EUROPEAN SEMESTER THEMATIC FACTSHEET

RESOURCE EFFICIENCY

1. INTRODUCTION

Natural resources are fundamental to human health, economic activity, well-being and quality of life, but their supply is limited.

Growing global demand for these resources is causing scarcity problems and price volatility. The resulting competition for resources has the potential to cause instability in many regions of the world. EU Member States rely on the rest of the world for resources such as fuel and a number of key raw materials. They are therefore vulnerable to security of supply risks.

The European Union's current model of development is highly resource-intensive. To reduce resource depletion and the environmental degradation it can entail, we need to replace the current model with more resilient and sustainable production and consumption patterns, in line with the principles of a 'circular economy'. Moving towards a more productive and less resource-intensive economy requires investment in eco-innovation and can lead to major gains in both competitiveness and job creation.

In a more circular economy the value of products, materials and resources is maintained in the economy for as long as possible and the generation of waste is minimised.

It is becoming crucial for the EU to make this transition. Doing so would also help the EU meet the objectives of the UN's 2030 Agenda for Sustainable Development, in particular Sustainable Development Goal 12 on 'Responsible consumption and production'.

In recent years a variety of EU policies have promoted improvements in resource efficiency. In 2011 the European Commission launched the 'Resource-efficient Europe' flagship initiative[1] under the European 2020 Strategy. The initiative promotes a shift towards a resource-efficient and low-carbon economy to help achieve more sustainable growth and provide a long-term framework for action.

The 'Roadmap to a resource efficient Europe'[2] is one of the main building blocks underpinning the flagship initiative. The roadmap outlined the structural and technological changes needed by 2050 to decouple economic growth from resource use and its environmental impact. It includes milestones to be reached by 2020.

Progress by Member States and the EU as a whole towards the objectives and targets of the Europe 2020 flagship initiative is assessed through the Resource Efficiency Scoreboard, a set of indicators Eurostat has published regularly since December 2013. The scoreboard includes a lead indicator, a dashboard of indicators covering water, land, materials and carbon,

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1 European Commission, 'Communication from the Commission, EU2020 — A strategy for smart, sustainable and inclusive growth' [COM(2010) 2020].

2 European Commission, 'Roadmap to a Resource Efficient Europe' [COM(2011) 571].

and thematic indicators assessing priority policy areas.

With the 'EU action plan for a circular economy'[3] in 2015, the Commission stressed the economic case for increasing resource efficiency as an opportunity to generate new and sustainable competitive advantages for the EU. Moving away from the current linear economy model and 'closing the loop' of product life cycles through greater reuse and recycling could benefit both the environment and the economy.

The ambitious programme of measures put forward by the Commission covers the whole cycle, from production and consumption of products to waste management and the market for secondary raw materials. The European Structural and Investment Funds provide significant opportunities to support resource-efficiency investments across the EU.

In 2015 the Commission also presented the 'Framework strategy for a resilient energy union with a forward-looking climate change policy' and the related 'Roadmap for the energy union'[4]. A European energy union that ensures secure, affordable and climate-friendly energy requires innovative low-carbon technologies consuming less energy in order to reduce pollution and conserve domestic energy sources. It also calls for policies on energy efficiency and resource efficiency to be coordinated in order to go beyond the prevailing linear economic model.

The G7 Alliance on Resource Efficiency was launched by G7 leaders in 2015 as a forum to share knowledge and create information networks on a voluntary basis[5]. With the active involvement of the EU, the Alliance has supported the adoption by G7 environment ministers of the *Toyama Framework on Material Cycles*[6] (2016) and the *Five-Year Bologna Roadmap*[7] (2017). These seek to exploit the opportunities offered by resource efficiency, promote best practices and foster innovation.

The launch by G20 leaders of the G20 Resource Efficiency Dialogue[8] in July 2017 opens up new opportunities for international cooperation to promote a global transition towards a resource-efficient, low-carbon and circular economy.

This note is structured as follows. Section 2 reviews EU countries' performance on a few selected indicators. Section 3 discusses the available evidence on potential policies to promote effectively more efficient use of resources, and reviews their main strengths and weaknesses. Section 4 sketches an overview of the state of play in all EU countries. It highlights good practices in resource efficiency from EU countries, in particular the Netherlands.

2. POLICY CHALLENGES: AN OVERVIEW OF PERFORMANCE IN EU COUNTRIES

An economy becomes more resource-efficient when it reduces the absolute level of resources it consumes to produce each unit of output, or when it increases the output produced from each unit of resources it consumes.

Resource efficiency is usually measured by the 'resource productivity indicator'[9], the

[3] European Commission, 'Communication from the Commission to the EU Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, Closing the loop — An EU action plan for the Circular Economy' [COM(2015) 614].

[4] European Commission, 'Energy Union Package — A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy' [COM(2015) 80].

[5] Annex to the Leaders' Declaration G7 Summit, 7– 8 June 2015.

[6] G7 Toyama Framework on Material Cycles, May 2016, http://www.mofa.go.jp/files/000159928.pdf.

[7] G7 Bologna Environment Ministers' Declaration, Bologna Summit, 11-12 June 2017.

[8] Annex to G20 Leaders' Declaration, 'G20 Resource Efficiency Dialogue', G20 Summit, Hamburg, 7– 8 July 2017.

[9] To have a broader picture of Member States' performances this indicator needs to be complemented by additional indicators, as is the case in the Resource Efficiency Scoreboard.

lead indicator of the Resource Efficiency Scoreboard capturing material resource use with respect to economic growth. Resource productivity is defined as the ratio of gross domestic product (GDP) to domestic material consumption, which measures the total amount of materials directly used by an economy[10] (Figure A.1 in the Annex). It is expressed in euros per kilogram[11]. If GDP grows faster than material consumption, resource productivity improves and economic activity is decoupled from material consumption. (In other words, the economy is able to produce more without a proportional increase in resource consumption. This is known as 'relative decoupling'[12]).

The EU's resource productivity increased by 32.3% in the decade from 2007 to 2016. In 2016 EU productivity was 2.1 EUR/kg of GDP, a 2.7% rise from the previous year (Figure A.2 in the Annex).

Resource productivity varies widely among Member States. It greatly depends on the structure of national economies and the size and structure of their international trade. Typically, open industrial economies consume more resources because they import large quantities of raw materials which are later exported as finished goods. Service economies, by contrast, tend to create GDP from activities that are less material-intensive, such as financial services, tourism, arts and recreation, healthcare and public administration. Service economies thus appear more efficient because they consume fewer material resources per euro of output.

Over the last decade the biggest increases in resource productivity have been registered in Spain (138%), Ireland (127%) and Slovenia (84%). This was due to a substantial reduction in their material use compared to the change in their GDP[13].

In 2016 the Netherlands shows the biggest improvement from the previous year (19.5%)[14] and is also the Member State with the highest resource productivity [4.2 GDP in purchasing parity standards (PPS)/kg materials]. It is followed by Luxembourg, Italy and the United Kingdom (Figure 1). Bulgaria, Estonia, Latvia, Lithuania, Poland and Romania continue to be the least resource-productive countries. It should be noted that resource productivity strongly reflects a country's economic structure. Member States with lower GDP and large industrial and primary extractive sectors (e.g. forestry and/or mining) are typically less productive than Member States with a more important services sector.

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[10] Domestic material consumption is one of the dashboard indicators included in the Resource Efficiency Scoreboard. It is defined as the annual quantity of raw materials extracted from the domestic territory of the focal economy, plus all physical imports minus all physical exports.

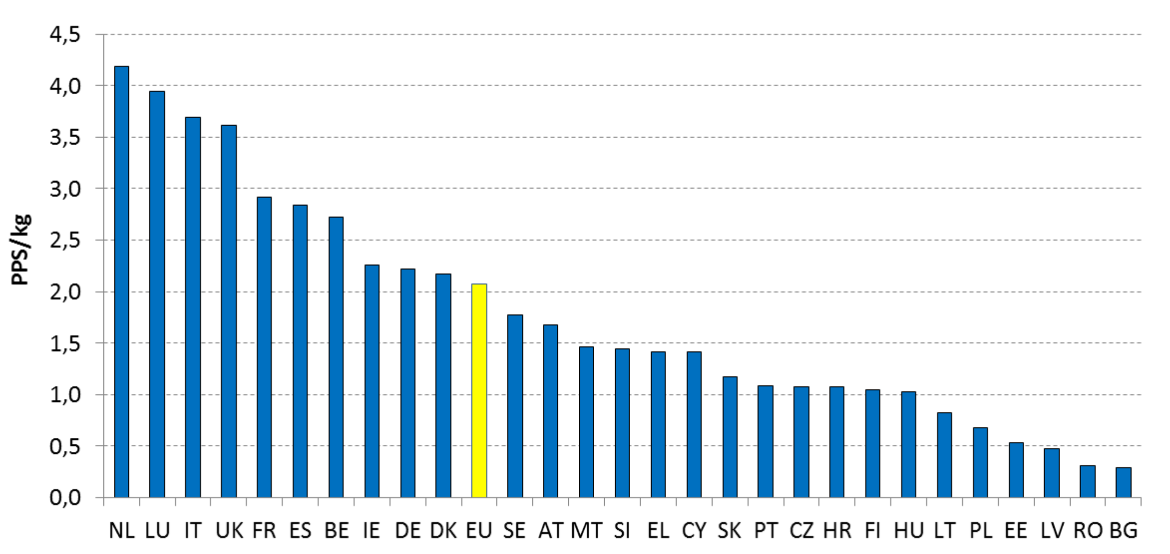
[11] To track trends over time in a single geographical area, calculations are usually based on GDP expressed in real terms (chain-linked volumes) to exclude inflation. To compare countries at the same moment in time, calculations are usually based on GDP expressed in purchasing power standards to remove differences in purchasing power.

[12] Relative decoupling occurs when the growth rate of the resources used is lower than the economic growth rate, so that resource productivity is rising. Absolute reductions in resource use are a consequence of decoupling when the growth rate of resource productivity exceeds the growth rate of the economy.

[13] Over 2007-2016 domestic material consumption fell by 58.3% in Spain, 40.8% in Ireland and 45.1% in Slovenia. This was mainly driven by a fall in the physical extraction of non-metallic minerals in those countries, largely due to the crisis in the construction industry. In the same period, GDP fell by 0.4% in Spain while it increased by 39.7% in Ireland and by 1.4% in Slovenia. (Trends for Irish GDP reflect the upwards revision for 2015, primarily due to the relocation to Ireland of a number of big companies http://ec.europa.eu/eurostat/documents/24987/6390465/Irish_GDP_communication.pdf).

[14] For an explanation of domestic material consumption please see the above footnote.

Figure 1 — Resource productivity, 2016



Source: Eurostat, 2017.

As the Commission's 'circular economy action plan' highlights, the transition towards a more resource-efficient economy entails a number of policy challenges.

We focus here on three of them:
i) fostering eco-innovation,
ii) increasing energy efficiency and
iii) increasing the proportion of municipal waste recycled.

2.1. Eco-innovation

Innovation can play an important role in the transition towards making more efficient use of resources. Innovations, particularly eco-innovations, help in developing the new technologies, processes, products, services and business models needed to change our production and consumption patterns. Supporting innovative projects relevant to resource efficiency and the circular economy is a key plank of the circular economy action plan.

An important indicator of environmental innovation and R&D is the Eco-Innovation Index, one of the thematic indicators in the EU Resource Efficiency Scoreboard.

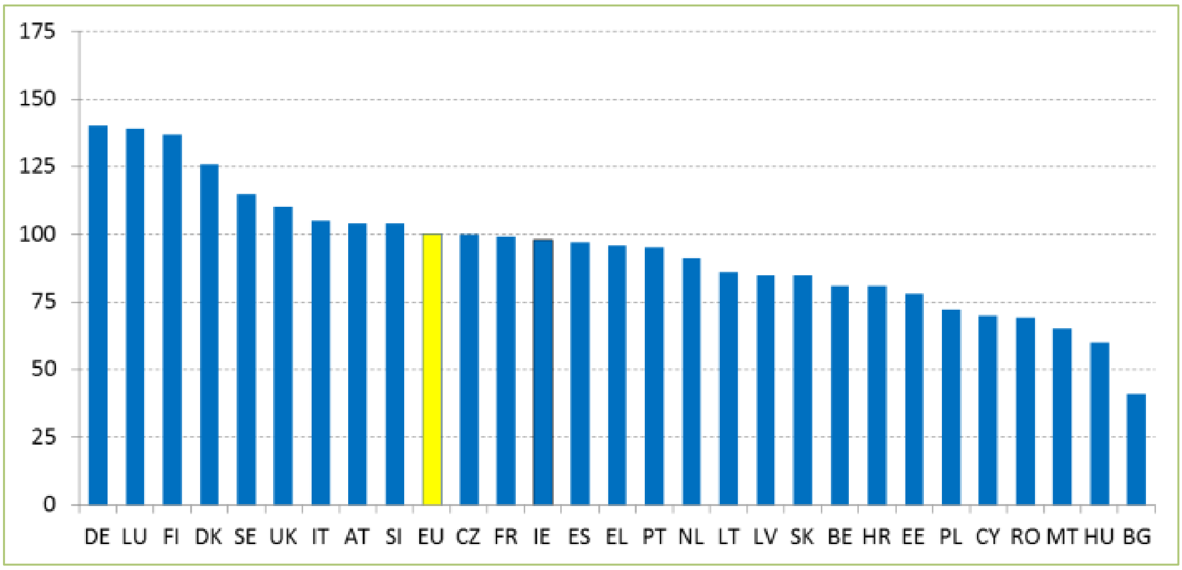
The index measures the performance of individual Member States on various dimensions of eco-innovation compared to the EU average (EU index=100), highlighting their strengths and weaknesses.

The Eco-Innovation Index builds on 16 indicators covering five innovation areas:

- eco-innovation inputs,
- eco-innovation activities,
- eco-innovation outputs,
- environmental outcomes and
- socioeconomic outcomes.

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

Figure 2 — Eco-innovation index, 2016



Source: Eco-innovation Observatory, 2017.

Data show that since 2010 Finland and Denmark have consistently been the most eco-innovative Member States (by more than 25% above the EU average). The changes in rates of eco-innovation vary considerably between countries. While some Member States are relatively stable, Lithuania, Latvia and Slovakia have improved their positions relative to other Member States. Conversely, Bulgaria and Belgium have seen their positions deteriorate.

In 2016 Germany, Luxembourg and Finland are the most eco-innovative countries (by 30% above the EU average, Figure 2). Bulgaria and Hungary rank respectively last and in penultimate position (at no more than 60% of the EU average).

Data for the individual eco-innovation categories show some interesting differences in performance across Member States (Figure A.3 in the Annex). Denmark, Germany and Finland stand out by far from other Member States as the best performers in terms of eco-innovation inputs[15]. On eco-innovation activities[16], Finland and Sweden occupy the top two positions. The best performers on eco-innovation outputs[17] are Luxembourg and Finland. For resource efficiency outcomes, Luxembourg, the United Kingdom and Malta have the highest scores. On socioeconomic outcomes[18], Poland and Slovakia come out top.

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[15] The score for eco-innovation inputs results from a simple average of the scores on 'governments' environmental and energy R&D appropriations and outlays (Share of GDP)', 'total R&D personnel and researchers (Share of total employment)' and 'total value of green early stage investments (USD/cap)'.
[16] The score for eco-innovation activities results from a simple average of the scores on 'firms having implemented innovation activities aiming at a reduction of material input per unit output (% of total firms)', 'firms having implemented innovation activities aiming at a reduction of energy input per unit output (% of total firms)' and 'ISO 14001 registered organisations (per mln pop)'.
[17] The score for eco-innovation outputs results from a simple average of the scores on 'eco-innovation related patents (per million people)', 'eco-innovation related publications (per million people)' and 'eco-innovation related media coverage (per number of electronic media)'.
[18] The score for resource efficiency outcomes results from a simple average of the scores on material productivity, water productivity, energy productivity and greenhouse gas emission intensity.

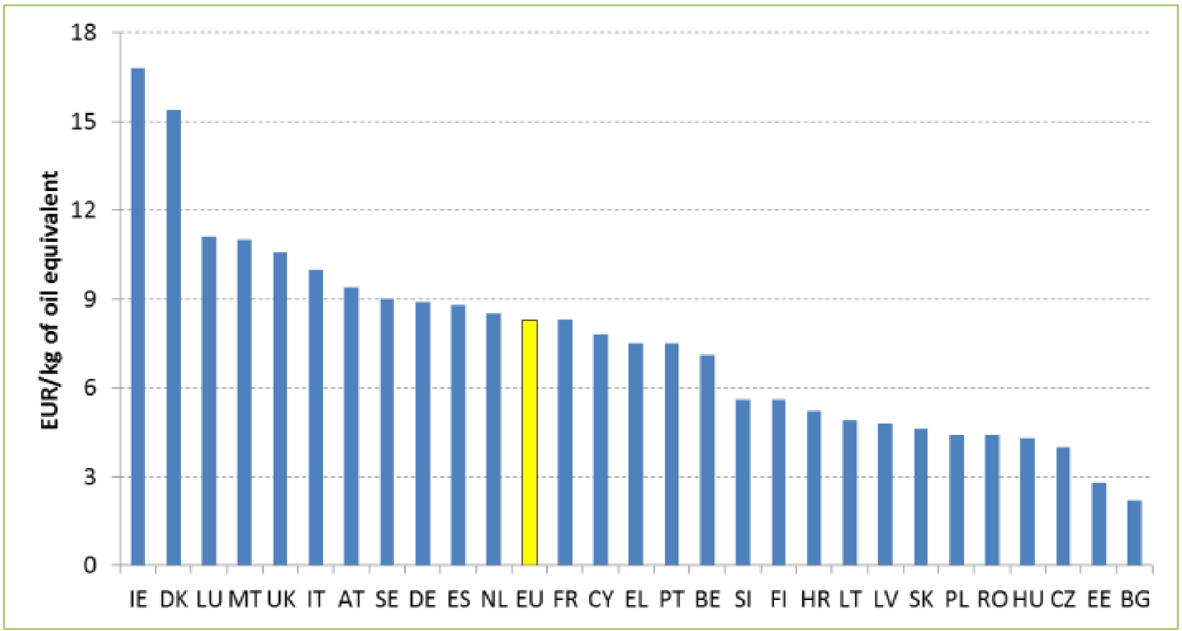
2.2. Energy efficiency

Making progress towards a more resource-efficient economy also involves reducing energy consumption at all stages of the energy chain, from generation to final consumption. This means delivering more services for the same energy input, or the same services for less energy input.

Putting strong emphasis on energy efficiency is in line with the objectives set in the 2030 climate and energy framework and the energy union strategy. By using energy more efficiently, Europeans can lower their energy bills, reduce their reliance on imported fuels and help protect the environment. This is also good for public health (e.g. by reducing air pollution). Doubling the global rate of improvement in energy efficiency by 2030 is a key objective of the Sustainable Development Goals[19].

A useful indicator for assessing energy efficiency is energy productivity, one of the dashboard indicators in the EU Resource Efficiency Scoreboard. It measures the productivity of energy consumption. This indicator is the ratio of GDP to gross inland consumption of energy for a given calendar year. It is expressed in euros per kg of oil equivalent.

Figure 3 — Energy productivity, 2015



Source: Eurostat, 2017 .
Notes: data for Spain, France, Greece and Romania are provisional.

In 2015, energy productivity in the EU reached 8.3 EUR/kg of oil equivalent, a 20.3% increase from 2006 levels (Figure 3). Individual countries' performances vary widely. Ireland (with 16.8 EUR/kg of oil equivalent) and Denmark (with 15.4 EUR/kg of oil equivalent) are the best performers. They are followed by Luxembourg, Malta, the United Kingdom and Italy, all scoring above 10 EUR/kg of oil equivalent. Nine Member States are below 5 EUR/kg of oil equivalent. However, it is important to keep in mind that these differences are very much related to the structure of the economy.

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[19] One of the targets related to Goal 7 (http://www.un.org/sustainabledevelopment/energy/).

According to the Commission's 2016 Energy Efficiency Progress Report, the EU as a whole is becoming more energy-efficient. Energy consumption fell significantly between 2005 and 2014: primary energy consumption was down 12% and final energy consumption decreased by 11%.

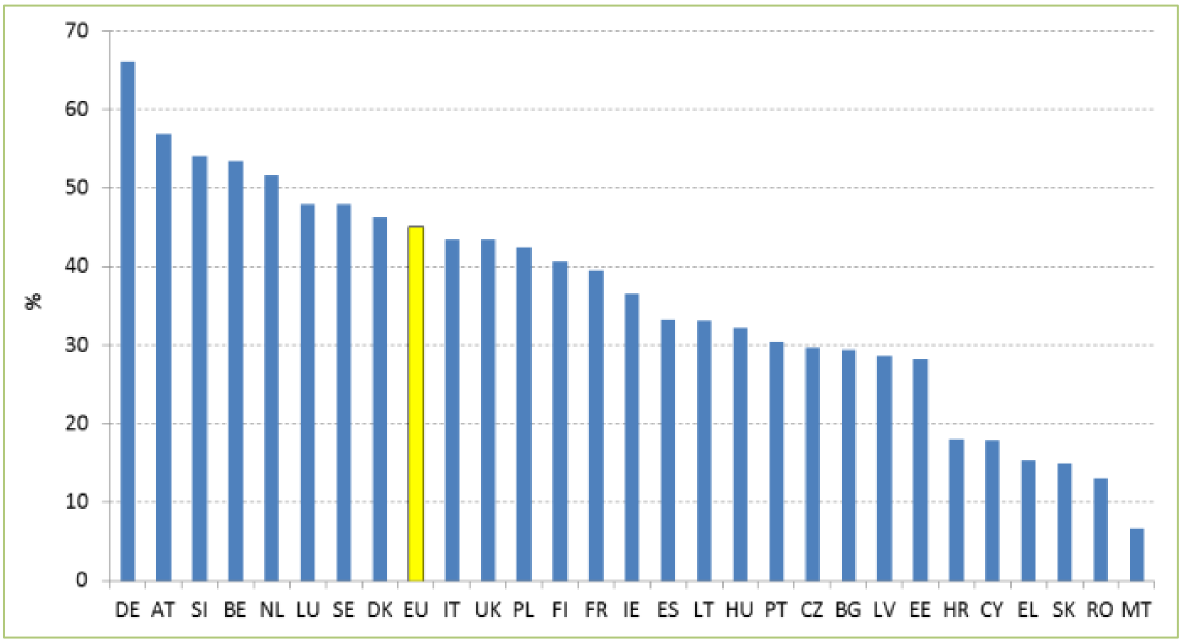
2.3. Recycling of municipal waste

Recycling can help reduce resource extraction by collecting reusable materials and reintroducing them into the production process. Lower demand for raw materials reduces demand for primary resource extraction and, generally, the environmental damage caused by waste generation. Recycling is also a useful indicator of sustainability and of the development of more 'circular' economic patterns.

One of the Resource Efficiency Scoreboard's thematic indicators is the recycling rate for municipal waste. This quantifies the proportion of recycled municipal waste (including the composted and anaerobically digested component) in total municipal waste. Municipal waste consists to a large extent of waste generated by households but may also include similar wastes generated by small businesses and public institutions collected by, or on behalf of, municipalities[20]. This latter part of municipal waste may vary by municipality and by country, depending on the local waste management system.

These differences may at least partially explain the disparities between Member States (Figure 4). Over the past decade the EU has continuously increased the proportion of municipal waste recycled, to 45%[21] in 2015 (10 percentage points higher than in 2007).

Figure 4 — Recycling rate of municipal waste, 2015



Source: Eurostat, 2017.
Notes: EU data are Eurostat estimates. Data for Ireland refer to 2012 and for Greece refer to 2014.

[20] It excludes industrial and agricultural waste.
[21] Eurostat estimates. 2014 data are not available for Ireland and Greece.

With a few exceptions (Belgium, Greece and Austria), the overall trend at country level is upwards. Some of the Member States that joined the EU most recently (Croatia, Latvia, Lithuania Poland and Romania) have exhibited important increases over time. However, Croatia and Cyprus, as well as Greece, Malta, Romania and Slovakia, still do not reach a recycling rate of 20% in 2016. By contrast, the best performers — Germany, Austria, Slovenia, Belgium and the Netherlands — recycle more than 50%.

3. POLICY LEVERS TO ADDRESS THE POLICY CHALLENGES

Using traditional command-and-control environmental regulation to accomplish policy goals can be costly. Environmental taxes[22] can be an effective market-based alternative. Environmental taxes are those where the tax base is a physical unit (or a proxy of it) of something that has a proven, specific, negative impact on the environment.

Environmental taxes remove the need for authorities to receive detailed information about the cost structure of abatement technologies and the economic activities of polluters. This makes the overall administrative costs of environmental taxes — and often the compliance costs too — lower than the costs and effort required to monitor and enforce rules covering regulated activities.

Furthermore, in contrast to regulation which imposes specific conditions and behavioural patterns, environmental taxation gives economic actors the flexibility to decide the best or cheapest way to reduce environmental damage. Environmental taxes also create incentives for businesses to opt for innovative, greener products and production processes.

Environmental taxes as policy instruments have been widely analysed in economic and political literature. According to the mainstream economic approach, by influencing consumer choices environmental taxation can correct for 'negative externalities', i.e. additional costs imposed on society by environmental pollution and resource use.

Whenever market prices do not reflect the full costs of producing goods and services ('market failure'), environmental taxes make it possible to internalise such costs. In other words, environmental taxation has the effect of reducing environmental pollution and resource use, ensuring that costs and benefits are fully taken into account in economic decision-making.

The revenue from environmental taxes can be used to reduce other, more distorting, taxes (e.g. on labour) or re-invested in 'greener' infrastructure and initiatives. This argument is known in the literature as the 'double-dividend hypothesis' and led to increased interest in environmental taxation in the 1990s.

Under this approach, in addition to the first dividend of improving the environment, tax-shifting programmes could yield a second dividend. This would involve using the revenues from environmental taxes to reduce distorting labour and capital taxes in a revenue-neutral way. Doing this would increase the overall efficiency benefits of the tax reform.

Evasion of environmental taxes is also much lower than for other taxes, while administrative costs are below those for income and value-added taxes. Environmental taxation is supported by reputable international organisations such as the World Bank, International Monetary Fund (IMF) and Organisation for Economic Cooperation and Development (OECD).

Closely linked to taxation is the need to reform and phase out environmentally harmful subsidies, particularly for fossil fuels. This is also seen as a precondition for making environmental taxation effective. The 'EU Roadmap for a resource efficient Europe' calls for the phasing-out of environmentally harmful subsidies by 2020, with due regard to the impact on people in need. In June 2017 the G7 reiterated its commitment to eliminating inefficient fossil fuel subsidies and encouraged all countries to do so by 2025.

[22] See the European Semester thematic factsheet on Taxation.

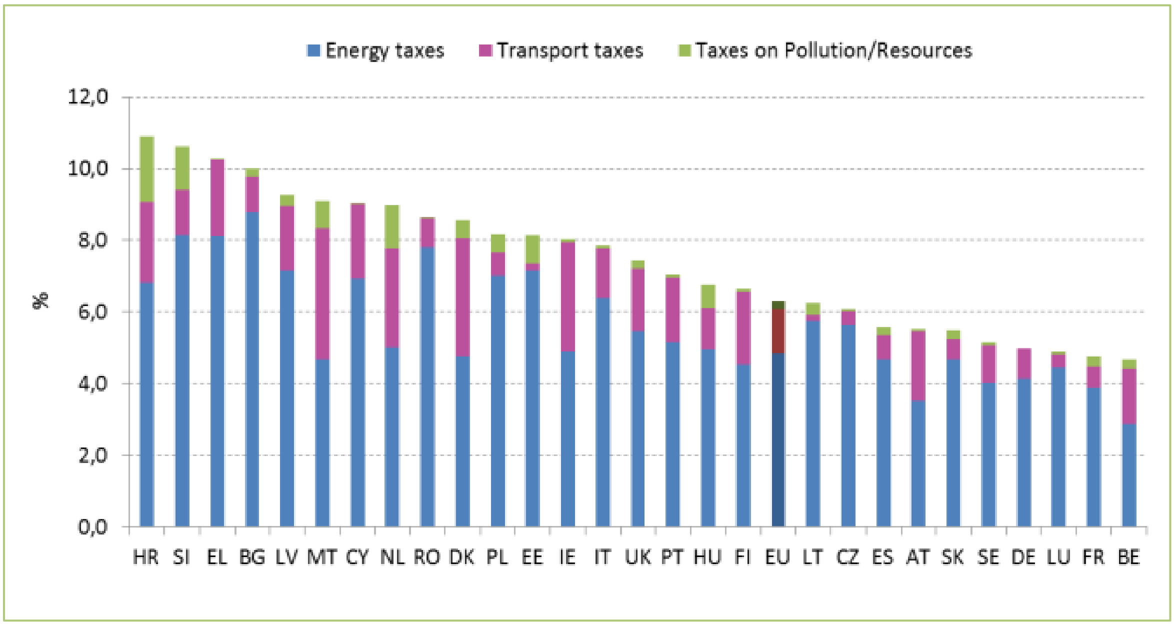
The removal of fossil fuel and other environmentally harmful subsidies should be seen in a broader context: that of making the transition towards a green economy.

In this, considerations and trade-offs regarding resource efficiency, ecosystem resilience, human wellbeing and societal equity need to be balanced.

4. CROSS-EXAMINATION OF POLICY STATE OF PLAY

In EU countries the implementation of environmental taxes is still quite limited. Energy, carbon and transport (vehicle) taxes are by far the most commonly used, while waste-related instruments exist in most Member States. However, taxes addressing air and water pollution and resource use are rather less widespread.

Figure 5 — Total revenues from environmental taxes and social contributions (excluding imputed social contributions) as a share of total tax revenue, 2015



Source: Eurostat, 2017.
Note: Taxes and social contributions do not include imputed social contributions.

From 2000 to 2008 environmental tax revenues as a proportion of total tax revenues in the EU slightly decreased. In 2009 they increased due to falls in other taxation (a result of the financial crisis) and in income and corporate tax revenue. Since then environmental tax revenues have more or less stabilised.

In 2015 environmental taxes accounted for 6.3% of total revenues from taxes and social contributions (excluding imputed social contributions, Figure 5). Most of this (4.8%) comes from energy taxes, followed by transport taxes (1.3%).

Taxation of pollution or resource use makes the smallest contribution (0.2%).

Environmental taxes raised over 10% of total tax revenue in Croatia, Greece and Slovenia but less than 5% in Belgium, France, Germany and Luxembourg. Energy taxes are always the biggest contributor, though with some variances. According to a European Commission report[23], around a third of Member States would have potential scope to change their environmentally related taxation.

[23] European Commission, 'Tax Reforms in EU Member States 2015. Tax policy challenges for economic growth and fiscal sustainability', Institutional paper 008, September 2015.

Between 2006 and 2015 the contribution of environmental taxes to overall tax revenue was low and quite stable (at slightly above 6%) across the EU on average (Figure A.4 in the Annex). By contrast, the contribution of labour taxes remained high, rising by almost 1 percentage point from 48.8% to 49.7% (though it has declined since 2012). Taxes on labour and capital are calculated on bases (such as salaries and capital) that increase in value over time. Environmental taxes, however, are often calculated in units of physical consumption or wastes produced and are frequently fixed in nominal terms. Under these circumstances, their revenue will also fall if they are successful in changing behaviour.

The Netherlands' experience of levying environmental taxes since 1970 provides an interesting case study.

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 of economic and social activities. Taxes on motor vehicles (e.g. registration and annual circulation taxes) were raised 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 carbon dioxide (CO_2) emissions by 210 000 tonnes in its first 2 years.

Green taxation in the Netherlands also comprises:

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

In 2015, the contribution of environmental taxes to overall tax revenue in the Netherlands was the eighth highest in the EU. Over 50% of its environmental tax revenues are from energy, but taxes on transport also make a significant contribution (30%).

Recent years have seen some interesting developments in Dutch transport taxation. Transport tax revenues as a share of GDP in the Netherlands (1%) are among the highest in Europe, ranking third in 2015 (after Denmark and Malta). Until 2009, the registration tax rate was 45.2% of the net list vehicle price. Changes introduced in 2009 based the tax partly on vehicles' carbon emissions. Petrol vehicles emitting less than 110 grams of CO_2 per kilometre and diesel vehicles emitting less than 95 grams were exempt from the tax. After some further adjustments to the cut-off limits, since 2013 the registration tax is based entirely on carbon emissions. Since 2008, the same cut-off limits for carbon emissions also apply to the circulation tax.

These changes at least partly explain why the Netherlands' average CO_2 emissions from vehicles improved from the 12th-lowest in the EU in 2007 to the lowest in 2014. This policy change had a clear budgetary impact, however: revenue from the vehicle registration tax dropped by about 65% from EUR 3.6 billion in 2007 to EUR 1.1 billion in 2014 (in nominal prices).

Date: 13.11.2017

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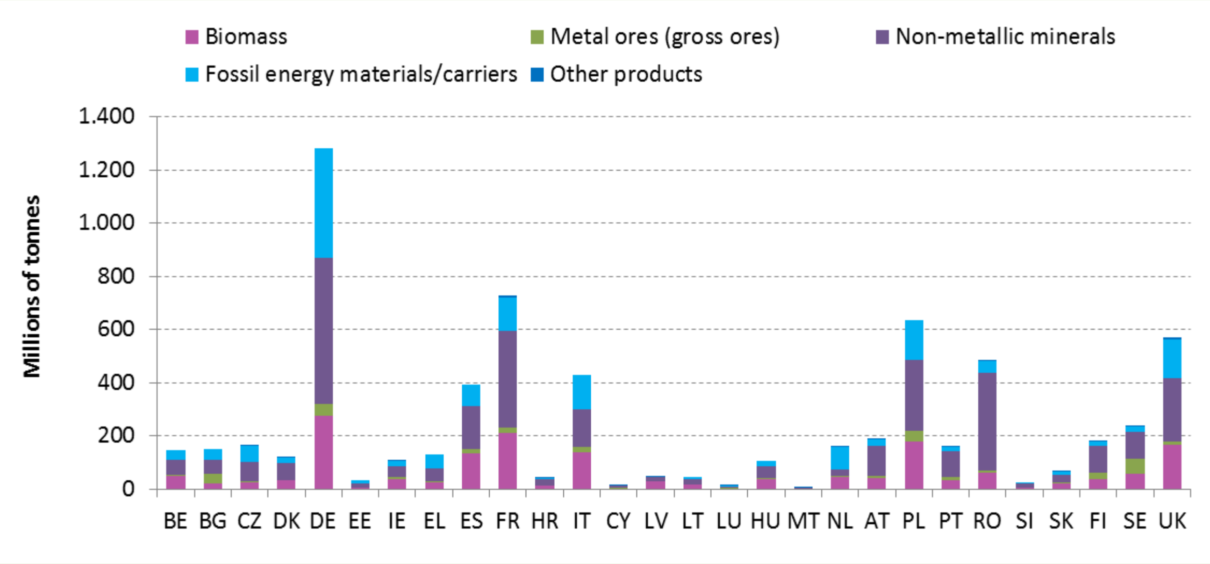
6. USEFUL RESOURCES

- Eco-Innovation Scoreboard http://ec.europa.eu/environment/ecoap/scoreboard_en
- Resource Efficiency Scoreboard http://ec.europa.eu/environment/resource_efficiency/targets_indicators/scoreboard/index_en.htm

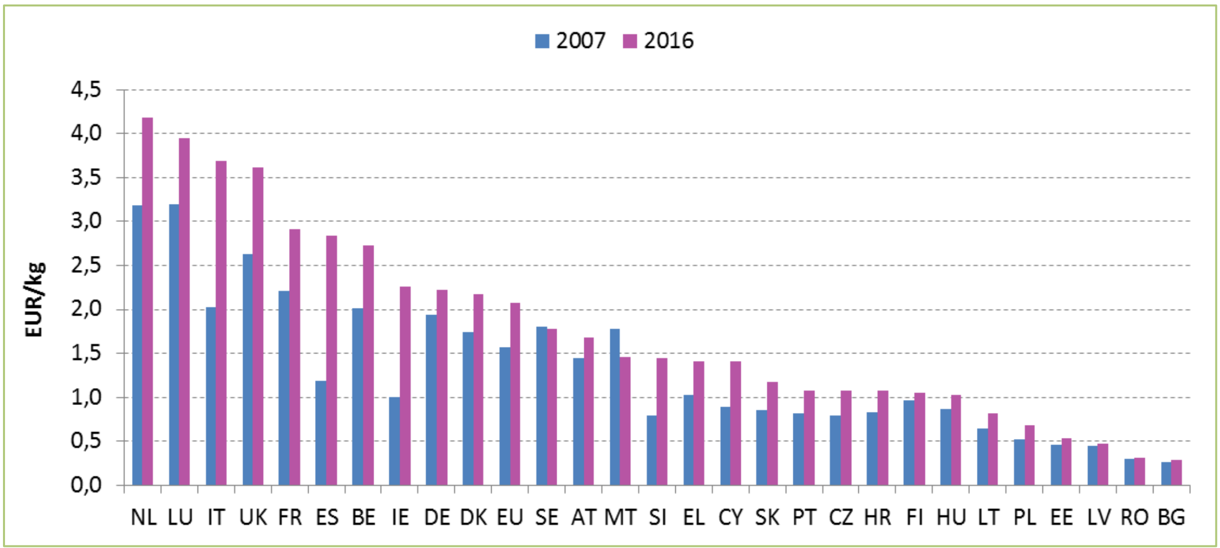
ANNEX

Figure A.1 — Domestic material consumption, 2016



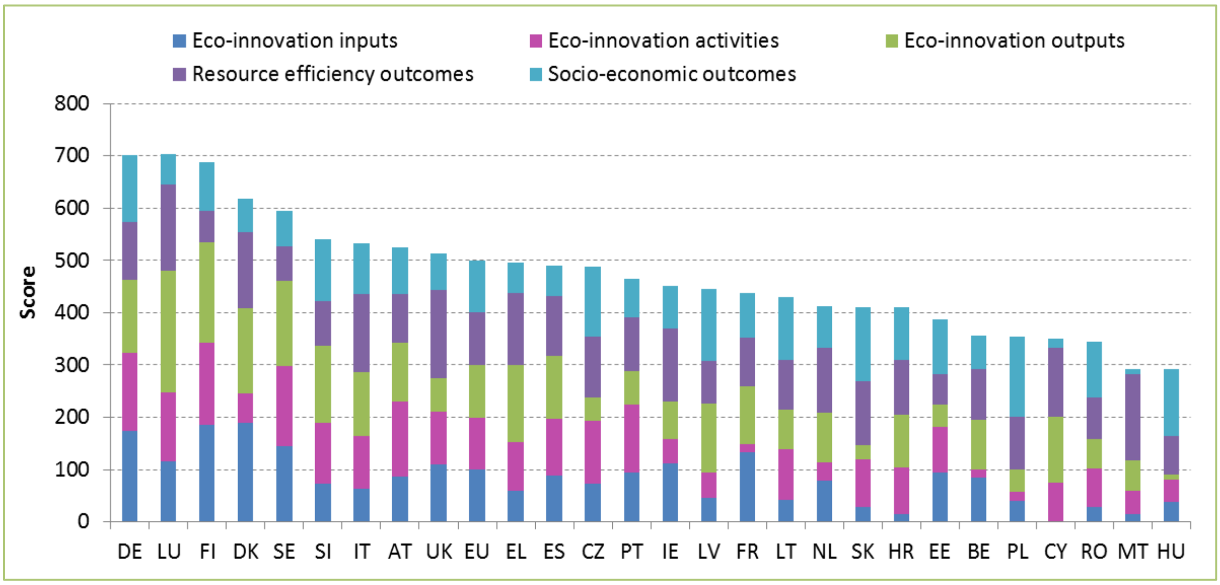
Source: Eurostat, 2017.

Figure A.2 — Resource productivity, GDP in 2010 chain-linked volumes 2007 and 2016



Source: Eurostat, 2017.

Figure A.3 — Eco-innovation index, individual categories score, 2016



Source: Eurostat, 2017.

Figure A.4 — EU labour and environmental taxes as a share of total revenues from taxes and social contributions, 2006-2015

Source: Eurostat, European Commission DG Taxation and customs union 2017.