |                            | Share of renewable energy in gross final energy consumption | 2012       | 24    |
| Transforming the economy | Turning waste into a      | Generation of waste excluding major mineral wastes           | Eurostat   | 27    |
|                        | resource                   | Landfill rate of waste excluding major mineral wastes         | Eurostat   | 28    |
|                        |                            | Recycling rate of municipal waste                            | Eurostat   | 29    |
|                        |                            | Recycling rate of e-waste                                    | Eurostat   | 29    |

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub theme</th>
<th>Indicator</th>
<th>Source</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transforming the economy</td>
<td>Supporting research and innovation</td>
<td>Eco-innovation index</td>
<td>Eco-Innovation Observatory</td>
<td>31</td>
</tr>
<tr>
<td>Getting the prices right</td>
<td>Total environmental tax revenues as a share of total revenues from taxes and social contributions</td>
<td>Eurostat</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Energy taxes by paying sector – households</td>
<td>Eurostat</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Nature and ecosystems</td>
<td>Biodiversity</td>
<td>Index of common farmland bird species</td>
<td>European Bird Census Council (EBCC)/Royal Society for the Protection of Birds (RSPB)/BirdLife/Statistics the Netherlands</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Area under organic farming</td>
<td>Eurostat</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Landscape fragmentation</td>
<td>EEA</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>Safeguarding clean air</td>
<td>Urban population exposure to air pollution by particulate matter – PM$_{2.5}$</td>
<td>EEA</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urban population exposure to air pollution by particulate matter – PM$_{10}$</td>
<td>EEA</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urban population exposed to PM$_{2.5}$ concentrations exceeding the daily limit value (50 µg/m$^3$ on more than 35 days in a year)</td>
<td>EEA</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>Land and soils</td>
<td>Soil erosion by water (area eroded by more than 10 tonnes per hectare per year)</td>
<td>Joint Research Centre</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gross nutrient balance in agricultural land – nitrogen</td>
<td>Eurostat</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gross nutrient balance in agricultural land – phosphorus</td>
<td>Eurostat</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>Key areas</td>
<td>Addressing food</td>
<td>Daily calorie supply per capita by source</td>
<td>UN Food and Agriculture Organization (FAO)</td>
<td>52</td>
</tr>
<tr>
<td>Improving buildings</td>
<td>Final energy consumption in households by fuel – petroleum products</td>
<td>Eurostat</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>Ensuring efficient mobility</td>
<td>Average CO$_2$ emissions per km from new passenger cars</td>
<td>EEA</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pollutant emissions from transport – NOx, NMVOC and PM$_{10}$</td>
<td>EEA</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Modal split of passenger transport – passenger cars</td>
<td>Eurostat</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Modal split of freight transport – road</td>
<td>Eurostat</td>
<td>59</td>
<td></td>
</tr>
</tbody>
</table>

PM$_{2.5}$/PM$_{10}$ = Particulate matter less than or equal to 2.5 microns and 10 microns respectively  
CO$_2$ = Carbon dioxide  
NOx = Nitrogen oxides  
NMVOCs = Non-methane volatile organic compounds (NMVOCs)
2 Lead indicator

2.1 Resources

Resource productivity

Resource productivity is the lead indicator of the Scoreboard. It is used as a proxy for measuring resource efficiency (i.e. how efficiently the economy uses material resources to produce the products and services available in the market, known as Gross Domestic Product - GDP). It is expressed in absolute terms (i.e. EUR per kg (GDP chain-linked volumes)). This tracks how much each Member State has changed in performance over time and measures (using an index) how much Member States have improved, in percentage terms, compared with their performance in 2000 (base year 2000 = 100). If GDP grows faster compared to material consumption, resource productivity improves and economic activity is decoupled from material consumption (i.e. the economy is able to create more wealth without a proportional increase in resource consumption).

The resource efficiency of Member States is very dependent on the structure of national economies, and the size and structure of international trade. Typically, open, industrial economies consume more resources because they import large quantities of raw materials, which are later exported as finished goods. On the other hand, service economies tend to create GDP from activities that are less material intensive, so they appear more efficient because they consume fewer material resources per EUR of output. At the same time, transforming a country’s economy, towards a more circular model with less primary material input, will reduce dependency on scarce raw materials and improve competitiveness.

The trends in Member States’ resource productivity are shown in Figure 1. Member States are ranged from left to right based on the improvement in resource productivity – from Spain (which increased its productivity by 127 % between 2002 and 2014) to Malta and Estonia (which decreased by 19 % over the same period).

Overall, resource productivity for EU28 has improved from 1.52 EUR/kg in 2002 to 1.95 EUR/kg in 2014. Almost all Member States have improved over this period, with the best performers being Luxembourg, the Netherlands and the United Kingdom. The performance of these countries can be attributed to the fact their economies are dominated by the service sector (e.g. financial services), which consumes fewer material resources. Nine Member States display decreases in productivity between 2010 and 2014.

Figure 1 shows trends over time and indicates whether individual Member States’ resource productivity is improving – it cannot be used to compare performance between them. To compare the resource productivity of different countries to one another, GDP in purchasing power standards (PPS) is used and this is displayed in the map in Figure 2.

Figure 1: Resource productivity, GDP in 2005 chain-linked volumes ranked by percentage improvement 2002-2014
In 2014, the average for resource productivity for EU28 amounted to 2.01 PPS/kg. The best performers are Luxembourg, the Netherlands, the United Kingdom, Spain and Italy (all between 3.75 PPS/kg and 3.03 PPS/kg), followed by France, Belgium and Germany (all between 2.45 PPS/kg and 2.14 PPS/kg). Resource productivity in PPS is higher in countries with high income and in economies with large service sectors (financial services, tourism industry, arts and recreation, healthcare and public administration).

Member States with lower GDP, and large industrial and primary extractive sectors (e.g. forestry and/or mining) are less productive. These tend to be Member States on the fringes of the EU in northern, eastern and southern Europe. In the middle are those Member States with high income and an export-oriented manufacturing sector (Austria and Sweden) and Member States with large agricultural or extractive sectors (Ireland and Slovenia). Southern European Member States with large tourism-based economies (Malta, Greece and Cyprus) also tend to have medium-to-high resource productivity.
3 Dashboard indicators

3.1 Materials

Domestic material consumption per capita

Domestic material consumption (DMC) measures the total amount of material directly used in an economy. Figure 3 shows data for each Member State and EU28 expressed in tonnes per capita. As stated in the previous section, the amount of materials used in Member States is highly dependent on the make-up of national economies, and the size and composition of international trade. Industrial economies may require significant amounts of raw materials and physical imports, while service economies create their GDP from non-materials-based services (which require minimal inputs of materials and, therefore, have low impacts on physical flows of materials or resources). The EU action plan for the Circular Economy aims at increasing the use of secondary raw materials which are fed back into the economy, by actions focused on improving product design and production processes.

In 2014, average resource consumption amounted to 13.3 tonnes per capita, slightly less than that in 2012 when it was 13.5 tonnes per capita. This continues the downward trend which began in 2008 when it peaked at 16.5 tonnes per capita. However, consumption varies markedly across Europe. For example, Spain used around a quarter of the amount of materials consumed per capita by Finland. During the period 2002–14, 19 Member States reduced their resource consumption. However, part of this reduction may be attributable to the general economic recession in 2008 and 2009 as well as ongoing economic slowdowns (e.g. within the resource-intensive construction sectors in Ireland, Italy and Spain). At the same time (2002–14), most central and eastern European countries (plus Sweden) increased resource consumption per capita. The greatest increase was in Romania, where per capita consumption increased by 178% in the last 12 years, while in Lithuania and Estonia it has increased by 106% and 89% respectively. Between 2000 and 2014, six Member States (Malta, Bulgaria, Latvia, Poland, Sweden and Slovakia) increased their per capita consumption between 12% and 50%, mostly through sustained economic growth and large infrastructure investments.

Figure 4 shows the relative proportions of the different categories of materials measured by the indicator across the EU in 2014. Non-metallic minerals, typically used in the construction sector, dominated material consumption in 2014 representing 47% (equivalent to 6.2 tonnes per capita) of all materials consumed. Biomass and fossil energy materials each represented around a quarter of materials used (3.5 and 3.0 tonnes per capita respectively), while metal ores amounted to only 4% (0.5 tonnes per capita). Since 2005, the use of fossil energy materials has steadily declined. The other categories are more heavily influenced by economic conditions and have fluctuated significantly in recent years.

DMC will be replaced in the future by raw material consumption (RMC) when data become available. The RMC indicator will provide a better insight into consumption and resource efficiency by taking into account the materials used for the production of the goods the economy consumes (including the materials not embodied in the product). RMC will also give a better picture of the materials footprint of a country.
Using the DMC indicator, the importation of more finished goods shifts materials consumption to countries outside the EU. This gives a potentially false impression of actual improvements in resource productivity because the (physical) weight of finished goods is, by definition, lower than the sum of the weight of all the materials used to produce them. For example, the amount of imported products in Germany has doubled over the last 10 years, replacing domestic production and, consequently, reducing the need for heavy raw material imports such as metal ore concentrates.

3.2 Land

Built-up areas

Land is a finite resource and changes in its use (especially from natural, semi-natural, agricultural and forestry land to artificial land – ‘land take’) are generally irreversible and have economic and environmental impacts (such as higher risk of flooding, higher temperatures and increasing erosion in surrounding areas). The Scoreboard tracks changes in artificial land, including built-up land (roofed constructions and greenhouses) and non-built-up land (parking areas, yards and roads). Land-use data for a wide range of land types are collected using the Land Use/Cover Area frame statistical Survey (LUCAS)\textsuperscript{19}, which is repeated every three years.

According to the EEA, between 2000 and 2006, land take increased by 2.7 percentage points. This is equivalent to an additional 52 000 km\textsuperscript{2} of built-up land\textsuperscript{20} and about half of it was driven by demand for housing, services and recreation. At this pace, an area equivalent to that of Cyprus is paved over every 10 years\textsuperscript{21}.

Despite the aggregate and national figures not being fully comparable (due to methodological differences) between 2009 and 2012, most Member States have seen increases in the share of built-up land. Moreover, preliminary results from the EEA show that, overall, land cover changes were higher in the period 2006 to 2012 than those in 2000 to 2006. Figure 5 shows artificial land as a percentage of total land area and artificial land area per capita in 2012. Finland, Sweden and Cyprus had the largest areas of built-up land per capita (all are above 750 m\textsuperscript{2} per capita). In 2012, most Member States ranged between 300 m\textsuperscript{2} and 600 m\textsuperscript{2} of artificial land per capita, with only five Member States (Malta, the United Kingdom, the Czech Republic, Slovakia and Romania) having less than 300 m\textsuperscript{2} of artificial land per capita. Member States with a low population density had the lowest proportions of artificial land to total land, but had high levels of built-up land per capita. This is the case for the Baltic and northern European countries, such as Finland.

In 2012, the majority of Member States had less than 3 % of their land area covered by buildings (the EU27 aggregate is 1.5 %). Only Malta (19 %), Belgium (7.1 %) and the Netherlands (4.2 %) exceeded this level. All three countries are relatively small and densely populated. For all Member States, except Malta and Belgium, the share of non-built-up land is consistently larger than the share of built-up land. This indicates far more land across Europe is devoted to roads and parking areas than it is for buildings.

Figure 5: Built-up land as percentage of total land and as m\textsuperscript{2} per person, 2012


The Scoreboard measures the productivity of artificial land across Member States at a given moment, expressed in PPS of GDP per km² of artificial land (see Figure 6). There is ongoing work by the European Commission to develop an indicator that provides better insights into efficiency in land-use management – in particular, whether increasing land productivity is accompanied by deteriorations in natural capital.

In this context, in 2012, Luxembourg appeared to be the Member State with the most productive artificial land (over 115.5 million PPS/km²), due its GDP (see Figure 1), followed by the Netherlands and the United Kingdom (107.7 million PPS/km² and 104.4 million PPS/km² respectively). Germany, Malta and Belgium also displayed very high productivity, well above the EU average, ranging from 82 million PPS/km² to 93 million PPS/km². Germany’s performance may be the result of a successful land-management policy that was implemented in 2002 (see details in the box below). The large majority of EU Member States had a built-up land productivity of between 30 million PPS/km² and 70 million PPS/km².

Figure 6: Productivity of artificial land, 2012

Germany’s land-management strategy

In 2002, Germany introduced its Sustainable Development Strategy. Two of the strategy’s objectives were to limit excessive land use and to encourage sustainable land management. The strategy also included a key target of reducing the rate of land consumption for new settlements and transport areas to 30 hectares (ha) per day in 2020, a reduction of 75% from the 2002 figure.

In addition, there was a programme called Research for the Reduction of Land Consumption and for Sustainable Land Management (REFINA), which was run alongside the strategy until 2012. REFINA was funded by the Federal Ministry of Education and Research to support the development and testing of innovative measures that could help reduce land consumption. It funded a number of projects between 2006 and 2012 covering issues such as site appraisals, economic support tools and strategic planning.

So far, actions undertaken as part of the Sustainable Development Strategy have contributed to reduced land usage and encouraged environmental protection, nature conservation and efficient urban planning. Germany has one of the lowest levels of built-up land area per capita in the European Union (114 m²/capita) and the expansion rate of new settlements and transport areas was reduced by 40% over a decade, from 123 ha/day in 2002 to 73 ha/day in 2013²⁰.

Furthermore, over this period, the distribution of land use shifted, with the share of buildings and commercial/industrial land declining and the proportion of recreational land increasing.

²² Statistisches Bundesamt, Indikatoren zur nachhaltigen Entwicklung in Deutschland (Indicators for sustainable development in Germany), GENESIS-Online Datenbank, 2014.
3.3 Water

Water exploitation index

Water plays a central role in the functioning of the biosphere and in supporting all life. Freshwater ecosystems are particularly important, providing a unique and diverse array of services upon which human society depends. Not only is water required by households for drinking, cooking and washing, it is a key resource for many sectors: the energy, chemicals, mining and industrial sectors use it for cooling and cleaning while the agricultural, paper, food and drinks, and drinking water sectors use it as a production input. However, water is a finite resource and, in some areas, its availability is limited and the existing sources are under significant stress.

The water exploitation index (WEI) monitors water scarcity by measuring the ratio between the mean annual total amount of freshwater abstraction and the long-term average amount of available freshwater resources (see Figure 7). The indicator refers to freshwater abstraction (which includes public drinking water, industrial and agricultural uses) and a high WEI indicates water stress (i.e. overexploitation of available water resources).

The issue of water scarcity does not just concern a lack of freshwater supplies. It is also closely linked to demand for water resources. Even countries with high rainfall can experience water stress problems caused by overexploitation. Over-abstraction of freshwater can lead to shortages, which may cause degradation of freshwater habitats and threaten businesses that are reliant on water. However, it should be noted that any conclusions have to be treated with care as the indicator does not reflect the uneven spatial distribution of water resources and national data may mask water-stress situations at regional or local river basin levels. Furthermore, it does not highlight regional or local risks due to uneven conditions during different seasons.

Figure 7 shows that water stress varies markedly between Member States, partly due to different geography and climate. Member States having a lower WEI tend to have wetter climates and an abundance of lakes and rivers. There are 23 Member States with a low WEI as indicated by the blue bars (under 20 % is considered sustainable), 15 of which have a very low WEI (under 10 %). Slovakia, Latvia and Croatia are all in the bottom 1 % of the WEI.

Countries with water-stress challenges include Cyprus and Malta (WEI of 58 % and 80 % respectively) and Spain, Belgium and Italy (WEI between 24 % and 34 %). Malta and Cyprus are islands with hot dry climates and few natural water resources. Major factors putting water resources under stress in Italy and Spain are the hot, dry climates, poor quality infrastructure and heavy consumption by large agricultural sectors. Agriculture accounts for 33 % of total water use in Europe, and this can be as high as 80 % in parts of southern Europe.

Figure 7: Water exploitation index, 2013 or latest available year

Water indicators are generally of low accuracy, due to practical challenges in data collection and methodological differences at the national level. Some Member States (e.g. Belgium) include water for energy cooling in measurements of freshwater abstraction, which leads to statistical discrepancies when comparing Member States. Water abstraction is measured with different methodologies in Bulgaria, France, Cyprus, and Lithuania than in the other countries.


Belgium’s relatively high WEI could be due to its nuclear energy industry which requires very high volumes of water for cooling.

Looking at trends over time (though there are some limitations due to lack of high-quality annual data), the level of water stress appears to have remained fairly stable in most countries. Water stress levels in Belgium, Lithuania, Slovakia, Latvia, Luxembourg and Romania seem to have decreased between 2000 and 2013. The water stress in Malta and Cyprus is more variable due to these countries’ reliance on rainfall for their supplies, while other countries have greater natural resources (rivers, lakes and aquifers), which replenish quicker due to greater rainfall.

The Water Framework Directive requires Member States to improve the efficient use of water. Water pricing could become an essential tool to help countries improve the management of their water resources in the future. This is promoted in the 2015 EU Action Plan for the circular economy which also encourages the reuse of treated wastewater in order to reduce freshwater abstraction. The WEI is being reviewed to develop an improved ‘WEI +’ index that can better describe how water scarcity affects different parts of each Member State. This is because the droughts of recent years (which in some areas of central and southern Europe have been among the worst in the last 100 years) have had major impacts in countries that have a ‘healthy’ WEI. Figures from 2007 indicated that, at that time, some river basins in southern Spain had a WEI of over 100 %, and several basins in the United Kingdom and Germany were above the 20 % threshold. Furthermore, even though the WEI appears stable, the number of affected river basins, and the severity of stress in affected basins, has been increasing in recent years. In the future, the number of river basins experiencing water stress (particularly in summer, but all year round in some areas) is expected to increase by up to 50 % by 2030.

The price of water scarcity

The EEA 2012 thematic assessment on ‘Vulnerability to Water Scarcity and Drought in Europe’ estimates that at least 11 % of the European population and 17 % of its territory have been affected by water scarcity. Most of the affected areas were in southern Europe and stress mainly occurred during the summer months. However, droughts have extended into the winter months in recent years and severe water stress episodes have been recorded further north in countries that, previously, did not had such issues (for example the United Kingdom and Germany).

As well as being damaging to flora and fauna, water overexploitation and drought has severe economic impacts, with costs estimated in billions of euros. Low water volume and flows can also contribute to low water quality due to concentration of pollutants in the water. The adverse economic impacts primarily manifest themselves through reduced crop and livestock production, increases in manufacturing costs and interruptions in energy production. Secondary impacts may include increases in costs for food, energy and other products; water; and mitigation actions (such as transferring water long distances or building desalination plants). A 2006-2007 survey estimated the economic impacts of droughts over the past 30 years was EUR 100 billion across the EU, with annual costs of over EUR 6.2 billion or 0.05 % of (2006) GDP. In response to this growing issue, there is a new EU-wide policy on water scarcity – The Blueprint to Safeguard Europe’s Water Resources.

Water productivity measures the amount of economic output produced (EUR or PPS) per unit of water abstracted (m$^3$) and provides some indication of how efficiently water resources are used. However, it is not a very sophisticated measure since the indicator will be influenced by Member States’ GDP and economic make-up. Countries with high GDP and large low-water-using sectors (e.g. financial services) will perform better while countries with large agricultural and food manufacturing sectors (which use large amounts of water) will not perform as well.

Figure 8 shows that the countries with the highest water productivity (based on the latest available data) are Luxembourg (EUR 788/m$^3$ in 2013), the United Kingdom (EUR 250/m$^3$ in 2011), Denmark (EUR 214/m$^3$ in 2011) and Malta (EUR 129/m$^3$ in 2013). Most Member States’ productivity levels are under EUR 100/m$^3$: eight Member States are under EUR 50/m$^3$ and seven range between EUR 50/m$^3$ and EUR 100/m$^3$.

The higher levels for Luxembourg and Malta are partly due to the small size of the country’s agricultural and industrial sectors. Denmark’s performance is mainly due to its reliance on groundwater for drinking water. This has resulted in an extensive eco-efficiency programme (coupled with the ability to enforce compliance) along with protection zone legislation and specific technical guidelines for groundwater supplies and protection. However, Denmark’s performance has been falling, particularly in recent years. In contrast, there has been a significant growth in water productivity in Lithuania and Slovakia (95 % and 205 % growth respectively).

Water productivity model from Denmark

Denmark exhibits very safe levels of water exploitation and has the second highest water productivity level in the EU. There are a number of reasons for this enviable position.

In Denmark, water pricing and metering are used to control water consumption. The direct cost of water supply is covered by tariffs, and any environmental or resource impacts or costs resulting from water use are recovered through taxes. Between 1993 and 2004, water prices for households in Denmark increased by 54 % while daily water use per capita decreased by almost 20 % to reach one of the lowest levels in any Organisation for Economic Co-operation and Development (OECD) country. Denmark also has abstraction fees which are set at a level that ensures full cost recovery. A study by the EEA concluded that appropriate water pricing can encourage efficient water use.

In addition, Denmark has a water supply tax that is levied when water companies abstract more water than their customers pay for. This encourages water companies to repair leaks promptly and reduce wastage.

Figure 8: Water productivity (GDP 2005 chain linked volumes), selected countries, 2001-2013

---


33 The collection of data by Member States on water productivity is voluntary resulting in a number of gaps in the data series.
Figure 9 compares water productivity (in blue) and the WEI (in orange), providing an indication of how efficiently water resources are being used. In eight Member States (Luxembourg, Denmark, the United Kingdom, Slovakia, Croatia, Latvia, Slovenia and Lithuania), the use of water appears to be quite efficient (water productivity is greater than or equal to the WEI) and overall water stress is low. In 11 Member States, this trend is reversed with low productivity and increasing levels of water stress. Cyprus, Malta and Spain have relatively high levels of water exploitation (over the 20% sustainable level). However, Spain’s water productivity appears to be quite low, whereas productivity in Malta is fairly high and in Cyprus it is average.

With regards to water abstraction, Cyprus and Malta had reasonably low usage per capita, whereas the figure for Spain was quite high (although Bulgaria, Finland and Greece are higher). This suggests that, despite water resources in Malta and Cyprus being under stress, both countries use water fairly efficiently. However, it must be noted that both are islands with limited natural resources and suffer severe summer shortages, worsened by increased water use by the tourism and agriculture sectors. Water use in Spain is heavily affected by irrigation and intensive agricultural activities. The irrigable area increased by 80% between 1961 and 1996. In 2000, irrigation for agriculture represented 80% of the total water demand in Spain and nearly 90% of actual water consumption.\textsuperscript{34}

\textsuperscript{34} European Commission, \textit{The Environmental Impacts of Irrigation in the European Union}, 2000.
3.4 Carbon
Greenhouse gas emissions per capita

Decarbonisation to reduce greenhouse gas (GHG) emissions is an important part of mitigating the effects of climate change and it can also indicate the development of more resource efficient economic practices. In October 2014, the EU set a new target for 2030 of a 40 % cut in (domestic) GHG emissions compared to 1990 levels. This sends a strong signal to the market to encourage further investment in low carbon technologies and business practices35.

This indicator shows man-made emissions of six GHGs as defined by the Kyoto protocol: carbon dioxide (CO$_2$), methane (CH$_4$), nitrous oxide (N$_2$O) and the so-called F-gases (hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF$_6$)). It should be noted that the indicator only reflects emissions within national boundaries. It does not include emissions associated with goods manufactured and imported into the EU, but it does include the emissions released during production of products for export. Emissions from international aviation, maritime transport, land use, land-use change and forestry (LULUCF) (i.e. carbon stock changes in forests and agricultural soils), and emissions from the use of biomass are also excluded.

Figure 10 shows there has been an overall downward trend in GHG emissions per capita across EU28 since 2000, a trend which became more pronounced after 2005. GHG emissions have fallen from 10.5 tonnes of CO$_2$ equivalent (CO$_2$e) per capita in 2000 to 8.9 tCO$_2$e per capita in 2012, even despite a brief resurgence during the economic recovery in 2010. According to Eurostat, total emissions from fossil fuels in EU28 decreased by 5.0 % compared to those in 201336, with a few Member States delivering exceptional reductions (over 10 % for Slovakia and Denmark).

While there was a wide variation in emissions per capita across Member States, emissions for each unit of GDP for most Member States were, with the exception of a few outliers, very similar (between 0.3 kg per PPS and 0.4 kg per PPS). The most efficient economies (those with the lowest emissions per unit of GDP PPS) appear to be Sweden and France. Sweden is particularly notable in that it had low emissions per capita and low emissions for each unit of GDP making it the best performer in Europe. This is due to the use, especially in the domestic sector, of less carbon-intensive energy sources such as hydro, biomass and natural gas.

Luxembourg had high emissions per capita, but the emissions per unit of GDP were relatively low, which possibly suggests that fossil fuels were being used efficiently in the economy to generate each unit of GDP. One reason for Luxembourg’s high per capita emissions may be the relatively high production of steel (compared to its inhabitants). Another reason is that most of its emissions derive from transport (around 50 % of its GHG emissions against an EU average of around 20 %). This is likely due to ‘fuel tourism’ (sales of cheap vehicle fuel to residents of neighbouring Member States). Other factors might include significant cross-border commuting to work and the country’s location at the transport hub of Europe.

Figure 11 provides an analysis of the relative ‘efficiency’ of Member States’ economies (emission efficiency of GDP generation), by comparing GHG emissions in tonnes per capita and GHG emissions in kg per unit of GDP PPS.

Figure 10: EU28 GHG emissions (tonnes per capita), 2000-2012


36 Eurostat, Early estimates of CO$_2$ emissions from energy use, Press release, 15.06.2015.
A resilient energy union with a forward-looking climate change policy

One of the 10 priorities of the European Commission, put forward in 2014, is a European Energy Union to ensure secure, sustainable, competitive and affordable energy.

Energy is used throughout Europe to heat and cool buildings and homes, transport goods and power the economy. However, ageing infrastructure, poorly integrated markets and uncoordinated policies mean consumers (households and businesses) do not benefit from increased choice or from lower energy prices. An appropriately interconnected European energy grid could save consumers up to EUR 40 billion a year.

In February 2015, in response to this situation, the European Commission set out its plans for a framework strategy for a resilient energy union with a forward-looking climate change policy. The framework strategy sets out, in five interrelated policy dimensions, the goals of an energy union together with the detailed steps needed to achieve it. These include:

- new legislation to redesign and overhaul the electricity market;
- ensuring more transparency in gas contracts;
- substantially developing regional cooperation as an important step towards an integrated energy market;
- new legislation to ensure the supply for electricity and gas;
- increased EU funding for energy efficiency or a new renewable energy package, focusing on a European research and innovation energy strategy;
- annual reporting on the ‘State of the Energy Union’.

The framework also includes an EU target to achieve 10% electricity interconnection by 2020, which is the minimum necessary for the electricity to flow and be traded between Member States. At present, 12 Member States do not meet this minimum interconnection target. The EU has listed 137 electricity projects, including 35 on electricity interconnection which, between them, could reduce that figure from 12 to two Member States.

The first ‘State of the Energy Union’, presented in November 2015, shows there has been progress towards a low-carbon, secure and competitive economy but that additional actions are needed to ensure momentum is maintained.

---

Energy productivity

During the few last decades, the EU has become more productive in terms of energy use – the European economy has grown faster than the consumption of energy. This indicates the emergence of more sustainable economic practices and the potential decoupling of energy use from GDP. In 2013, gross inland energy consumption (the energy necessary to satisfy inland consumption) in the EU amounted to 1 666 million tonnes of oil equivalent (Mtoe), the same as it was in the early 1990s and down by 9.1 % compared to its peak of 1 832 Mtoe in 2006\textsuperscript{40}. However, no matter how good this progress may be, efforts to reduce energy consumption and improve productivity will need to increase in intensity if the EU is to reach its 2030 target to reduce energy consumption by 27 % compared with the business-as-usual scenario\textsuperscript{41}.

Figure 12 shows Member States’ energy productivity in 2013. This is defined as the ratio between GDP (calculated in PPS) and gross inland consumption of energy (coal, electricity, oil, natural gas and renewable energy sources) and is expressed as kg of oil equivalent. Energy productivity in EU Member States ranges between 3.8 PPS/kg and 11.4 PPS/kg. In Malta and Ireland, it is relatively high due to low energy consumption per capita, which results in relatively higher energy productivity.

Figure 13 shows that energy productivity has steadily improved over time. Between 2000 and 2013, there was an overall 20 % improvement in energy productivity for EU28. However, energy productivity improved at different rates across Member States, ranging from 90 % in Lithuania to 4 % in Austria (not shown in the graph). The most significant improvements took place in eastern European countries such as Lithuania (+90 %), Slovakia (+76 %), Romania (+88 %), Bulgaria (+60 %) and Poland (+43 %). This impressive looking improvement is due to their low starting base, which means it is relatively easier to make greater improvements. In 2000, their energy productivity was very low, ranging from 2.4 PPS/kg to 4 PPS/kg and, while energy productivity has undoubtedly improved, Figure 12 shows they are still all below-average performers.

---

\textsuperscript{40} Eurostat news release Energy production and consumption in 2013, 9.02.2015.

\textsuperscript{41} European Commission, 2030 Energy Strategy, accessed 18.08. 2015.
Although more GDP is being produced per unit of energy used, structural changes in economies (e.g. increasing imports of finished products rather than raw materials) are important components of this trend. Total in-country consumption figures do not account for energy used during the production process of imported goods, which can be substantial in the metal and mineral industries.

**Energy dependence**

Energy dependence gives an indication of how resilient Member States are with regards to energy generation and how reliant they are on energy imports for their energy needs. This indicator shows the relationship between net imports and total gross inland energy consumption. Exchanges with other EU Member States are included and, for EU28, the indicator covers trade (imports/exports) with non-EU countries and highlights a real dependence on energy imports. The level of energy dependence is important because energy security, supply and price shock issues can have significant negative effects on European economic activities and public finances.

Figure 14 shows that all Member States had to import energy in 2013 and dependence levels varied from 12 % (Estonia) to 100 % (Malta). Overall, the situation for EU28 was quite challenging, with dependence on imported energy rising from 47.4 % in 2001 to 53.2 % in 2013. In 2013, 16 Member States imported over 50 % of their energy and four Member States (Malta, Luxembourg, Cyprus and Ireland) imported over 80 % of their energy. Four Member States (Poland, the United Kingdom, Lithuania, and Denmark) showed dramatic increases in their dependency on energy imports (over 50 % in the case of the United Kingdom). These changes can have very specific and different explanations across Member States. For example, Lithuania increased to 81.8 % from 49.9 % in 2009. This is due to a decrease in production of nuclear energy following the closure of a nuclear power plant. Falling production from the North Sea has eroded Denmark’s self-sufficiency since 2004 and, in 2013, it changed from being a net energy exporter (the only Member State in this position) to a net importer, importing 12.3 % of its energy needs. The UK has moved from being a net exporter in 2001 to importing 46 % of its energy in 2013. This is due to North Sea production peaking in 1999, which led to the UK becoming an energy importer again in 2004. Between 2010 and 2013, the amount of imported energy increased sharply due to the general decline in North Sea oil and gas output. In total, 19 Member States reduced their energy dependence, by between 0.5 % (Ireland and Luxembourg) and 20 % (Estonia).

**Figure 14: Energy dependence, 2001 and 2013**

---

42 Danish Energy Agency, Press Release: Lowest Danish energy consumption in 32 years, 27.03.2015.
43 UK Department of Energy and Climate Change, UK Energy in Brief 2014.
Share of renewable energy in gross final energy consumption

The use of renewable energy in the EU has grown strongly in recent years, prompted by a series of legally binding targets for renewable energy, the latest of which is a 27% share of renewable energy consumption by 2030. To be more sustainable and have better protection against potential energy supply issues, the EU needs to improve energy efficiency and reduce its overall dependency on imports by reducing demand and developing renewable energy sources. Increasing renewable energy production will help with this and contribute to cutting EU GHG emissions.

Figure 15 shows the proportion of energy derived from renewable sources (wind, solar, hydroelectric, tidal, geothermal and biomass) that is used across EU28. Every Member State has shown clear improvements in the amount of renewable energy generation and consumption. Four Member States are already generating over 30% of their energy from renewable sources and Sweden in particular makes use of its extensive hydropower and other resources to generate 52.1% of its energy.

One of the EU’s 2020 targets is to generate 20% of European energy from renewable resources and this overall target has been translated into national targets for each Member State. Figure 15 shows the share of renewable energy in gross final energy consumption together with the EU and national 2020 targets. Sweden, Estonia, Lithuania and Bulgaria have already reached their 2020 targets. The most recent progress report indicates that 25 EU countries should have met their 2013/2014 interim targets.

In 2013, 15% of the energy used by EU28 came from renewable sources and the estimate for 2014 is 15.3%.

In many countries, strong development of the renewable heating sector was important for Member States reaching and exceeding their 2013/14 interim targets. Development in Bulgaria, Finland and Sweden has mainly been driven by low-cost biomass. This development, while positive in terms of reducing the use of fossil fuels, has a range of potential negative impacts such as increased CO₂ emissions, increased energy inputs (e.g. use of fertilisers) and biodiversity loss due to the current major sources of supply – low-cost biomass production from intensive forests, cropland and grasslands.

The main growth in electricity generation between 1990 and 2013 was in hydropower, which increased by 28% to be the main renewable energy source used in electricity production (43%). However, its share fell by 11% from 2012 to 2013 due to the more rapid expansion of other renewable generation sources. Solar photovoltaic (PV) and wind, in particular, have increased considerably – wind power generation has more than tripled over the period 2005 to 2013 and PV power generation has increased rapidly in recent years, accounting for 10% of all renewable electricity in 2013.

The EU and an overwhelming majority of Member States are on course to meet the 2020 strategy targets. However, the trajectory is becoming steeper and some Member States may need to intensify their efforts to keep on track, and may need to resort to using the cooperation mechanisms with other Member States to meet their targets.

The use of renewable energy (predominantly biofuels) as a transport fuel has also grown from almost nothing in 1990 to account for 5.1% of energy used in transport in 2012. However, progress in the past five years towards the 2020 target of a 10% share, has been slow – with a projection of only 5.7% renewable energy in transport in 2014.

---

46 Ibid.
47 Ibid.
There is growing evidence that the continued development of renewable energy industries across Europe will further encourage technological innovation and employment in Europe. Even conservative estimates suggest benefits to GDP and the creation of over 200,000 new jobs by 2020 if investments in renewable energy simply continue on their current path. However, a moderate increase in effort by Member States could raise the figure to over 400,000.

Case study – The employment and economic potential of renewable energy

The renewable energy industry recorded strong energy production and economic growth between 2005 and 2010, but the development slowed down during the recession.

In 2013, the sector generally maintained employment and economic activity levels compared to those in 2012. There are around 1.15 million people directly or indirectly employed in the EU’s renewable energy sector, but there has been a downward trend in renewables-related employment in the last three years. EurObserv’ER recorded a decline of around 54,000 jobs between 2012 and 2013.

The photovoltaic (PV) sector experienced the highest job losses (77,000 throughout Europe), but there was weak growth across other technologies – wind power added 7,000 jobs, biomass added 14,000 and heat pumps added 4,000 job. However, these additions were unable to compensate for the contraction within the PV sector.

Biomass and wind energy are the largest sectors, employing 312,000 and 302,000 people respectively. Germany is the largest renewable energy employer with 363,000 jobs (despite the loss of 40,000 PV-related jobs), France is the second largest (177,000 jobs), followed by the UK and Italy (99,000 jobs and 95,000 jobs respectively).

In 2013 the renewable energy industry had a total turnover of EUR 138 billion, mostly due to wind (EUR 39.8 billion), solid biomass (EUR 36 billion) and PV (EUR 22 billion). Germany has the highest turnover (EUR 31 billion – 22% of overall share), followed by France (EUR 17.6 billion – 12% of overall share), the UK (EUR 15.4 billion – 11% of overall share), Italy (EUR 13.9 billion) and Denmark (EUR 12.5 billion). Despite these impressive statistics, the pace of development slowed in larger countries in 2013 (in some cases, large job losses were experienced), while the labour market has shown positive trends in some smaller countries. However, the figures vary notably according to technologies, with negative trends often limited to mature technologies.

New momentum for economic growth and job creation might emerge from the exploitation of rapidly expanding international markets in Asia, South America and, more recently, in Africa. A big question for the industry is how far the EU 2030 targets will stimulate the revitalisation of renewables in Europe. The revision of the EU Emissions Trading System (ETS) will be vital for further market growth.

---

49 Results vary according to assumptions. See Fraunhofer ISI et al., EmployRES: The impact of renewable energy policy on economic growth and employment in the European Union, Final report, 27.4.2009.

Case study – Wind energy in Denmark

Denmark is a country with strong winds and a long coastline, providing it with optimal conditions for the development of onshore and offshore wind power.

The country’s 2012 Energy Agreement includes plans to significantly expand the wind power sector by 2020, with targets for more than 30 % renewable energy in final energy consumption and approximately 50 % of electricity consumption to be supplied by wind power. Its ultimate goal is to achieve a target of 100 % renewable energy in the energy and transport sectors by 2050.

In 2013, Denmark generated 27.2 % of its energy from renewable sources and the country has one of the EU’s most developed renewable energy sectors. This figure has increased by 79 % in the last decade and the Energy Agreement has been a key driver for further change. Wind power has been a key contributor to progress, with installed capacity steadily increasing to 4 890 MW in 2014.

In addition to the environmental benefits of using wind power to cover part of Denmark’s energy needs, the sector has also created jobs. According to the 14th EurObserv’ER report on the State of Renewable Energies in Europe, Denmark had the eighth highest number of wind power jobs in Europe in 2013 (37 500). The Danish Government estimates that meeting the 2020 Energy Agreement targets will create between 10 000 and 11 000 jobs by 2019.

Community projects are a feature of wind power developments in Denmark. There are many wind turbine cooperatives throughout the country, each typically having up to three wind turbines on land next to smaller towns or industrial areas. Some 40 000 Danes are part owners or individual owners of some of the more than 5 200 wind turbines in Denmark.

Despite once more becoming a net energy importer in 2013 (due to falls in production from the North Sea), Denmark occasionally generates more energy than it needs. Unusually high winds on Thursday 9 July 2015 enabled Denmark to generate as much as 140 % of its electricity needs at that time. The excess power was exported to Germany, Norway and Sweden.

Case study – Growth of EU renewable capacity

The EU’s power sector continues to move away from fuel oil, coal, nuclear and gas as it increases wind and PV generating capacity.

In 2000, new renewable energy installations had a capacity of 3.6 GW. However, since 2010, annual renewable capacity additions have been between 24.7 GW and 34.6 GW – eight to ten times higher than that in 2000. The share of renewables in total new power capacity has also grown. In 2000, the 3.6 GW represented 22.4 % of new power capacity installations, increasing to 21.3 GW representing 79.1 % in 2014. Since 2000, 412.7 GW of new power capacity has been installed in the EU. Of this, 29.4 % has been wind power, 56.2 % other renewables and 91.1 % renewables and gas combined.

Wind power surges ahead

In 2014, the EU’s grid-connected wind energy capacity reached 129 GW, equivalent to 8 % of European electricity demand. The continued growth of the industry means that at least 12 % of the EU’s electricity should come from wind energy by 2020. This is a significant contribution to the European target of generating 20 % of its energy from renewable sources. This development means that six countries – Denmark, Portugal, Ireland, Spain, Romania and Germany – generate between 10 % and 40 % of their electricity from wind.

The net growth since 2000 of wind power (116.8 GW), gas (101.3 GW) and PV (87.9 GW) has been at the expense of fuel oil (down 25.3 GW), coal (down 24.7 GW) and nuclear (down 13.2 GW). The other renewable technologies (biomass, hydro, waste, geothermal and ocean energies) have also been increasing, although at a slower rate than wind power and PV.

51 Danish Energy Agency, Danish Climate and Energy Policy, Accessed August 2015.
54 Danish Ministry of Climate, Energy and Building, Energy policy report 2013, April 2013.
55 Energy Transition, Morris C, Pehnt M, Energy Transition The German Energiewende, Chapter 5C: Denmark is putting its money on wind, Released 28 November 2012, Revised July 2015.
56 Energinet.dk.
58 European Commission Joint Research Centre Wind energy provides 8% of Europe’s electricity, 23 July 23 2015, accessed 18 August 2015.
4 Thematic indicators

4.1 Transforming the economy

4.1.1 Turning waste into a resource

Generation of waste excluding major mineral wastes

Reducing the amount of waste generated through prevention and re-use is an important component in improving resource and materials efficiency. It also contributes towards the development of a circular economy that enables society to maximise the economic returns on scarce resources. Europe could gain many benefits from treating waste as a resource including reducing environmental pressure, securing vital resources, creating jobs and boosting competitiveness. The European Commission has produced revised legislative proposals for waste which define clear targets for reducing waste and sets out an ambitious and credible long-term path for waste management and recycling\(^{59, 60, 61, 62}\).

Figure 16 shows that, overall, less waste is being generated across Europe – 6.4 % less waste was being generated per capita across EU28 in 2012 compared to that in 2004\(^{63}\). Waste generation per capita has fallen (red boxes below the 0 % variation line) in more than half of Member States. This suggests that many Member States are producing and consuming goods more efficiently and it provides tentative evidence that a decoupling of economic growth and materials use is taking place.

Due to differences in national data collection methods and over time\(^{64}\), waste statistics need to be used with caution, but despite this there are some clear trends. In 2012, Croatia, Latvia, Malta and Cyprus exhibited the lowest levels of waste generation per capita, but they show different trends. In Cyprus waste generation reduced by 60 % between 2004 and 2012, whereas in Latvia it increased by 68 %. Members States generating the highest levels of waste in 2012 include Estonia, Finland and Belgium, but in Estonia and Finland the overall trend is downwards.

---


\(^{63}\) The data for Austria, Portugal, Sweden and Ireland show a break in series in 2010 due to methodological changes in data collection in these countries.

\(^{64}\) Austria, Belgium, Denmark, Portugal, Ireland and the United Kingdom changed their method of data collection between 2004 and 2010, which has impacted the percentage changes.
Landfill rate of waste excluding major mineral wastes

On the waste hierarchy, landfill is the least preferred option for dealing with waste because landfilled resources are lost to the economy and can have adverse environmental impacts due to the production of methane and leachate. As resources become scarcer and more valuable, the EU has to move towards a circular economy. A circular economy is where, at the end of their life, products and materials are not disposed of to landfill, but are recovered and put back into the cycle of production and use. In 2015, the European Commission produced a revised legislative proposal on the landfilling of waste which set a binding target to reduce landfill to a maximum of 10% of municipal waste by 2030.

The overall EU landfill rate was just 29% in 2012 (Figure 17), which indicates that over two-thirds of Europe’s waste is being re-used, recycled or recovered. Nine Member States had landfill rates of less than 20%, namely Luxembourg, the Netherlands, Denmark, Belgium, Austria, Sweden, Germany, Finland and Slovenia. A further 11 Member States (mainly in eastern and southern Europe) had landfill rates of over 50% (in two, the landfill rate is over 80%). This indicates that these countries need to do much more to improve resource efficiency and divert materials away from landfill. On a positive note, nearly all Member States have reduced their landfill rates since 2010, with exceptionally good performance recorded by Latvia (a 32 percentage point improvement) and Slovenia (a 16 percentage point improvement).

There tends to be a strong correlation between low landfill rates and high recycling rates, although large-scale use of energy-from-waste technologies can also result in low landfill rates.

Figure 17: Landfill rate of waste (excluding major mineral wastes), 2012

Recovering energy from waste can reduce demand for primary energy sources. However, as the resources are irrevocably lost from the economic system, energy from waste should, ideally, only be used for waste that cannot be recycled.

Landfill tax is one of the policies driving landfill diversion in a number of EU countries. It has been very successful in diverting waste from landfill towards other options further up the waste hierarchy. As well as landfill tax, four Member States (Austria, Germany, Sweden and the Netherlands) have bans on sending some biodegradable wastes or recyclable materials to landfill. This has resulted in their landfill rates being among the lowest in Europe.

---

Recycling rate of municipal waste

Materials recovery is a vital component for a resource efficient Europe. Recycling reduces the demand for raw materials, leading to reduced demand for primary resource extraction and, generally, decreases the negative environmental impacts of waste generation. Recycling is also a useful indicator for sustainability and the development of more circular economic patterns. In the 2015 revised legislative proposal on waste, the European Commission set a common EU target for recycling 65% of municipal waste by 2030\(^66\).

This indicator covers municipal waste only, which includes household waste and waste from small businesses and institutions collected by, or on behalf of, municipalities. It excludes industrial and agricultural waste.

Figure 18 shows that, for the great majority of Member States, recycling rates have increased significantly in the last decade and have done so regardless of economic conditions. The overall EU recycling rate has increased from 25% in 2000 to 42% in 2013. Countries with the highest recycling rates are Germany (64.5%), Austria (56.1%) and Belgium (55%). Although Austria has the second highest recycling rate, its rate has in fact fallen by over seven percentage points since 2000. A further six Member States have recycling rates of between 42% and 50%. The United Kingdom and Slovenia have seen the greatest improvements in their recycling rates during this period, increasing by over 30 percentage points\(^67\).

Overall, the trend is a positive one with many Member States significantly increasing their recycling rates. However, progress is slowing down and Europe is still wasting vast quantities of valuable resources in landfills or energy-from-waste plants.

Recycling rate of e-waste

Electrical and electronic equipment (EEE) use a range of valuable resources in their manufacture (e.g. precious and rare earth metals) and these resources are of strategic importance to European industry. They are also associated with high environmental impacts. In addition, waste electrical and electronic equipment (WEEE or e-waste) can contain hazardous substances.

As electronic and electrical products have become more widespread and complex, and replacement rates have increased, the amount of such waste has increased dramatically. Fortunately, many of them can be recovered through recycling so that the environmental impact is reduced, the valuable materials are recycled within the economy and the adverse impacts from landfilling are avoided.

The recycling rate indicator for e-waste is defined by the ‘total collection’ in the given year divided by the average annual weight of EEE put on the market during the three preceding years, multiplied by the ‘re-use and recycling rate’ (how much of the WEEE that enters recycling facilities is actually recovered).

---


\(^67\) The data for Austria, Portugal, Sweden and Ireland show a break in series in 2010 due to methodological changes in data collection in these countries.
Figure 19 shows the recycling rate for e-waste in 2010 as calculated on the basis of the recycling rate indicator. While the data are interesting, detailed comparisons are unfortunately not possible as data are unavailable for a number of countries and there are differences between Member States in the interpretation of the definition and scope of WEEE. However, Figure 19 does indicate a wide variation in WEEE recycling rates across Europe, from just above 10% to over 50% and that five Member States (Sweden, Bulgaria, Denmark, Slovakia and Lithuania) have achieved recycling rates of over 40%.

The WEEE Directive requires Member States to achieve a minimum annual collection rate by 2019 of either 65% of the average weight of EEE placed on the market in the three preceding years in the Member State concerned or 85% of WEEE arising in the territory of that Member State. Figure 19 shows that, in 2012, eight Member States were recycling under 30% of their WEEE. This indicates that some Member States will have to make significant efforts by 2019 to achieve the collection targets set out in the Directive.

The benefits of recycling for a greener economy

Recycling has an important contribution to make to improving sustainability and the economy. The industry has grown steadily since 2004 and in 2009 the gross value added (GVA) by the recycling sector amounted to EUR 11 billion. Precise data on employment are not available, but a conservative estimate suggests that overall employment in the recycling sector has increased from 422 per million inhabitants in 2000 to 611 per million inhabitants in 2007 (45% increase). The industry is relatively recession proof as well. Despite the recession impacting several industry trends, the recycling and waste management sector showed clear signs of recovery in the second half of 2009 and was able to maintain its rate of recovery throughout the period of crisis.

Closing the loop – An EU action plan for the circular economy

In December 2015 the European Commission adopted an ambitious new circular economy package, to stimulate Europe’s transition towards a circular economy, which will boost competitiveness, create jobs and generate sustainable growth, by ensuring that resources are used in a more sustainable way. The action plan covers the full life cycle: from design, production and consumption to waste management and the market for secondary raw materials.

The circular economy package includes:

- An action plan on the circular economy which sets out measures to “close the loop” of products and materials cycles, targets market barriers in specific sectors or material streams, (such as plastics, food waste, critical raw materials, construction and demolition, biomass and bio-based products), as well as horizontal measures in areas such as innovation and investment;
- Revised legislative proposals on waste, establishing a clear and ambitious long-term vision to increase recycling and reduce landfilling, and proposing concrete measures to address obstacles on the ground in terms of improvement of waste management.

Waste prevention, eco-design, re-use and similar measures could bring net savings of EUR 600 billion (or 8% of annual turn-over) for business in the EU, while reducing total greenhouse gas emissions by 2 - 4%. Finally, the impact assessment for the waste proposals estimated that more than 170,000 direct jobs could be created by 2035, most of them impossible to delocalize outside the EU.

---

68 See Appendix 2 for a precise definition and calculation methodology.
71 Op. cit. (5).
73 Ellen MacArthur Foundation, the McKinsey Centre for Business and Environment and the Stiftungsfonds für Umweltökonomie und Nachhaltigkeit (SUN), Growth within: a circular economy vision for a competitive Europe, June 2015.
4.1.2 Supporting research and innovation

Eco-innovation index

Moving towards a resource efficient and circular economy requires a systematic change in our production and consumption patterns. Innovations, and in particular eco-innovations, play a major role in developing new technologies, processes, products and services, and business models. Supporting innovative projects, that are relevant to resource efficiency and the circular economy, is a key action of the EU Circular Economy Package, the Horizon 2020 work programmes (2014–15 and 2016–17) and the Eco-innovation Action Plan.

An important indicator measuring innovation and R&D is the Eco-innovation index (sometimes referred to as the Eco-Innovation Scoreboard). This assesses and illustrates eco-innovation performance across EU Member States by capturing the different aspects of eco-innovation using 16 indicators. These indicators are grouped into five thematic areas: eco-innovation inputs, eco-innovation activities, eco-innovation outputs, resource efficiency and socio-economic outcomes (see the box below for more detail). The index shows how well individual Member States perform across different dimensions of eco-innovation compared to the EU average (set at 100), and highlights their strengths and weaknesses.

The Index is published annually by the Eco-Innovation Observatory. It aims to present a holistic view of economic, environmental and social performance and, in particular, measure innovations that reduce the use of natural resources and decrease the release of harmful substances across the whole life-cycle of products.

**Figure 19: Recycling rate of e-waste, 2012**

![Graph showing recycling rate of e-waste, 2012](image)

---

**Measuring eco-innovation in the EU**

*The EU Eco-Innovation Scoreboard measures the relative eco-innovation performance of EU countries against the EU average.*

The scoreboard, which was published for the fourth time in 2013, is based on 16 indicators. These indicators are divided into five components covering eco-innovation inputs (including early-stage investments in cleantech), eco-innovation activities (such as the percentage of firms taking resource efficiency measures), eco-innovation outputs (such as relevant patents), resource efficiency performance and socio-economic outputs (such as data on turnover, employment and exports). Indicators developed to reflect eco-innovation turnover and employment cover waste, recovery and recycling, and, for the first time, repair, maintenance and rental services.

The eco-innovation index is calculated by the (unweighted) mean of the 16 indicators. These indicators are normalised (made comparable) by measuring their distance from the EU average. For a list of eco-innovation indicators, see next page.

---

75 For more information see the Eco-innovation Action Plan.

76 Additional information is available on the Eco-Innovation Observatory website [www.eco-innovation.eu](http://www.eco-innovation.eu).
List of eco-innovation indicators, sources and year

<table>
<thead>
<tr>
<th>Name of indicator</th>
<th>Source</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Eco-innovation inputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Governments environmental and energy R&amp;D appropriations and outlays (% of GDP)</td>
<td>Eurostat</td>
<td>2012</td>
</tr>
<tr>
<td>1.2 Total R&amp;D personnel and researchers (% of total employment)</td>
<td>Eurostat</td>
<td>2012</td>
</tr>
<tr>
<td>1.3 Total value of green early-stage investments (USD/capita)</td>
<td>Cleantech</td>
<td>2010-2013</td>
</tr>
<tr>
<td>2. Eco-innovation activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Firms having implemented innovation activities aiming at a reduction of material input per unit output (% of total firms)</td>
<td>Eurostat</td>
<td>2008</td>
</tr>
<tr>
<td>2.2 Firms having implemented innovation activities aiming at a reduction of energy input per unit output (% of total firms)</td>
<td>Eurostat</td>
<td>2008</td>
</tr>
<tr>
<td>2.3 ISO 14001 registered organisations (per million population)</td>
<td>ISO survey of certifications</td>
<td>2012</td>
</tr>
<tr>
<td>3. Eco-innovation outputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Eco-innovation related patents (per million population)</td>
<td>Patstat</td>
<td>2010</td>
</tr>
<tr>
<td>3.2 Eco-innovation related academic related publications (per million population)</td>
<td>Scopus</td>
<td>2012</td>
</tr>
<tr>
<td>3.3 Eco-innovation related media coverage (per numbers of electronic media)</td>
<td>Meltwater</td>
<td>2013</td>
</tr>
<tr>
<td>4. Resource efficiency outcomes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1 Material productivity (GDP/DMC)</td>
<td>Eurostat</td>
<td>2011</td>
</tr>
<tr>
<td>4.2 Water productivity (GDP/water footprint)</td>
<td>Water Footprint Network</td>
<td>1996-2005</td>
</tr>
<tr>
<td>4.3 Energy productivity (GDP/gross inland energy consumption)</td>
<td>Eurostat</td>
<td>2011</td>
</tr>
<tr>
<td>4.4 GHG emissions intensity (CO₂e/GDP)</td>
<td>EEA</td>
<td>2011</td>
</tr>
<tr>
<td>5. Socio-economic outcomes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1 Exports of products from eco-industries (% of total exports)</td>
<td>Eurostat</td>
<td>2012</td>
</tr>
<tr>
<td>5.2 Employment in eco-industries and circular economy (% of total employment across all companies)</td>
<td>Thomson One</td>
<td>2012</td>
</tr>
<tr>
<td>5.3 Revenue in eco-industries and circular economy (% of total revenue across all companies)</td>
<td>Thomson One</td>
<td>2012</td>
</tr>
</tbody>
</table>

The score assigned to each country is intended to provide a snapshot of eco-innovation performance in diverse areas. The scores can be influenced by many structural factors, such as the relative importance of different industrial sectors or the economic trends in each country. Because it is measured against the EU average, the Eco-Innovation Index does not track absolute eco-innovation performance over time (i.e. whether the performance of each country is improving or not).

Since the first edition of the Scoreboard, northern and western EU countries have tended to outperform their eastern and southern counterparts. The main exception is Spain, which was about average in 2010, but between 2011 and 2013 has scored 10 to 28 points above the EU average.

Information about the 2013 Eco-Innovation Scoreboard, and links to data and visualisation tools, are available in the on-line Eco-Innovation Observatory’s database at: www.eco-innovation.eu
Figure 20 shows the eco-innovation performance of Member States compared to the EU average (100). Although the index cannot be used to make direct comparisons from year to year, there are some general trends that can be discerned. Firstly, in the four years for which data are available (2010-2013), the top eco-innovating Member States have consistently been Finland, Sweden, Germany and Denmark. Secondly, the better innovators are generally those Member States in northern and western Europe. Thirdly, rates of eco-innovation improvement vary across Members States – Spain, Luxembourg, Estonia and Lithuania have all achieved greater improvements in their positions relative to other Member States. While some Member States are relatively stable, a few have experienced reasonably significant reversals in their positions.

Data for the individual eco-innovation categories (for details see box ‘Measuring Eco-innovation in the EU’ in section 4.1.2) show some interesting differences in performance across Member States in 2013 (see Figure 21).

Finland and Sweden stand out from other Member States as the best performers in terms of eco-innovation inputs. However, looking at eco-innovation activities, Spain, Denmark and the Czech Republic occupy the top three positions with Spain being particularly prominent, having a much higher score than its nearest neighbour, Denmark. The top performers in terms of eco-innovation outputs are Denmark, Sweden, Finland, Germany and Austria.

For resource efficiency outcomes, the UK, Luxembourg and the Netherlands are the best performers.

As regards socio-economic outcomes, the Member States with the highest figures are the United Kingdom, Germany, France, Finland, Spain, Belgium and Sweden.
4.1.3 Getting the prices right

**Total environmental tax revenues as a proportion of total revenues from taxes and social contributions**

Environmental taxes can be an effective market-based way to support and help achieve environmental policy objectives. They can provide strong signals to change behaviours in order to reduce pollution, improve resource efficiency or move towards a circular economy. The revenue gained can reduce other, more distorting, taxes (e.g. labour) or re-invested in ‘greener’ infrastructure and initiatives.

In 2013, the share of environmental taxes as a percentage of total tax revenues in the EU is around 6 % (see Figure 22). Recent estimates suggest that a 10 % share for environmental taxes would ensure a level playing field and give a clear signal to foster sustainable behavioural change. The share for environmental taxes has remained fairly static and declined slightly from 6.37 % to 6.32 % between 2006 and 2013. The share of environmental taxes was falling between 2003 and 2008, but increased in 2009 due to falls in other taxation as a result of the downturn in economic activity and decreases in income and corporate tax revenue. Since 2009, the share of environmental tax revenues has stabilised.

When compared with labour taxes (see Figure 23), the share of environmental taxes is low. The share of labour taxes has remained high at around 50 % of all taxation – between 2006 and 2012, labour taxation rose by 2.2 percentage points from 48.8 % to 51 %.

There are a number of possible explanations for the overall reduction in the share of environmental taxation. Environmental taxes are often calculated in units of physical consumption or waste produced and are frequently fixed in nominal terms. Furthermore, they are not usually indexed and would naturally lose their value in relation to taxes on labour and capital, which are calculated on bases (such as salaries and capital) that increase in value over time.

Overall, energy taxes account for the highest proportion of environmental tax revenues (75 %), followed by transport taxes (20 %) with pollution/resources taxation making the lowest contribution (5 %). Taxes on resources and pollution are the fastest growing category of taxation. However, in most countries, they are still quite a relatively low share of all taxes (below 5 % of environmental tax revenues or 0.31 % of total taxes).

---

**Figure 22: EU28 environmental taxes (as a share of total revenues from taxes and social contributions) by category, 2006-2013**

**Figure 23: EU28 labour and total environmental taxes (as a share of total revenues from taxes and social contributions), 2006-2012**

---

Figure 24 looks at the share of revenues from taxes and social contributions for Member States in 2005 and 2013. Considering the desirable 10% environmental tax threshold mentioned previously, the contribution that environmental taxes make to Member States’ total tax revenues ranges from 4.5% in France to over 10% in Bulgaria and Slovenia. Some Member States have increased the share of environmental taxes in the past seven years, with Greece and Slovenia increasing their share by more than 2 percentage points to 9.4% and 10.5% respectively. Other Member States, for example Lithuania and Bulgaria, have increased environmental taxes, but only by small amounts. The Netherlands, Croatia, Denmark and Malta have very high levels of environmental taxes although their share has been dropping since 2006. Of concern is that the proportion of environmental taxes has substantially decreased in several Member States such as Portugal, Malta, Luxembourg and Cyprus.

The actual make-up of environmental taxes varies between countries, although for virtually all Member States taxation on energy makes up the largest share. Malta, Denmark and Ireland have relatively high transport taxes, while the Netherlands, Slovenia and Croatia have high taxes on pollution and resource use.

**Environmental taxation in the Netherlands**

The Netherlands has levied environmental taxes since 1970.

Today, the country has the fifth highest share of environmental taxes in the EU, with environmental tax contributions representing 3.6% of its GDP. Over 50% of Dutch environmental taxes are on energy, but taxes on transport and pollution also make significant contributions.

The country introduced a Green Tax Reform Commission in 1995 that helped to restructure the tax system to take better account of the environmental dimension to everyday economic and social activity. There were higher taxes on motor vehicles (e.g. registration and annual circulation taxes) and two energy taxation initiatives were introduced – the Energy Tax Regime and the Energy Premium Scheme.

The Energy Premium Scheme used funds collected through the energy tax to subsidise households and social housing organisations that invested in renewable energy and energy efficiency measures. Following its introduction in 2000, the Scheme boosted sales of energy efficient appliances by 70%, reducing CO₂ emissions by 210 million kg in its first two years.

Other green taxation in the Netherlands include:

- incentives to reduce pollution and other negative environmental impacts (at the same time as covering the costs of environmental restoration and protection);
- taxation on the use of groundwater, tap water and coal, landfilling, and incineration of waste and pollution of surface waters.

---

78 For Cyprus, Hungary and Portugal, 2012 data are used (as opposed to 2013) as 2013 figures are not available.

Energy taxes by paying sector

Energy taxation makes energy users pay for the negative effects that energy production and consumption has on health and the environment, and encourages energy consumers to be more efficient. Figure 25 shows the share of energy taxes by sector for six sectors in 2012 – households, industry and construction, transport and storage, services, agriculture forestry and fishing and other sectors.

Households made the highest energy tax contributions (40% or more) in 15 Member States in 2012. The industry and construction sector contributes much less, but does provide over 30% of energy taxes in three Member States (Romania, the Czech Republic and Malta). The transportation and storage sector contributes at least 20% in four Member States (Estonia, Bulgaria, Belgium and Romania). Services contributes over 20% in only three Member States (Denmark, the Czech Republic and Slovakia). However, Slovakia is an exceptional case as it is the only Member State that does not tax household energy use and transport sector taxes are paid by producers or distributors of fuels.

The energy taxation applied to the different sectors does not match consumption, with households in many Member States paying more than their share in taxes compared to the amount of energy the sector uses (up to twice as much in some cases). If the share of taxation is larger than the share of use of a sector, then that sector is effectively subsidising the energy use of other sectors. This issue – whether energy taxation should more closely reflect energy consumption and environmental impact across different sectors – needs to be considered more widely across the EU.

Figure 25: Energy taxes by paying sector, 2012

---

80 Not all Member States report data on composition of energy taxation.
4.2 Nature and ecosystems

4.2.1 Biodiversity

Index of common farmland bird species

The populations of common birds are often considered to be a general proxy for measuring the biodiversity of the natural environment. Although they are highly sensitive to anthropogenic changes and their numbers also fluctuate due to other environmental factors, such as climate and interactions with other species, the long-term trends are considered reliable and indicative of the natural ‘health’ of the environment (or particular ecosystems).

The Scoreboard tracks bird populations using the Common Birds Index, which monitors common farmland species (39 species), common forest species (34 species) and all common bird species (167 species)\(^1\) (see Figure 26).

Overall, there has been a 16 % decline in the index for all common bird species with numbers declining steadily (with periodic fluctuations) between 1980 and 2013. The greatest decline has been in common farmland species where populations have declined by 57 %, although forest species have slightly increased by 1 %. The main reasons for the decline in farmland species could be due to on-going intensification and industrialisation of farming, and widespread habitat destruction and disturbance. However, the decline in forest species appears to have stabilised around 2000 and this may be due to increasing preservation of remaining forest habitats (e.g. for recreational purposes) across Europe.

Figure 26: Index of common bird species in EU, 1980–2013

\(^1\) More information on the survey’s methodology and regional data are available on PECBM’s website.
The Index also monitors a number of species at a macro-regional level and the associated trends (see Figure 27) show a widespread decline in common farmland and forest birds in almost every region. The exception is west Europe where forest bird populations have increased since 1980. The reduction in bird numbers across Europe is estimated to be 421 million in the last 30 years\(^2\). The decline has been most widespread in common species such as house sparrows, skylarks, grey partridges and starlings. However, moderate increases have been observed in a few less common farmland species.

Figure 27: Trends of common farmland birds and common forest birds in European regions, 1980-2013\(^3\)

<table>
<thead>
<tr>
<th>Monitoring period</th>
<th>Common farmland birds</th>
<th>Common forest birds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of species monitored</td>
<td>Trend</td>
</tr>
<tr>
<td>Central and East Europe</td>
<td>1982-2013</td>
<td>23</td>
</tr>
<tr>
<td>North Europe</td>
<td>1980-2013</td>
<td>14</td>
</tr>
<tr>
<td>South Europe</td>
<td>1989-2013</td>
<td>37</td>
</tr>
<tr>
<td>West Europe</td>
<td>1980-2013</td>
<td>22</td>
</tr>
</tbody>
</table>

Area under organic farming

Organic farming is – from a biodiversity perspective – a more sustainable agricultural system that puts a high priority on environmental protection and animal welfare. It avoids or largely reduces the use of synthetic chemical inputs such as fertilisers, pesticides, additives and medical products (e.g. antibiotics in animal feed). The amount of land used for organic farming is an indicator of the move towards more sustainable agricultural production practices.

Figure 28 shows organic farming is continuing to increase and the amount of organic farming has expanded significantly since 2005 in all countries for which data are available (except for Portugal and the United Kingdom where it has fallen).

The European organic market is the second largest in the world with a 40 % market share and a total value of EUR 22.2 billion in 2013. Germany and France had the second and third largest

---

\(^2\) Inger et al., Common European birds are declining rapidly while less abundant species’ numbers are rising, Ecology Letters, 2.11.2014

\(^3\) For further information, see the Pan-European Common Bird Monitoring Scheme (PECBMS), European wild bird indicators, 2015 update.
markets in the world, valued at EUR 7.6 billion and EUR 4.4 billion respectively. From a global perspective, the EU organic farming sector is one of the key players with 11.5 million hectares (ha) of organic agricultural land (a 27 % share of global organic agricultural land)\textsuperscript{84}.

The proportion of organically farmed land for EU27 (2005-13) has risen from under 3.6 % to 5.8 %, while in EU15 (2005-13), it has risen by a similar amount from 4.2 % to 6.4 %, but with a significant increase between 2009 and 2010 (data for EU15 post 2010 are not available). However, from 2010 to 2013 the rate of increase for EU27 has been slowing down.

Looking at the increase across Member States (see Figure 29), five countries (Austria, Sweden, Estonia, Czech Republic and Italy) had more than 10 % of their land used for organic farming in 2013. Austria and Sweden had the highest percentage of organic farming with 19.3 % and 16.5 % respectively.

Sweden, Estonia and the Czech Republic have all seen significant increases in the percentage of land farmed organically. Italy increased its proportion of organically farmed land to over 10 % between 2012 and 2013. However, in contrast, since 2005, the area of organic farmland has barely increased (or even showed marginal decreases) in Ireland, Luxembourg and the Netherlands. In Greece, Malta and the United Kingdom the amount of organic farmland has fallen slightly since 2009.

Support for organic farming is provided in a variety of different ways across EU Member States, with most implementing specific area payments to compensate for additional costs or lost income resulting from organic management. Most of the organic land (78 %) and organic farms (83 %) are situated in the EU15 Member States (which joined the EU before 2004) where national and European legislation helped stimulate the development of this sector. Those European countries that joined the EU after 2004 have been rapidly expanding their organic sector as well, recording a 13 % yearly growth rate between 2002 and 2011, with the number of organic farms increasing almost tenfold between 2003 and 2010\textsuperscript{85}.

Overall, organic farms tend to be bigger than conventional farms and can provide between 10 % and 20 % more jobs per ha – a 2006 survey in the UK found organic farming provided 32 % more jobs per farm than equivalent non-organic farms\textsuperscript{86}.

\textbf{Figure 29: Increase in area under organic farming, 2001-2013}

---

\textsuperscript{84} FiBL and IFOAM, \textit{The World of Organic Agriculture: Statistics and Emerging Trends}, 2015.


EU policy on organic farming

It is estimated that organic is the fastest growing sector of the food industry, with global revenues increasing from $18 billion in 2000 to $72 billion in 2013, i.e. a fourfold increase in just over a decade (first 2014 estimate being close to $80 billion).

The EU organic market amounted to €22.2 billion in 2013 (i.e. almost a third of the global total), and has increased yearly by 6% on average during 2010-2013.

Despite the economic crisis, the organic sector has seen continuous growth in recent years, thus contributing to the growth and jobs Commission political priority.

In order to consolidate consumer confidence in organic products and remove obstacles to the development of organic agriculture, the European Commission published a proposal for a new Regulation on organic production and the labelling of organic products in 2014.

The Commission proposes in particular:
- to strengthen and harmonise rules, both in the EU and for imported products;
- to reinforce controls;
- to make it easier for small farmers to join organic farming;
- to better address the international dimension of trade in organic products; and
- to simplify the legislation.

The Commission has also presented an Action Plan to help farmers, producers and retailers adjust to the proposed policy changes. The Plan foresees to better inform farmers on EU initiatives encouraging organic farming, strengthen the links between EU research and innovation projects and organic production, and to encourage the use of organic food, e.g. in schools.

The Commission proposal has been discussed by the European Parliament and the Council of Ministers of the EU since 2014, with a view to its adoption in 2016.

Organic farming in the European Union

The total area under organic farming across Europe increased from 5.9 million ha in 2003 to 9.6 million ha in 2011 (63 % growth).

The large majority of organically farmed areas are in EU15, but EU12 has also grown rapidly in terms of both the total land area and the number of holdings. During 2003-10 in EU27, the number of organic holdings increased by 50 % while, at the same time, the total number of holdings decreased by 20 %.

According to the latest data from the 2013 Farm Structure Survey the total EU area under organic farming further increased during 2010-2013 to 10.1 million ha (i.e. an increase of almost 10% during 2010-13 and of 70% during 2003-2013). The number of organic holdings in the EU has continued to expand, increasing by 36% during 2010-2013 to 253,600, while the overall number of holdings decreased further during the same period. The increase in EU12 is remarkable.

The majority of organic farms tend to be larger and managed by younger holders. Despite there being some uncertainty about the numbers of workers on organic versus traditional farming, between 2003 and 2010, the regular labour force (expressed in annual work unit) decreased by 25 % in the non-organic farming sector, while it increased by around 18 % in the organic farming sector.

According to the latest data from the 2013 Farm Structure Survey, during 2010-2013 jobs in the traditional farming sector decreased by about 7%, while they increased by almost 20% in the organic farming sector.

Further information is available from the European Commission’s organic farming portal.

References:
- European Commission, Organic Farming Portal.
Landscape fragmentation measures the degree to which wildlife movement is interrupted by barriers in the environment such as roads, railways, buildings and settlements. It is measured by the number of barriers that fragment the landscape to produce a ‘mesh density’ based on the number of meshes per 1000 km² (see the map in Figure 30).

Landscape fragmentation can contribute to ecosystem decline, loss of wildlife and the endangerment of species through, for example, the dissection and isolation of populations and disturbances to natural corridors such as water courses.

Increased fragmentation can escalate vulnerability to climate change and associated weather-related risks (such as flooding) by reducing the landscape’s ability to absorb the impacts of extreme weather events. It also affects the aesthetic and recreational quality of landscapes. Basically, the more heavily populated and developed an area is (e.g. with extensive transport infrastructure) the more fragmented the landscape.

To maintain biodiversity, it is important that wildlife corridors and landscapes with low mesh density are maintained so animal and plant populations can connect with each other and not become isolated.

**Figure 30: Landscape fragmentation per 1 km² grid, 2009**
The map in Figure 30 shows that the countries in northwest continental Europe (Luxembourg, Belgium, the Netherlands, France and Germany) have the most fragmented landscapes. The mesh densities in these countries range between 42 per 1 000 km$^2$ and 135 per 1 000 km$^2$ (see Figure 31). However, most countries display large variations in landscape fragmentation depending on their geography, the location of urban areas and connecting transport links. For some countries (for example the United Kingdom and Sweden) with less fragmentation, it can be discerned how the fragmentation matches the major conurbations, transport routes and geography (e.g. major valleys and lowland areas).

Figure 31 confirms the high levels of correlation between population, road density and landscape fragmentation. The north central European countries (Luxembourg, Belgium, the Netherlands, Germany, France and the Czech Republic) together with Malta (which, as an island, is an exception) have medium-to-high mesh densities ranging from 16 to 135. Luxembourg and Belgium have the most fragmented landscapes with mesh densities of over 100. This is a reflection of their position at the nexus of cross-European transport links.

There are 15 countries that have fewer than 10 meshes per 1 000 km$^2$ and these are spread around the periphery of the EU where geography and climate exert a greater influence on settlement patterns. Countries with large areas of hills or mountains are likely to be less fragmented because the landscape itself deters settlement and urban development. An exception to the overall trend appears to be the United Kingdom and Italy which have relatively high populations and road densities, but relatively low levels of landscape fragmentation. Looking at the map in Figure 30, it appears that landscape fragmentation is concentrated in lowland areas and along a few principal transport corridors.

However, fragmentation is not only the result of infrastructure. The trend in the amount of fragmented natural and semi-natural land in Europe increased between 2000 and 2006 due to the spread of artificial and intensively managed agricultural areas. However, only ‘healthy’ agricultural ecosystems can offer a wide array of benefits to society – from food and fibre production to pollination, erosion prevention, carbon storage and aesthetically valuable landscapes for tourism. In 2006, 35 % of the EU28 forest lands were intermingled with natural and semi-natural non-forested land, agriculture and artificial land$^{91}$. These fragmented forests are losing their function as natural powerhouses providing – at the same time – timber, carbon storage, water and air purification, erosion prevention, biodiversity havens and space for recreation.

Some Member States have active policies towards increasing connectivity (for example through Green Infrastructure initiatives$^{92}$). An example is France’s ‘Trames vertes et bleues’, which is a planning tool designed to improve environmental communication between large natural areas through three approaches – buffer zones, ecological corridors and the restoration of natural areas within cities. Germany has also adopted interesting initiatives.

---

$^{91}$ European Environment Agency, EU 2010 Biodiversity baseline.

Case study – Green Infrastructure, UK green belts

Green Infrastructure addresses the spatial structure of natural and semi-natural areas, but also other environmental features. Therefore, the same area of land can offer many benefits to citizens if its ecosystems are in a healthy state.

The fundamental aim of the UK green belt policy is to prevent urban sprawl by keeping land permanently open (although there are some exceptions). Green belt land is defined and maintained by local authorities under the UK Government’s National Planning Policy Framework (NPPF) and serves five purposes:

• to check the unrestricted sprawl of large built-up areas;
• to prevent neighbouring towns merging into one another;
• to assist in safeguarding the countryside from encroachment;
• to preserve the setting and special character of historic towns;
• to assist in urban regeneration, by encouraging the recycling of derelict and other urban land.

Green belts were started in 1935, but it was not until 1955 that the idea really started to be used throughout the UK. The total size of the UK green belt was 721,500 ha in 1979. By 2013/14 Government statistics estimated them to cover 1,638,610 ha, around 13 % of the land area of England. There are around 14 green belts throughout England, varying in size from 486,000 ha around London to 700 ha at Burton-on-Trent in the Midlands.

The UK green belts have been ‘highly effective’ in their principal purpose of preventing urban sprawl and maintaining a clear physical distinction between town and country. They form a clear buffer zone and deliver many benefits to people in the form of cleaner air, better control of surface drainage, buffering for heatwaves, recreation facilities, maintaining traditional landscapes and cultural heritage, etc.
4.2.2 Safeguarding clean air

Urban population exposure to air pollution by particulate matter - PM$_{2.5}$ and PM$_{10}$

Air pollution is still an issue for many countries across Europe, particularly in urban areas. Particulate matter (PM) includes a range of liquid and solid particles and is of most concern, due to its well-known detrimental effects on human health. Particles with a diameter of less than 10 micrometres (µm) (PM$_{10}$) and especially those less than 2.5 µm (PM$_{2.5}$) can be carried deep into the lungs where they can cause inflammation, particularly in sensitive groups such as the elderly, children, and people with heart and lung diseases.

The EU has had comprehensive legislation on air quality assessment and management since 1996 (Directive 96/62/EC and Directive 1999/30/EC) and the revised Ambient Air Quality Directive (Directive 2008/50/EC)$^9$, that sets the following limits for air quality to be achieved everywhere (including in urban areas):

- PM$_{2.5}$ – annual mean average concentration limit of 25 micrograms per cubic metre ($µg/m^3$);
- PM$_{10}$ – annual mean average concentration limit of 40 $µg/m^3$ and a maximum of 35 days per year with the daily value above 50 $µg/m^3$.

The Scoreboard has indicators for both pollutants and measures the progress made towards reducing PM concentration in urban areas by reporting the average exposure of urban dwellers to PM$_{10}$ and PM$_{2.5}$.

Figure 32 indicates the urban population exposure to particulate matter PM$_{2.5}$ ($µg/m^3$) for 2009 and 2013, by showing the concentrations levels of PM$_{2.5}$ compared to the EU limit value and the World Health Organisation (WHO) guideline. In 2013, Bulgaria was the only country that exceeded the 25 $µg/m^3$ EU annual average limit value (red line in Figure 32) with a concentration of 26.5 $µg/m^3$. It is followed by four countries (Poland, Czech Republic, Slovenia and Italy) for Europe.

Figure 32: Urban population exposure to air pollution by PM$_{2.5}$ ($µg/m^3$), 2009 and 2013

Emissions of PM in urban areas originate mainly from combustion, but also from other sources such as soil dust raised by wind, photo-oxidation of gaseous pollutants and mechanical processes (for example, brake wear and road abrasion). The major sources are road traffic (especially diesel vehicles) and non-road machinery (such as construction vehicles), but also domestic heating using solid fuels.

The performance of road and non-road vehicles, combined with transportation and energy tax policies (in particular the relative tax rates on petrol vs diesel fuel) are key factors influencing the levels of urban air pollution. One important contributor is the higher number of diesel vehicles: the market share of EU diesel cars increased from 31% in 2000 to 55% in 2012, then decreased slightly to 53% in 2014 (due to small inroads by hybrid and electric vehicles). Diesels produce 15% less $CO_2$ than petrol, but emit four times more nitrogen dioxide pollution ($NO_2$) and 22 times more PM. For further details about vehicle emissions, see also the indicator on pollutant emissions from transport ($NO_x$, NMVOC and PM) in section 4.3.3.

all of which have a value greater than 20 µg/m³. These figures are around four times the concentration in Sweden which is the best performing country. The EU28 average exposure figure was 15.9 µg/m³ in 2013, which is a slight decrease compared to 2009.

The WHO guideline (recommended) value for the protection of human health is set at 10 µg/m³ of PM$_{2.5}$ (green line in Figure 32). In 2013, only a few countries (Sweden, Finland, Estonia, Portugal and Spain) met (on average) the WHO guidelines, but the majority of Member States have shown improvements in recent years. However, there are a number of urban hotspots with considerably higher concentrations than the overall country average. In 2013 more than 80% of the reporting urban stations (traffic and background) show concentrations above the WHO guideline. Between 2011 and 2013, the fraction of urban population in EU28 exposed to concentrations above the EU limit varied between 9% and 14%, while the fraction of population exposed to values above the WHO guideline was between 87% and 93%.

These data need to be treated with some caution though. The length of the time series and the limited number of monitoring stations in some Member States do not allow firm conclusions on trends at average levels to be drawn. Furthermore, data are collected from a sample of monitoring stations and the aggregate figures at national level are estimated following established methodologies. However, data gaps and uncertainty over the overall reliability are unavoidable, especially for PM$_{2.5}$ which has only been monitored regularly in recent years.

Figure 33 shows the annual population-weighted concentration of PM$_{10}$ (µg/m³) for urban populations for 2005 and 2013. The WHO guideline (recommended) value is set at 20 µg/m³ of PM$_{10}$ (green line) while the EU limit value is set at 40 µg/m³ of PM$_{10}$ (orange line). On the basis of data on PM$_{10}$ provided by AirBase, overall EU28 urban population weighted concentrations fell by 15% (i.e. 4.3 µg/m³) between 2005 and 2013. In 2013, population-weighted concentrations exceeded the 40 µg/m³ EU limit only in Bulgaria, while two countries (Poland and Cyprus) reported concentrations higher than 30 µg/m³. Many other Member States exceeded this limit in some urban hotspots but, on average, they fell below the overall limit.

Figure 33 also shows that several countries have considerably reduced annual mean concentrations. Most Member States reduced concentrations by at least 15% between 2005 and 2013, with particularly high reductions in Estonia, Romania, Slovenia, Spain and Portugal (over 30%). However, in Lithuania, average annual concentrations increased, while no data are available for Luxembourg, Latvia and Cyprus in 2005. In general, northern European countries perform better, while countries in eastern and southern Europe have higher PM$_{10}$ exposure levels.

Figure 33 shows the annual population-weighted concentration of PM$_{2.5}$ (µg/m³) for urban populations for 2005 and 2013. The WHO guideline (recommended) value is set at 20 µg/m³ of PM$_{2.5}$ (green line) while the EU limit value is set at 40 µg/m³ of PM$_{2.5}$ (orange line). On the basis of data on PM$_{2.5}$ provided by AirBase, overall EU28 urban population weighted concentrations fell by 15% (i.e. 4.3 µg/m³) between 2005 and 2013. In 2013, population-weighted concentrations exceeded the 40 µg/m³ EU limit only in Bulgaria, while two countries (Poland and Cyprus) reported concentrations higher than 30 µg/m³. Many other Member States exceeded this limit in some urban hotspots but, on average, they fell below the overall limit.

These data need to be treated with some caution though. The length of the time series and the limited number of monitoring stations in some Member States do not allow firm conclusions on trends at average levels to be drawn. Furthermore, data are collected from a sample of monitoring stations and the aggregate figures at national level are estimated following established methodologies. However, data gaps and uncertainty over the overall reliability are unavoidable, especially for PM$_{2.5}$ which has only been monitored regularly in recent years.

Figure 33 shows the annual population-weighted concentration of PM$_{2.5}$ (µg/m³) for urban populations for 2005 and 2013. The WHO guideline (recommended) value is set at 20 µg/m³ of PM$_{2.5}$ (green line) while the EU limit value is set at 40 µg/m³ of PM$_{2.5}$ (orange line). On the basis of data on PM$_{2.5}$ provided by AirBase, overall EU28 urban population weighted concentrations fell by 15% (i.e. 4.3 µg/m³) between 2005 and 2013. In 2013, population-weighted concentrations exceeded the 40 µg/m³ EU limit only in Bulgaria, while two countries (Poland and Cyprus) reported concentrations higher than 30 µg/m³. Many other Member States exceeded this limit in some urban hotspots but, on average, they fell below the overall limit.

These data need to be treated with some caution though. The length of the time series and the limited number of monitoring stations in some Member States do not allow firm conclusions on trends at average levels to be drawn. Furthermore, data are collected from a sample of monitoring stations and the aggregate figures at national level are estimated following established methodologies. However, data gaps and uncertainty over the overall reliability are unavoidable, especially for PM$_{2.5}$ which has only been monitored regularly in recent years.

Figure 33 shows the annual population-weighted concentration of PM$_{2.5}$ (µg/m³) for urban populations for 2005 and 2013. The WHO guideline (recommended) value is set at 20 µg/m³ of PM$_{2.5}$ (green line) while the EU limit value is set at 40 µg/m³ of PM$_{2.5}$ (orange line). On the basis of data on PM$_{2.5}$ provided by AirBase, overall EU28 urban population weighted concentrations fell by 15% (i.e. 4.3 µg/m³) between 2005 and 2013. In 2013, population-weighted concentrations exceeded the 40 µg/m³ EU limit only in Bulgaria, while two countries (Poland and Cyprus) reported concentrations higher than 30 µg/m³. Many other Member States exceeded this limit in some urban hotspots but, on average, they fell below the overall limit.

These data need to be treated with some caution though. The length of the time series and the limited number of monitoring stations in some Member States do not allow firm conclusions on trends at average levels to be drawn. Furthermore, data are collected from a sample of monitoring stations and the aggregate figures at national level are estimated following established methodologies. However, data gaps and uncertainty over the overall reliability are unavoidable, especially for PM$_{2.5}$ which has only been monitored regularly in recent years.

Figure 33 shows the annual population-weighted concentration of PM$_{2.5}$ (µg/m³) for urban populations for 2005 and 2013. The WHO guideline (recommended) value is set at 20 µg/m³ of PM$_{2.5}$ (green line) while the EU limit value is set at 40 µg/m³ of PM$_{2.5}$ (orange line). On the basis of data on PM$_{2.5}$ provided by AirBase, overall EU28 urban population weighted concentrations fell by 15% (i.e. 4.3 µg/m³) between 2005 and 2013. In 2013, population-weighted concentrations exceeded the 40 µg/m³ EU limit only in Bulgaria, while two countries (Poland and Cyprus) reported concentrations higher than 30 µg/m³. Many other Member States exceeded this limit in some urban hotspots but, on average, they fell below the overall limit.

These data need to be treated with some caution though. The length of the time series and the limited number of monitoring stations in some Member States do not allow firm conclusions on trends at average levels to be drawn. Furthermore, data are collected from a sample of monitoring stations and the aggregate figures at national level are estimated following established methodologies. However, data gaps and uncertainty over the overall reliability are unavoidable, especially for PM$_{2.5}$ which has only been monitored regularly in recent years.

![Figure 33: Urban population exposure to air pollution by PM$_{2.5}$ (µg/m³), 2005 and 2013](image-url)
Urban population exposed to PM$_{10}$ concentrations exceeding the daily limit value (50 µg/m$^3$ on more than 35 days per year)

There are wide differences across Europe in the number of urban dwellers exposed to particulate concentrations above the threshold of 50 µg/m$^3$ for more than 35 days per year. Figure 34 shows that, despite increases in PM values in localised areas, the overall percentage of urban populations exposed to concentrations above the daily limit threshold has been decreasing since 2000 and that the best years on record are 2012 and 2013. In 2013, 17.4 % of the urban population was exposed to concentrations above the daily limit threshold.

Despite this good progress, between 2011 and 2013, the percentage of the urban population across the EU exposed to PM$_{10}$ concentrations above EU limit values ranged from 17 % to 30 %. When compared to internationally-agreed pollutant limits, the picture is even less positive: 61 % to 83 % of the urban population was exposed to higher concentrations than the WHO guideline value (above 20 µg/m$^3$ for at least 1 day per year) between 2011 and 2013$^{103}$. Those Member States with the highest levels of urban particulate pollution tend to have older coal-fired power plants near to urban centres and use solid fuels for domestic heating.

It should be borne in mind that the data can be significantly influenced by three factors. The first is simply the weather, which can lead to high variability in particulate emissions from year to year – especially specific events like winter temperature inversions and summer heatwaves. The second is that data are only collected for cities covered by monitoring stations. These can be limited in number for some cities (and, for smaller Member States, for the entire country). Therefore, for some cities, data may not give a true picture of wider air pollution across urban areas. The third is the methodology used to calculate the indicator. Data from monitoring stations recording daily values above the limit for fewer than 35 days or just below the 50 µg/m$^3$ limit will not be included (as the threshold is not exceeded), even though there may be high levels of pollution. In addition, the number of monitoring stations is increasing, so the population monitored increases from year to year, which influences the data analysis. To reduce the influence of these annual variations, Figure 35 presents three-year averages for the periods 2006 to 2008 and 2011 to 2013.

---

Using the reported data under AirBase and the data in Figure 35, approximately 100% of the urban population of Cyprus, Malta and Bulgaria experienced very high levels of exposure between 2011 and 2013. Furthermore, these three countries show no improvement in air quality compared to 2006-2008 (2005-2007 for Malta). Exposure actually increased in Bulgaria as it did in Poland (where there was a 14 percentage point increase) and Denmark (which had an increase of 6 percentage points). However, there is some good progress in other countries with the Netherlands, Spain, Latvia, Portugal, Slovenia, Greece and Romania reporting reductions in urban population particulate exposure of between 32 and 54 percentage points.

Figure 35: Urban population exposed to PM$_{10}$ above daily limit values (50 μg/m$^3$ for over 35 days per year), multi-annual average 2006-2008 and 2011-2013$^{104}$

4.2.3 Land and soils

Soil erosion by water – area eroded by more than 10 tonnes per ha per year

Soil is ubiquitous and often taken for granted. Yet it is a non-renewable resource that provides a range of essential biological goods and valuable services ranging from farmland for food production to natural landscapes for recreation. Soil erosion by water is a natural process. However, accelerated erosion, caused by human activities such as inappropriate agricultural practices (e.g. deforestation, overgrazing and intensive agriculture), forest fires and construction, can be severely detrimental over the long term. To protect nature, ecosystems and Europe’s ability to produce food, the prevention of soil loss is important.

This indicator assesses soil erosion by water and gives an indication of areas (expressed in km$^2$ (1 km$^2$ = 100 ha) and as a percentage of the total non-artificial area of a country) affected by moderate to severe rates of erosion. Where the rate is above 1 tonne per ha per year (1 t/ha/year or 100 t/km$^2$/year), the process may be irreversible in a time span of between 50 and 100 years. Rates above 10 t/ha/year indicate severe soil erosion.

These levels of soil erosion across the EU cause concerns for the future of soils, as a number of Member States have such high erosion rates that permanent damage could be caused within a generation.

$^{104}$ For some Member Countries, the average is based on less than three years. The data for Malta cover the periods 2005 to 2007 and 2011 to 2013.
Figure 36 shows there is widespread water erosion throughout Europe, with levels ranging from under 2 t/ha/year (green) to over 50 t/ha/year (red). The majority of soil erosion is fairly low (under 2 t/ha/year), but there are quite large areas where erosion is between 2 t/ha/year and 10 t/ha/year (yellow and orange), and significant areas of high erosion (over 10 t/ha/year). There are also significant areas where soil erosion is even higher, ranging from 10 - >50 t/ha/year. High rates of erosion are particularly marked in Italy and Spain, and some areas of France and Portugal. There are also areas of relatively high erosion in several Member States, particularly Austria, Cyprus, France, Greece, Portugal, Romania and the UK. At the moment, there is no specific EU legislative instrument regulating soil, though ‘The Roadmap to a Resource Efficient Europe’ aims to reduce the area of land in the EU that is subject to severe soil erosion by at least 25 % by 2020.

Figure 36: Erosion by water in the European Union, 2010


The map was produced using a modified version of the Revised Universal Soil Loss Equation (RUSLE) model, RUSLE 2015. With a resolution of 100m, this is the most detailed assessment yet of soil erosion by water for the EU. More information is available at the European Soil Data Centre (ESDAC).
Figure 37 shows that Italy, Slovenia and Austria exhibit the highest proportion of soil erosion with between 15 % and 25 % of their land area affected. Italy and Spain have the largest actual land areas experiencing erosion (68,000 km$^2$ and 43,000 km$^2$ respectively). Italy appears to be in a particularly poor position with the largest absolute area of land affected, which constitutes nearly 25 % of its total land area. By contrast, erosion in Malta affects only 23 km$^2$, but this still represents over 10 % of its total land area.

There is a clear north-south European split, with northern countries generally experiencing less erosion. France is a notable exception, but it is a relatively large country and the area affected is under 5 % of its total land area. The erosion is generally linked to intense agriculture and drier soils, making them more susceptible to erosion during periods of wet weather. However, soil erosion in northern Europe, which is characterised by lower lying ground and gentle slopes, is mainly due to year-round rainfall. The gradual trend towards more intense weather events may exacerbate erosion if steps are not taken to reduce it in many of the affected countries.

Data for this indicator are collected by the Joint Research Centre every six years. Where there is no land that is considered to be subject to soil erosion of more than 10 t/ha/year, Member States will have a zero value. So, although Denmark, Estonia, Latvia and Lithuania all have ‘zero’ values in Figure 37, soil erosion may still be occurring in areas of those countries, but at lower rates (less than 10 t/ha/year), as indicated in Figure 36.

Gross nutrient balance in agricultural land

In recent decades, food productivity has increased due to improving agricultural production by, for example, mechanisation and increased use of fertilisers, pesticides and other inputs. Between 1960 and 2000, nitrogen fertiliser application in the EU almost quadrupled (EEA, 2004). However, intensive farming can have a double-edged impact – excessive use of fertilisers can cause water pollution and eutrophication, with consequences for human health and ecosystems. Failure to replace nitrogen and phosphorus lost through intensive cropping can lead to soil degradation and loss of fertility. In 2012, it was estimated that, despite reductions in agricultural inputs, diffuse pollution from agriculture is a significant pressure in more than 40 % of Europe’s rivers and coastal waters, and in one third of lakes and transitional waters$^{107}$.

Gross nutrient balances (GNBs) estimate the relative amount (surplus or deficit) of nitrogen and phosphorus – two important soil and plant nutrients – present in agricultural land. Nitrogen and phosphorus GNBs can provide valuable information about the link between agricultural activities, land-use intensity, soil quality and the environmental impacts of nutrient use in agriculture. GNBs can help identify areas at risk from nutrient pollution (when estimated at low regional levels), identify factors behind agricultural related nutrient pollution and enable trends to be followed over time. Furthermore, as GNBs roughly represent the difference between the nutrients applied to soils and the nutrients removed with crops, it also reflects the risk of the remaining nutrients leaching into the soil and water or being released into the atmosphere.

---

To reduce the effect of weather conditions on the balance (climate can have a significant impact on the nutrient balance) the indicators for nitrogen (Figure 38) and phosphorous (Figure 39) have been presented as four-year averages. However, these indicators do need to be carefully interpreted as, individually, they do not capture the full complexity of soil balances, which are influenced by many factors\(^{108}\). In the future, these indicators will be complemented by additional metrics, such as ‘Vulnerability to phosphorus leaching and run-off’, to better summarise each Member State’s situation.

**Gross nutrient balance in agricultural land – nitrogen**

Figure 38 shows that, since the mid-1990s, the nitrogen surplus per hectare has been continuously decreasing in most EU countries. The gross nitrogen balance for EU28 has decreased by more than 20%, falling from a four-year average of 59 kg/ha between 1997 and 2000 to 46 kg/ha between 2009 and 2012.

Nitrogen balances in soils vary widely across Member States and all, except Romania, have positive balances. Although five Member States have relatively low positive balances (ranging from 8 kg/ha to 25 kg/ha), most Member States show good nitrogen balances (with four-year averages ranging from between 32 kg/ha and 87 kg/ha). Four Member States (Cyprus, the Netherlands, Belgium and Malta) have quite high balances of between 114 kg/ha and 194 kg/ha, although the amount has been steadily reducing (except in Cyprus where it appears to be increasing sharply). Other Member States, with lower overall surpluses, may still have very high surpluses concentrated in some areas, which may cause localised pollution issues. In the case of the Netherlands and Belgium, the relatively large surplus is due to spreading manure from their large national stock of cattle. Better management of fertilisers has improved the balances in recent years and significantly reduced surpluses.

**Gross nutrient balance in agricultural land – phosphorus**

Figure 39 shows that in most Member States, the phosphorus surplus per hectare has been continuously decreasing since the early 1990s. EU28 gross phosphorus balance decreased from 5 kg/ha between 1997 and 2000 to an average of 0.67 kg/ha between 2009 and 2012. Between 2009 and 2012, 11 Members States had a phosphorus balance deficit.

\(^{108}\) In general, it is not possible to tell which balance is ‘good’ or ‘poor’ by looking at aggregated figures, as the effective balance will be influenced by management practices.
This depletion in the balance is causing increasing concern in Europe as phosphorus is a finite resource. Not only are supplies becoming more scarce, but it is being used inefficiently as well. As a result, the EU is considering strategic action to improve the sustainable use of phosphorus across its whole life-cycle (from mining to final use). This includes improving application methods and using balanced fertilisation techniques. Phosphorus recovery and recycling from organic sources (such as manure, sewage sludge and compost) could also be valuable opportunities to close the ‘gap’ in the phosphorus cycle.

Figure 39: Gross phosphorus balance in agricultural land, four-year averages, 1993-2012
4.3 Key areas

4.3.1 Addressing food

Daily calorie supply per capita by source

Food production is a resource-intensive process that impacts water, land use and biodiversity, and generates GHG emissions. Overall, food and drink contributes to over 20% of the environmental impact of all European consumption. For eutrophication, the contribution is even higher – up to 60%.

Furthermore, research suggests agriculture is responsible for 60% of the loss of global terrestrial biodiversity. Many studies have shown that vegetal products have a lower environmental footprint than meat and dairy products.

The total daily calorie availability across EU28 increased very slightly (+0.6%) between 2000 and 2011 to 3416 kcal per capita. This is higher than the 2000 – 2600 kcal per day average daily energy intake requirement set by the European Food Standards Agency for adults (aged between 30 and 59). The amount of food available to Europeans ranges across Member States from 2700 kilocalories (kcal) per day in Cyprus to 3800 kcal per day in Austria. This seems to suggest that too much food is being produced and supplied throughout Europe.

Between 2000 and 2011, the balance of supply between vegetal and animal products changed, with slightly more vegetal products and slightly less meat products being produced. Throughout EU28, the aggregate supply of vegetal products increased by just 1% between 2000 and 2011. At the Member State level, four countries increased the availability of vegetal products by between 5% and 11% (Cyprus, the Netherlands, Ireland and France), while five countries saw rises of between 5% and 9% in the availability of animal products (Finland, Latvia, Denmark, Lithuania and Croatia).

Figure 40: Daily calorie supply per capita by source, 2000 – 2011

113 Meier and Christen, 2012 Gender and dietary recommendations in an IO-LCA of food consumption in Germany. Published in proceedings report, 8th international conference on Life Cycle Assessment in the Agri-Food Sector, October 1-4 2012 Saint-Malo, France.
114 Slezak, M, Going vegetarian halves CO₂ emissions from your food, New Scientist, June 2014.
The demand and subsequent supply of food is mainly driven by population growth and lifestyle changes. Over the last 50 years, the population in Europe has grown by approximately 20% to around 500 million in 2010 (EU27) and is projected to peak at 526 million in around 2040 (Eurostat, 2011e). In the medium term, the EU27 food demand is expected to increase modestly by around 5%. Globally, the rate of population growth is decreasing, but total population size is still projected to increase from 7 billion today to about 9 billion by around 2050 (UN, 2009).

This, combined with a global trend of increasing meat consumption (the production of which is more resource intensive than for vegetal products), could substantially increase global demand for agricultural production, putting additional pressure on European and global ecosystems as well as increasing GHG emissions. The EU wants to make the production and consumption of food more sustainable, and to halve the disposal of edible food waste in the EU by 2020.

In the EU, 90 million tonnes of food (or 180 kg per capita) are wasted, much of it suitable for human consumption. The EU is assessing how best to limit waste throughout the food supply chain, and how to lower the environmental impact of food production and consumption patterns. A daily food waste per capita indicator and the daily calorie supply per capita indicator – matched with additional information on consumption, energy requirement and under-nourishment – have the potential to fulfil this role.

4.3.2 Improving buildings

Final energy consumption in households

This indicator measures the total energy consumed (taking into account all different fuel types, i.e. solid fuels, oil products, gas, electricity, derived heat and renewable sources) by households as final users, expressed in 1000 tonnes of oil equivalent. Most energy used by households is for heating, which means that the data are heavily influenced by the prevailing weather (especially during the winter) of the year to which they refer. So, for example, the harsher winters in 2010 and 2012 resulted in significantly higher consumption in several countries and energy use was 12% higher in 2010 compared to that in 2011 (see Figure 41). To counteract this effect, rolling five-year averages have been used in Figure 41 and Figure 43.

Figure 41 shows the trend for total final energy consumption in households for EU28 since 1990. The five-year rolling average shows that total consumption has plateaued and started to reduce over the last 10 years, after a decade of steady increases.

---


Figure 42 shows that over 75% of all energy used by households in the EU is actually used in only eight Member States. The three most populous countries (Germany, France and the United Kingdom, which have 41% of total EU population) account for nearly half of the entire EU domestic energy consumption.

To look at trends in relative, rather than absolute, terms, Figure 43 shows ‘final energy consumption’ in households, in kg of oil equivalent per capita, rather than the total consumption in the Scoreboard. In 2013, total consumption was 586 kg per capita of oil equivalent, for a total consumption in the EU28 of 296 million tonnes of oil equivalent.

Figure 43 shows there has been progress in reducing household energy consumption per capita in most Member States. This reflects a combination of improving energy efficiency in buildings (better insulation, tighter building envelopes, etc), more energy efficient appliances, and changes in attitudes and behaviour to improve energy efficiency. There have been notable reductions above 10% between the periods 2004 and 2008, and 2009 and 2013 in Luxembourg, Greece, Belgium and Portugal. However, in some countries (Slovenia, Finland, the Netherlands, Romania, Poland, Estonia, Italy, Lithuania and Bulgaria), energy consumption has increased over the same period.

Poland, Italy, Lithuania, Romania and Bulgaria, despite using more energy, are still below the EU28 average in terms of per capita consumption. Luxembourg, Belgium, Germany, Denmark, Austria and Sweden have decreased energy consumption in per capita terms, but their per capita consumption is still above the EU28 average.
Final energy consumption in households by fuel

To reduce carbon emissions and conserve energy resources, households need to decrease their energy consumption, reduce their dependence on petroleum and other fossil-fuel-based products (such as coal) and increase energy derived from renewable sources. As Figure 44 shows, the share of petroleum products used as domestic fuel has decreased across EU28 by an average of 2.3 % per year, falling 10 percentage points between 1990 and 2013. This is a very positive trend which, apart from a few short-term fluctuations, has shown a steady decrease since 1992.

The highest reductions – over 20 percentage points – have been achieved by Finland, Italy, Malta, Cyprus, Denmark, Slovenia, Sweden, Luxembourg, Greece and Spain (see Figure 45). Six Member States sourced less than 1 % of their household energy from petroleum products in 2013 – Estonia (though peat is a significant energy source), the Netherlands, Sweden, Slovakia, Hungary and the Czech Republic.

These changes can be attributed to the shift towards using gas and the expansion of the renewable energy sector. In Sweden, renewable energy consumption in households rose from 9.7 % in 1990 to 14.5 % in 2013, while the consumption of gas remained static. In Hungary, the proportion of renewable energy generation rose from 8.4 % in 1990 to 15.4 % in 2013. However, gas use increased from 23.3 % in 1990 to 51.9 % in 2013. More detailed household energy consumption data (e.g. energy for space heating, space cooling, water heating and cooking) will be collected in the future under a new EU energy statistics regulation. This will complement the implementation of future collections of annual statistics on energy consumption in households.

Figure 44: Final energy consumption in households (EU28), share of petroleum products, 1990–2013

Figure 45: Final energy consumption in households, share of petroleum products, 1990 and 2013

118 Eurostat, Final energy consumption in households by fuel, accessed October 2015.
4.3.3 Ensuring efficient mobility

Average CO₂ emissions per km from new passenger cars

The car is by far the most popular mode of transport in Europe. However, this popularity comes with environmental costs, which include emissions of GHGs and other air pollutants, the continuing expansion of road infrastructure and the use of finite energy resources for fuel. To address these issues, the EU is developing new regulations to reduce CO₂ emissions and other air pollutants by making engines more efficient. This will have the added benefit of reducing energy consumption and energy dependency.

In 2015 implementing measures\textsuperscript{120} to introduce real driving emissions tests for air pollutant emissions by diesel cars were approved by the EU. The RDE test procedure was approved in May while the 'not to exceed' limits and their application dates were approved by the relevant regulatory committee (TCMV) in October. These new requirements will bring about sizeable environmental improvements from the current situation but will still need to be complemented by other local measures to improve air quality and bring it in line with existing EU standards.

The EU has set an emissions target for new cars of 130 g CO₂/km by 2015 and has recently set a new target of 95 g CO₂/km for 2021\textsuperscript{121}. The 2015 and 2021 targets represent reductions of 18 % and 40 % respectively compared with the 2007 baseline.

Figure 46 shows that the overall 2015 target was achieved in 2013, well ahead of time, and 2014 provisional data indicate a value of 125 g CO₂/km for EU27. This was partly due to the introduction of the emissions regulation (Regulation (EC) No 443/2009) which sped up the rate of improvement. Figure 46 indicates that current rates of improvements are likely to result in the 2021 targets being met and that the current momentum must not be lost if the targets are to be achieved.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure46.png}
\caption{Average CO₂ emissions per km from new passenger cars, 2000–2014 for EU15, EU12 and EU27 with targets}
\end{figure}

\textsuperscript{120}Committee procedure amending Reg 715/2007 and the subsequent implementing legislation Reg 692/2008.

Figure 47 shows that all Member States achieved considerable progress, in particular the Netherlands, Greece, Denmark, Sweden and Ireland (+30 % improvement between 2005 – 2014). The Netherlands, Greece and Portugal have the lowest emissions with averages ranging between 107 g/km and 109 g/km in 2014 (provisional data). Progress in some Member States, such as the Netherlands, is due to CO₂-based incentives and taxation policies (e.g. large-scale rebates on purchasing taxes for new fuel-efficient cars). In all, 21 Member States have reductions of more than 20 % compared to the levels in 2005. Europe is a world leader in cleaner automotive technologies, which will lead to further benefits for automotive and related industries.

**Figure 47: Average CO₂ emissions (g/km) from passenger cars by Member State, various years**

![Average CO₂ emissions graph](image)

**Pollutant emissions from transport – NOx, NMVOC and PM₁₀**

Other pollutant emissions from transport (nitrogen oxides (NOx), non-methane volatile organic compounds (NMVOCs) and PM₁₀) also decreased between 1990 and 2013. Figure 48 shows that NMVOCs have seen the greatest decrease. This trend is very positive because the reductions have been achieved despite little change in the amount of road use and an increase in the number of diesel engine vehicles since 1990 (diesel engines generally emit more of these types of pollutants per km than their gasoline equivalents, particularly black carbon (a source of PM) and nitrogen dioxide (NO₂)).

The success in curbing vehicle emissions is the result of several factors:
- tighter EU emission standards for new road vehicles;
- improvements in fuel quality driven by EU fuel quality directives;
- tighter regulations controlling emissions from new railway locomotive diesel engines and limiting the sulphur content of marine fuels.

**Figure 48: Pollutant emissions from transport in EU28 – NOx, NMVOC and PM₁₀, 1990-2013**

![Pollutant emissions graph](image)
In 2015 implementing measures\textsuperscript{122} to introduce real driving emissions (RDE) tests for air pollutant emissions by diesel cars have been approved. RDE test procedure was voted in May 2015 while the not to exceed limits and their application dates were voted in by the relevant regulatory committee (TCMV) in October 2015. These new requirements will bring about sizeable environmental improvements from today’s situation but would need to be complemented by other local measures to improve air quality and bring it in line with existing EU standards.

\textbf{Modal split of passenger transport}

This indicator covers three main passenger modes of transportation in Europe: passenger cars; motor coaches, buses and trolley buses; and railways\textsuperscript{123}. The car is by far the most popular mode of transport being used for 83\% of all journeys in 2013 (see Figure 49). Indeed, at a European level, there has been virtually no change in the modal split of passenger transport for the past 12 years. However, this picture is slightly incomplete as the indicator does not include other means of transport, such as air transport, which have become much more popular for national and international movements around Europe. Also, there are considerable differences at Member State and regional levels. However, these differences are obscured due to variations in voluntary data collection methodologies across Member States, which make detailed geographical and time-based comparisons difficult.

\textbf{Figure 49: Share of passenger transport by mode, 2000 and 2013}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure49.png}
\caption{Share of passenger transport by mode, 2000 and 2013}
\end{figure}


\textsuperscript{123}Air transport is not included in this indicator.
Figure 50 shows that there was a small overall rise in the share of car passenger transport across EU28 in 2013 compared to that in 2000 (+0.8 percentage points). Car passenger kilometres have decreased by up to 5.6 percentage points in seven Member States (Belgium, Italy, Luxembourg, the United Kingdom, Austria, France and Spain). However, the percentage of passenger car kilometres has increased in the remaining 22 Member States by up to 20 percentage points during the period 2000 to 2013. The data also indicate an east-west split: all Member States in western Europe show reductions while those with the largest increases are newer EU Member States in eastern Europe (Bulgaria, Poland, Estonia, Slovakia, Romania and Lithuania).

**Modal split of freight transport**

As with passenger transport, modes of freight transport in Europe have not changed substantially between 2000 and 2013 (see Figure 51). Overall, 75% of freight was transported by road, 18% by train and approximately 7% via inland waterways (although the figures do not consider other transport modes such as marine waterways or air transport).

---

124 Due to breaks in the time series for some countries, the data only have medium comparability over time.
There has been a small overall rise in road freight transport across EU28 (+1.7 percentage points) and the trends are very different among Member States (see Figure 52). As with passenger transport, a distinct regional divide for road freight transportation is evident. While Member States from eastern Europe have generally increased their share of road freight by a considerable amount, road freight in central and western European countries (with the exception of Luxembourg, France and Ireland), has decreased or stayed the same. In Belgium and Austria, the decrease in the road transport share was particularly marked, reducing by more than 10 percentage points.

Overall in the EU, rail freight transportation decreased by 1 % between 2000 and 2013, having decreased in almost twice as many countries as those in which it increased. Despite the decline, rail still accounts for over 30 % of freight transport in five Member States – Latvia (60.4 %), Estonia (44.1 %), Austria (42.1 %), Sweden (38.2 %) and Lithuania (33.6 %). Among these countries, the proportion of rail freight increased in Austria and Sweden by 11.9 % and 2.9 % respectively.

Considering transport via inland waterways, just 14 Member States use this mode and in only five of them is the amount significant: the Netherlands (38.9 %), Belgium (20.4 %), Romania (20.7 %), Bulgaria (15 %) and Germany (12.6 %). All of these countries have major navigable rivers and canal networks.

Figure 52: Change in freight transport via road, 2000-2013

Change in freight transport via road (percentage points of modal split)

20 10 0 -10 -20 -30

BE AT NL DK FI UK SE IT DE MT CY EL PT EU27 FR LU HU SI CZ LV RO EE LT SK BG PL
Appendices

1. Country codes and definitions
2. Indicator challenges and definitions

## Appendix 1: Country codes and definitions

### Country codes

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AT</td>
<td>Austria</td>
<td>EL</td>
<td>Greece</td>
</tr>
<tr>
<td>BE</td>
<td>Belgium</td>
<td>ES</td>
<td>Spain</td>
</tr>
<tr>
<td>BG</td>
<td>Bulgaria</td>
<td>FI</td>
<td>Finland</td>
</tr>
<tr>
<td>CY</td>
<td>Cyprus</td>
<td>FR</td>
<td>France</td>
</tr>
<tr>
<td>CZ</td>
<td>Czech Republic</td>
<td>HR</td>
<td>Croatia</td>
</tr>
<tr>
<td>DE</td>
<td>Germany</td>
<td>HU</td>
<td>Hungary</td>
</tr>
<tr>
<td>DK</td>
<td>Denmark</td>
<td>IE</td>
<td>Ireland</td>
</tr>
<tr>
<td>EE</td>
<td>Estonia</td>
<td>IT</td>
<td>Italy</td>
</tr>
<tr>
<td>LT</td>
<td>Lithuania</td>
<td>LU</td>
<td>Luxembourg</td>
</tr>
<tr>
<td>LV</td>
<td>Latvia</td>
<td>MT</td>
<td>Malta</td>
</tr>
<tr>
<td>NL</td>
<td>The Netherlands</td>
<td>PL</td>
<td>Poland</td>
</tr>
<tr>
<td>PT</td>
<td>Portugal</td>
<td>RO</td>
<td>Romania</td>
</tr>
<tr>
<td>SE</td>
<td>Sweden</td>
<td>SI</td>
<td>Slovenia</td>
</tr>
<tr>
<td>SK</td>
<td>Slovakia</td>
<td>UK</td>
<td>United Kingdom</td>
</tr>
</tbody>
</table>

### Definitions

**EU12**
European Union as from 1 November 1993 until 31 December 1994. EU12 comprises the following 12 Member States:
Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain and the United Kingdom.

**EU15**
European Union as from 1 January 1995 and until 30 April 2004. EU15 comprises the following 15 Member States:
Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

**EU27**
European Union as from 1 January 2007 and until 30 June 2013. EU27 comprises the following 27 Member States:
Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

**EU28**
European Union following Croatia's accession to the EU on 1 July 2013. EU28 comprises the following 28 Member States:
Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.
Appendix 2:
Indicator definitions and challenges

Indicator challenges

There are a number of issues and challenges with the indicators. These fall into two broad categories – collection and interpretation:

1. This is pioneering work as it is the first time that resource efficiency is measured across so many topics on such a large scale.

2. Some of the themes that the Scoreboard monitors are very difficult to measure and dedicated indicators do not exist or are difficult to develop. Therefore, some Scoreboard indicators must be regarded as proxies. However, the Scoreboard has so far been acknowledged as an initial, very useful tool to monitor progress in Resource Efficiency. It will evolve and include updated as well as new indicators in the future.

Indicators definition and interpretation

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Definition numerator</th>
<th>Definition denominator</th>
<th>Interpretation</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resources</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource productivity</td>
<td>Gross domestic product (EUR GDP chain-linked volumes 2005) (GDP PPS)</td>
<td>Domestic material consumption (kg of resource consumption)</td>
<td>Economic value generated per kg of raw material consumption.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>- EUR/kg, - EUR (PPS)/kg, - index 2000=100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic material consumption per capita</td>
<td>Domestic material consumption (tonnes of resources used each year)</td>
<td>Population</td>
<td>Provides an indication of the comparable resource consumption of nations normalised with the population.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>- tonnes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Land</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Productivity of artificial areas</td>
<td>Gross Domestic Product (GDP PPS)</td>
<td>Total artificial area (km²)</td>
<td>Provides a measure of the economic value generated per unit of built up and non-built up land within an economy.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>- million EUR (PPS)/km².</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Built up areas</td>
<td>Total built up area covered by roofed constructions such as buildings, greenhouses etc (km²)</td>
<td>Total national surface area (km²)</td>
<td>Indicates the level of artificial land development expressed as total built-up area over total national surface area.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>- km²; - % of total land</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water exploitation index</td>
<td>Total Fresh water abstracted (m³)</td>
<td>Long term Average available water (m³)</td>
<td>Evaluates the sustainability of water abstraction rates according to water availability. It is currently being reviewed and will be replaced by an indicator that will be able to account better for localised or temporary water scarcity in each Member State.</td>
<td>Eurostat, EEA</td>
</tr>
<tr>
<td>- %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water productivity</td>
<td>Gross Domestic Product (EUR GDP chain linked volumes 2005) (GDP PPS)</td>
<td>Fresh water abstracted (m³)</td>
<td>Provides a measure of the economic value generated per cubic metre of fresh water abstracted.</td>
<td>Eurostat, EEA</td>
</tr>
<tr>
<td>- EUR/m³ fresh water abstracted; - PPS/m² fresh water abstracted</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indicator</td>
<td>Definition numerator</td>
<td>Definition denominator</td>
<td>Interpretation</td>
<td>Source</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------------</td>
<td>------------------------</td>
<td>----------------</td>
<td>--------</td>
</tr>
<tr>
<td>Carbon</td>
<td>Greenhouse gas emissions per capita - tonnes CO₂ equivalent/capita</td>
<td>Population</td>
<td>Measures the volume of greenhouse gas emissions produced by each Member State normalised with population.</td>
<td>EEA</td>
</tr>
<tr>
<td>Energy productivity</td>
<td>Gross domestic product - (EUR GDP chain-linked volumes 2005) - (GDP PPS)</td>
<td>Energy consumption (kg of oil equivalent)</td>
<td>Provides an insight into the economic value generated per unit of energy consumed.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Energy dependence</td>
<td>Energy Imports (kWh)</td>
<td>Gross inland energy consumption plus bunkers (kWh)</td>
<td>Indicates the extent to which nations are reliant upon energy imports to satisfy final domestic energy consumption.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Share of renewable energy in gross final energy consumption</td>
<td>Renewable energy generation (kWh)</td>
<td>Gross inland energy consumption plus bunkers (kWh)</td>
<td>Indicates the proportion of energy consumption that is met from renewable energy sources.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Turning waste into a resource</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generation of waste (excluding major mineral wastes) - kg/capita</td>
<td>Total tonnes of waste produced annually (excluding major mineral wastes)</td>
<td>Population</td>
<td>Indicates weight of waste generated per inhabitant per year; mineral waste, including dredging spoils and contaminated soils, is excluded to enhance comparability. In some countries this type of waste accounts for large quantities deriving from a relatively small share of total economic activity.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Landfill rate of waste (excluding major mineral wastes) - % of total waste</td>
<td>Total waste (excluding major mineral waste) sent to landfill (tonnes)</td>
<td>Total waste generated (excluding major mineral waste) (tonnes)</td>
<td>Provides insight into the proportion of waste generated that is disposed of via landfilling. Mineral waste, including dredging spoils and contaminated soils, is excluded to enhance comparability. In some countries, this type of waste accounts for large quantities deriving from a relatively small share of total economic activity.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Recycling rate of municipal waste - % of municipal waste</td>
<td>Tonnes of municipal waste recycled (includes material recycling, composting and anaerobic digestion)</td>
<td>Total tonnes of municipal waste</td>
<td>This indicator compiles data on the proportion of municipal waste arising that is recycled – expressed as a percentage of total municipal waste generated.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Recycling rate of e-waste - % of e-waste</td>
<td>Total weight of WEEE collected in the respective year multiplied by the efficiency of treatment (tonnes*percentage)</td>
<td>Average weight of EEE placed on the market (PoM) in the three preceding years (tonnes)</td>
<td>Provides a view on the proportion of WEEE that is being collected and recycled. E-waste consists of waste material categorised under the WEEE and EEE classifications as they have been set out in Directive 2002/96/EC on WEEE.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Indicator</td>
<td>Definition numerator</td>
<td>Definition denominator</td>
<td>Interpretation</td>
<td>Source</td>
</tr>
<tr>
<td>----------------------------------------------------</td>
<td>-----------------------------------------------------------</td>
<td>------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Supporting research and innovation</td>
<td></td>
<td></td>
<td>Provides indication of the progress being made in supporting activities that contribute to the shift to more resource efficient economic activities.</td>
<td>Eco-Innovation Observatory</td>
</tr>
<tr>
<td>Eco-innovation index</td>
<td>Total score achieved by each Member State in each of the five categories</td>
<td>EU average score</td>
<td>Provides indication of the progress being made in supporting activities that contribute to the shift to more resource efficient economic activities.</td>
<td></td>
</tr>
<tr>
<td>Getting the prices right</td>
<td></td>
<td></td>
<td>Provides information on the proportion of total revenues from taxes and social contribution that derives from environmental taxes. These are made up of taxes on energy consumption, transport, resource use and pollutant emissions.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Total environmental tax revenues as a share of total revenues from taxes and social contributions</td>
<td>Total environmental taxation (EUR)</td>
<td>Total tax revenues and social contributions (EUR)</td>
<td>Provides information on the proportion of total revenues from taxes and social contribution that derives from environmental taxes. These are made up of taxes on energy consumption, transport, resource use and pollutant emissions.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Energy taxes by paying sector</td>
<td>Energy taxes paid by sector (EUR)</td>
<td>Total national energy taxes (EUR)</td>
<td>Indicates the proportion of energy taxes raised against five key sectors as a proportion of total tax revenues received from energy taxes: - households; - industry and construction; - transportation and storage; - services; - agriculture, forestry and fishing.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Biodiversity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index of common farmland bird species</td>
<td></td>
<td></td>
<td>Used as a proxy for overall biodiversity, it assess changes in the population abundance and the diversity of a selection of common bird species (including subsets of common farmland species and forest species) associated with specific habitats. Changes in this dataset can be linked to alterations in environmental quality and land use.</td>
<td>EBCC/ RSPB/ BirdLife/ statistics the Netherlands</td>
</tr>
<tr>
<td>Area under organic farming</td>
<td>agricultural area occupied by organic farming (existing organically-farmed areas and areas in process of conversion) (ha)</td>
<td>Total utilised agricultural area (UAA) (ha)</td>
<td>Indicates the proportion of agricultural land managed organically.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Landscape fragmentation</td>
<td>Number of meshes</td>
<td>Total national surface area (1 000 km²)</td>
<td>Indicates to what extent natural land is becoming more fragmented, potentially inhibiting movement of wildlife. Mesh density per 1 000 km² highlights the average size of unfragmented land with lower densities suggesting fewer barriers to wildlife migration.</td>
<td>EEA</td>
</tr>
<tr>
<td>Indicator</td>
<td>Definition numerator</td>
<td>Definition denominator</td>
<td>Interpretation</td>
<td>Source</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>--------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Safeguarding clean air</td>
<td>Sum of: Population living in each city multiplied by the concentration of PM$_{2.5}$ averaged over all the background and traffic monitoring stations in that city. (Population * µg/m³)</td>
<td>Total urban population in the considered cities (Population)</td>
<td>Indicates the population-weighted concentration of PM$_{2.5}$ to which the urban population is potentially exposed. Information on cities is obtained from Urban Audit data from Eurostat. Air quality monitoring data are obtained from AirBase from the EEA. The proportion of population living within 100 m of major roads in each member state is used to calculate a weighted average of background and traffic monitoring stations. Industrial monitoring stations are not included.</td>
<td>EEA</td>
</tr>
<tr>
<td>Urban population exposure to air pollution by PM$_{10}$ - µg/m³</td>
<td>Sum of: Population living in each city multiplied by the concentration of PM$_{10}$ averaged over all the background and traffic monitoring stations in that city. (Population * µg/m³)</td>
<td>Total urban population in the considered cities (Population)</td>
<td>Indicates the population-weighted concentration of PM$_{10}$ to which the urban population is potentially exposed. Information on cities is obtained from Urban Audit data from Eurostat. Air quality monitoring data are obtained from AirBase from the EEA. The proportion of population living within 100 m of major roads in each member state is used to calculate a weighted average of background and traffic monitoring stations. Industrial monitoring stations are not included.</td>
<td>EEA</td>
</tr>
<tr>
<td>EU urban population exposed to PM$_{10}$ concentrations exceeding the daily limit value (50 µg/m³ on more than 35 days in a year) - (% of total population exposed to above limit value for more than 35 days per year).</td>
<td>Sum of: Population living in cities where by the concentration of PM$<em>{10}$ averaged over all the background and traffic monitoring stations in that city is above the daily limit value for PM$</em>{10}$. (Population)</td>
<td>Total urban population in the considered cities (Population)</td>
<td>Indicates the extent to which [fraction] urban populations are exposed to levels of pollutants that are beyond limit values and are thus potentially dangerous for human health. The high annual variability in this indicator is due to the number of stations considered each year and to the fact that each station is taken into account only if the PM$_{10}$ exposure it measures exceeds the daily limit value. Information on cities is obtained from urban audit data from Eurostat. Air quality monitoring data are obtained from AirBase from the EEA.</td>
<td>EEA</td>
</tr>
<tr>
<td>Indicator</td>
<td>Definition numerator</td>
<td>Definition denominator</td>
<td>Interpretation</td>
<td>Source</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------------</td>
<td>------------------------</td>
<td>----------------</td>
<td>--------</td>
</tr>
<tr>
<td>Land and soils</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil erosion by water - % of area eroded by more than 10 tonnes per hectare per year; - km²</td>
<td>Area of land eroded by more than 10 tonnes/ hectare (km²)</td>
<td>The total non-artificial area in the country (km²)</td>
<td>Provides an indication of how rapidly soil erosion is occurring due to water erosion processes.</td>
<td>JRC</td>
</tr>
<tr>
<td>Gross nutrient balance in agricultural land – nitrogen - kg/ha</td>
<td>Inputs of nitrogen as fertiliser minus nitrogen removed through harvesting and as crop residue (kg)</td>
<td>Total arable land, permanent crops and permanent grassland (ha)</td>
<td>Provides an insight into how agricultural practices are affecting the quality of soils.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Gross nutrient balance in agricultural land – phosphorus - kg/ha</td>
<td>Inputs of phosphorus minus phosphorus removed through harvesting and as crop residue (kg)</td>
<td>Total arable land, permanent crops and permanent grassland (ha)</td>
<td>Provides an insight into how agricultural practices are affecting the quality of soils.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Addressing food</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily calorie supply per capita by source - (kilocalories per capita per day from food source); - total; - from vegetal products; - from animal products.</td>
<td>Kilocalories supply by food source (kcal)</td>
<td>Total population</td>
<td>Provides an indication of the variation in calorie intake and how this is split between vegetable and animal based food products. There are links with obesity and excessive consumption concerns in the EU.</td>
<td>FAO</td>
</tr>
<tr>
<td>Improving buildings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final energy consumption in households by fuel - %</td>
<td>Household energy consumption by fuel type</td>
<td>Total household energy consumption</td>
<td>Provides the breakdown of energy consumption in households by fuel type: petroleum products, gas, solid fuels, and electrical energy.</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Ensuring efficient mobility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average CO₂ emissions per km from new passenger cars - CO₂ g/km</td>
<td>Sales-weighted average CO₂ emissions of newly registered passenger cars. (g/km)</td>
<td>Indicates progression towards reducing the CO₂ emissions per km from passenger vehicles. The indicator reports national and EU sales-weighted averages, according to emissions reported by manufacturers for each of their models sold.</td>
<td>EEA</td>
<td></td>
</tr>
<tr>
<td>Pollutant emissions from transport – NOx, NMVOC and PM₁₀ index (2000 = 100).</td>
<td>Pollutant emissions from transport in the given year (NOx, VOC and PM) (tonnes)</td>
<td>Pollutant emissions from transport in 2000 (NOx, VOC and PM) (tonnes)</td>
<td>Indicates progression towards reducing other harmful pollutant emissions from passenger vehicles.</td>
<td>EEA</td>
</tr>
<tr>
<td>Modal split of passenger transport - % of passenger/km by type</td>
<td>Passenger kilometre by transport type</td>
<td>Total passenger-kilometre travelled</td>
<td>Indicates the share of passenger journeys undertaken by passenger cars, buses and coaches and railway. This indicator helps to monitor the use of more efficient forms of transport, such as public transport (coaches, buses and trains).</td>
<td>Eurostat</td>
</tr>
<tr>
<td>Modal split of freight transport - % of tonne-km by type</td>
<td>Freight tonne-km by transport type</td>
<td>Total freight tonne-kilometre transported</td>
<td>Indicates the share of freight transport moved via road, rail and inland waterways. This indicator helps to monitor the use of more efficient forms of transport, such as railways and waterways.</td>
<td>Eurostat</td>
</tr>
</tbody>
</table>