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Environmental taxation and EU environmental policies

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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

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

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Authors

Stefan Speck (EEA) and Susanna Paleari (ETC/WMGE)

Editorial support

Bart Ullstein and Peter Saunders (ETC/WMGE)

ETC/WMGE task manager

Roberto Zoboli

EEA project manager

Stefan Speck

Executive summary

EU environmental policies address a range of environmental and resource use challenges, including air pollution and transport, climate change and energy use, freshwaters, marine waters, chemicals, biodiversity and land use, waste, and sustainable consumption and production.

Overall, there are currently 82 binding targets and 84 non-binding objectives established in response to these challenges for the period 2013–2050, with several of them addressing environmental and socio-economic considerations together. Achieving them cost-effectively often requires the use of market-based instruments (MBIs) in tandem with regulations. The main MBIs in use include tradable permits and quotas, producer responsibility schemes, tariffs and environmental taxes. Currently 18 binding and 24 non-binding MBIs are in place based on current EU environmental legislation in force.

Environmental taxation and in particular tax-shifting programmes, also known as environmental tax reform (ETR), are high on the political agenda, as illustrated in the Europe 2020 strategy and several other EU policy documents. The current application of environmental taxes in European Environment Agency (EEA) countries shows that energy, carbon and transport (vehicle) taxes are by far the most commonly used, while waste-related instruments exist in the majority of these countries. The use of taxes for addressing air and water pollution and resource use is rather less widespread.

The primary objectives and benefits of environmental taxes are to reduce pollution and resource use. They are also several secondary benefits: for example, such taxes contribute to a healthier society and hence lower health-related costs, they trigger eco-innovations that generate wealth and jobs, while the broad diffusion of environmentally friendly technologies support sustainable systems of production and consumption.

Environmental taxes, eco-innovations and their diffusion are key enabling factors in the transition to a green economy alongside investment instruments.

A further benefit of environmental taxes is their fiscal function. Well-designed taxation systems should be efficient as well as enhance economic growth and help achieve important social objectives e.g. better health. Environmental taxes can achieve non-environmental goals and thereby contribute to a holistic, all-inclusive policy approach. Studies show that environmental taxes are less distorting towards economic behaviour than labour and corporate taxes. Evasion is also much lower than for other taxes, while administrative costs are lower than for income and value-added taxes (VAT).

The fiscal outlook in Europe has heightened political interest in the potential of revenue-neutral tax-shifting policies whereby the revenues resulting from environmental taxes are used to reduce labour taxes. Such environmental tax reforms have been beneficial and can continue to be in the short- to medium-term as shown by several EEA member countries. Environmental taxes have a role to play in the overall fiscal system. Although their revenue potential is well below those of labour and consumption taxes, such as value added tax, they are of the same order as those levied on the income of corporations.

Longer-term developments including demographic changes and technological breakthroughs on energy and transport in the transition to a low-carbon, green economy will contribute to the erosion of the current tax bases in European countries. These expected trends challenge the overall basis of current thinking on tax-shifts. Some countries have already developed new environmental tax instruments but much more needs to be done on the design of resilient, long-term tax systems in Europe in the face of such systemic challenges.

1 Introduction

This report does three things. It provides an overview of market-based instruments (MBIs) established by EU environmental legislation. Then it explains the established definitions and rationales for the application of environmental taxes and discusses their current design and application in EEA member countries ([1]). It concludes with overall findings and some reflections on the potential for long-term tax-shifting programmes in the context of policy targets as well as technological innovation and demographic changes.

The overview of MBIs and the assessment of environmental taxation schemes follows previous reports by EEA over the past 20 years. These include: *Environmental taxes — Implementation and environmental effectiveness* (1996); *Environmental agreements — Environmental effectiveness* (1997); *Environmental taxes — Recent developments in tools for integration* (2000); and *Using the market for cost-effective policy — Market-based instruments for environmental policy in Europe* (2006) which is a condensed version of *Market-based instruments for environmental policy in Europe* (2006) ([2]).

Chapter 2 provides an overview of the MBIs established by EU environmental legislation in force. This part of the report analyses how the legislation supports, at an EU level, the application of different types of MBIs. A set of criteria clarify the scope and coverage of the review, with regard to the policies/legislation examined and the MBIs selected.

Chapter 3 clarifies the definitions of environmental taxation and highlights the economic, social and environmental rationales for their use in support of environmental policy objectives.

Chapter 4 presents an overview of the current situation concerning environmental taxation in EEA member countries and reviews recent developments in their use. The analysis focuses on the design and application of carbon/energy taxes and transport taxation schemes.

The report closes with overall findings and a more reflective analysis that addresses wider considerations around the application of environmental taxes. It considers the prospects for ETR in the long-term (2030–2050) in the context of technological innovation, changing demographics, climate change, and energy reduction targets.

Two annexes contain further information relevant to the discussion of MBIs. Annex 1 provides an overview of the targets and objectives agreed since autumn 2012 under EU environmental policy and legislation across nine areas. This applies the same methodology and criteria in the 2013 EEA report *Towards a green economy in Europe — EU environmental policy targets and objectives 2010–2050*, and updates that analysis.

Annex 2 provides a more detailed breakdown of the overview table presented in Chapter 4 on the application of environmental taxes in EEA member countries.

The report draws on established data sources at the EU level. It also benefits from work the EEA started in 2010 with four EU Member States (Ireland, Italy, Spain and Portugal) to study the revenue potential of environmental taxation based on established and proven practice. The outcome of this new orientation was closer cooperation, through co-organised workshops and conferences with the relevant governments and producing background reports on environmental taxation potentials ([3]). Following this initiative, the Directorate-General Environment of the European Commission has undertaken an analysis of the future potential for environmental tax developments in the EU-28 up to 2025 ([4]) using elements of the methodology developed by EEA.

([1]) EU-28, Iceland, Liechtenstein, Norway, Switzerland and Turkey.

([2]) The EEA published other reports in this area but these focus on a more detailed analysis of different taxation schemes: *Environmental tax reform in Europe: opportunities for eco-innovation* (2012); and *Environmental tax reform in Europe: implications for income distribution* (2012); *Assessment of cost recovery through pricing of water* (2013); *Resource-efficient green economy and EU policies* (2014). Additionally, research assessing the potential of natural resource or primary materials taxes, as well as implications of different design schemes, can be found in reports published by the European Topic Centres on Sustainable Consumption (ETC/SCP), Waste and Materials in a Green Economy (ETC/WMGE) and the EEA: Eckermann et al., 2012 and 2015.

([3]) See for more information including the background reports for the four EU Member States: http://www.eea.europa.eu/highlights/fiscal-reform-can-create-jobs.

([4]) See the reports at http://ec.europa.eu/environment/integration/green_semester/studies_en.htm.

2 Market-based instruments in EU environmental legislation

This chapter provides an overview of selected categories of market-based instruments (MBIs) shaped by the EU environmental legislation in force.

It covers the nine environmental policy areas in which the EU environmental targets and objectives are set out (see Annex 1), namely: energy; greenhouse gas emissions and ozone depleting substance; air pollution and air quality; transport (greenhouse gas emissions and air pollutants) and noise; waste; water; sustainable consumption and production; chemicals; biodiversity and land use ([5]).

There are both binding and non-binding MBIs. Those that Member States are required by legislative provisions to adopt and implement are binding, all the others are non-binding. When MBIs are set out in very generic terms (for example, 'Member States shall apply the "polluter pays" principle to waste management'), when they are only one of a number of possible measures that Member States are required to implement, or when Member States 'shall facilitate' or 'encourage' their adoption, the provisions are non-binding.

The following five categorisations of MBIs cover the aims and focus of this chapter:

- General and mixed instruments: provisions that refer to MBIs and economic instruments in generic terms or to a set of MBIs belonging to different categories.
- Taxation and environmental tax reform: provisions related to taxes and/or promoting the shift from taxation of labour to environmental taxation.
- Tariffs, fees, charges ([6]) and pricing policies: for example, external-cost-charge for heavy goods vehicles; visible fees to finance waste electrical and electronic equipment management; provisions on the recovery of costs for water services, etc.
- Tradable permits and quotas: for example, greenhouse gas emissions trading scheme (mainly used in the greenhouse gas emissions and ozone depleting substances policy area).
- Producer responsibility schemes: mainly used for the collection and management of specific waste streams.

These categories are not mutually exclusive as MBIs may belong to more than one category. As a result, assigning an MBI to a specific category may involve a certain degree of subjective judgment.

The generic provision of measures aimed at achieving environmental objectives or addressing environmental problems, but not qualified in economic terms, is not considered as an MBI, even if MBIs can be included among such measures ([7]).

Finally, the review addresses a broad analysis of all MBIs shaped by current EU environmental legislation and the main political and strategic documents of the past decade.

There are 18 binding and 24 non-binding MBIs that have been identified based on current EU environmental legislation in force. Most of them, 9 binding and 12 non-binding, are concerned with producer responsibility and mainly apply to the waste policy. A few other policy areas have provision-shaping MBIs, namely energy; greenhouse gas emissions and ozone depleting substances, mainly related to the use of tradable permits and quotas; transport and noise; and water.

([5]) These nine environmental policy areas are also the basis for an update of environmental targets and objectives established by EU regulations in Annex 1 which closely follows the methodology and criteria set out in *Towards a green economy in Europe — EU environmental policy targets and objectives 2010–2050* published by the EEA in 2013.

([6]) For a definition of these terms, see Box 3.1 and footnote 23.

([7]) For example, according to Art. 15 par. 1 of Directive 2008/50/EC Member States shall take 'all necessary measures', not entailing disproportionate cost, to reduce exposure to $PM_{2.5}$ to achieve national exposure reduction targets. As the 'necessary measures' are generic and not qualified as economic, financial, fiscal, market-based, etc., they are not reported as MBIs.

Figure 2.1 Market-based instruments addressed in this report

MBIs

- established by existing EU environmental legislation in force
- aimed at achieving environmental objectives or with a positive impact on the environment
- related to selected environmental and resource policy areas
- classified under the five categories
- excluding generic measures not specifically qualified in economic terms

Binding MBIs

Non-binding MBIs

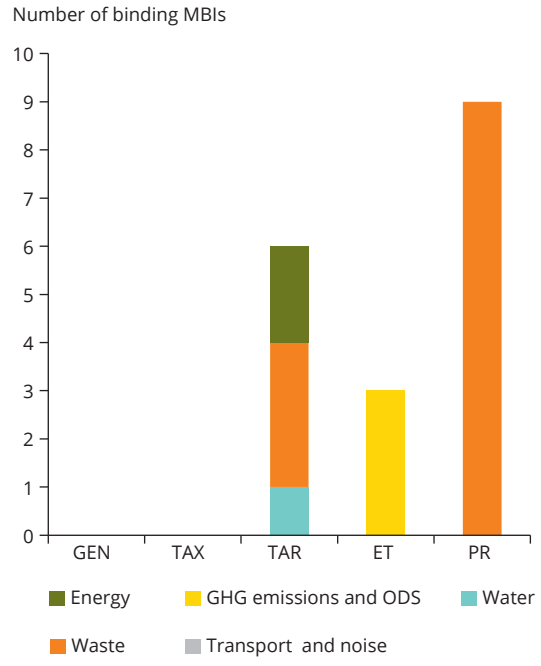
Including generic MBIs, those which are set as one of the options Member States are required to adopt and those which Member States are 'encouraged' to adopt

Figures 2.2 and 2.3 illustrate the relevant binding and non-binding MBIs in each environmental and resource policy area. The most significant and direct relationships between MBIs and environmental targets/objectives in the same policy area are also highlighted.

General and mixed market-based instruments

General and mixed MBIs are non-binding measures designed to achieve various environmental objectives. In the energy sector, Member States shall ensure that national energy regulatory authorities provide

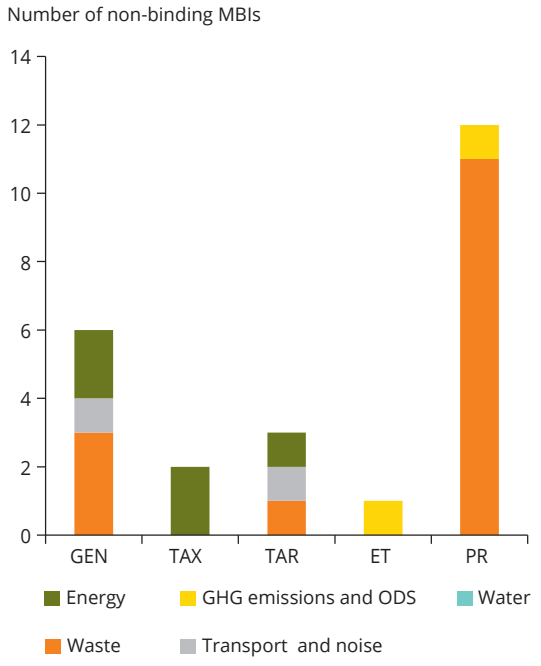
Figure 2.2 Binding market-based instruments established by EU legislation, by category and environmental policy area



Note: GEN: general and mixed instruments; TAX: taxation and environmental tax reform: TAR: tariffs, fees, charges and pricing policies; ET: tradable permits and quotas; PR: producer responsibility schemes.

Source: EEA-ETC/WMGE based on the analysis of EU environmental legislation in force.

Figure 2.3 Non-binding market-based instruments established by EU legislation, by category and environmental policy area



Note: GEN: general and mixed instruments; TAX: taxation and environmental tax reform: TAR: tariffs, fees, charges and pricing policies; ET: tradable permits and quotas; PR: producer responsibility schemes.

Source: EEA-ETC/WMGE based on the analysis of EU environmental legislation in force.

incentives for grid operators to make system services available to network users, allowing them to improve energy efficiency (EU, 2012a). To enable Member States to reach the renewable energy targets set by Directive 2009/28/EC (EU, 2009a) ([8]), they may, inter alia, use support schemes, which are defined as any instrument, scheme or mechanism applied by a Member State or a group of Member States, that promotes the use of renewable energy by reducing its cost, increasing its sale price, or increasing, for example, through a renewable energy obligation ([9]), the volume of renewable energy purchased. This includes, but is not restricted to, investment aid; tax exemptions or reductions; tax refunds; renewable energy obligation support schemes, including those using green certificates; and direct price support schemes, including feed-in tariffs and premium payments.

For transport and noise, Member States shall adopt action plans to managing noise issues and effects for all major agglomerations, airports, roads and railways. These may include regulatory or economic measures and incentives (Directive 2002/49/EC; EU, 2002).

For waste policy ([10]), pursuant to Directive 2015/720/EU (EU, 2015) that amended Directive 94/62/EC on packaging and packaging waste, Member States shall take measures to achieve a sustained reduction in the consumption of lightweight plastic carrier bags. These may include the use of national reduction targets, maintaining or introducing economic instruments, and marketing restrictions. Such measures shall ensure the achievement of the binding, preventive targets set by the directive. Member States may also use economic instruments to promote the collection of waste batteries/accumulators or to promote the use of batteries/accumulators containing less polluting substances, for instance by adopting differential tax rates (Directive 2006/66/EC; EU, 2006). Member States shall also take measures, as appropriate, to promote the reuse of products by encouraging the establishment and support of reuse and repair networks and through the use of economic instruments, procurement criteria, quantitative objectives or other measures (Directive 2008/98/EC; EU, 2008).

Tax and environmental tax reform

Two non-binding MBIs exist in the energy sector. Energy or carbon taxes that have the effect of reducing end-use energy consumption may be used, under specific conditions, by Member States as an alternative to setting up an energy-efficiency obligation scheme to achieve energy savings by final customers (Directive 2012/27/EU; EU, 2012a). The energy savings gained through taxation shall be equivalent to those reached through energy-efficiency obligation schemes which, in turn, shall, by 2020, ensure the achievement of a cumulative energy-saving target applied to energy distributors and sales companies.

Another relevant provision is contained in fiscal legislation in Directive 2003/96/EC (EU, 2003a) on the taxation of energy products and electricity ([11]). According to this, Member States may apply, under fiscal control, total or partial exemptions or reductions in the level of taxation to, among others, electricity generated by specified renewable sources and electricity produced from combined heat and power generation, provided that the combined generators are environmentally friendly.

Tariffs, fees, charges and pricing policies

Two binding MBIs have been established in the energy sector. EU Member States shall ensure the removal of those incentives in transmission and distribution tariffs that are detrimental to the overall efficiency, including energy efficiency, of the generation, transmission, distribution and supply of electricity (Directive 2012/27/EU; EU, 2012a). This provision is directly linked to the cumulative end-use energy savings target, set by the same directive, for energy

([8]) Increase renewable energy to at least 20 % of final energy consumption by 2020. Increase the share of energy from renewable sources to at least 10 % of final consumption in the transport sector by the same deadline.

([9]) Pursuant to the directive, 'renewable energy obligation' means a national support scheme requiring energy producers to include a given proportion of energy from renewable sources in their production, requiring energy suppliers to include a given proportion of energy from renewable sources in their supply, or requiring energy consumers to include a given proportion of energy from renewable sources in their consumption. This includes schemes under which such requirements may be fulfilled by using green certificates.

([10]) It should be underlined that, pursuant to the proposed directive on waste (EC, 2015a), which is part of the 2015 Circular Economy Package (see Annex 1), Member States shall make use of adequate economic instruments to provide incentives for the application of the waste hierarchy (Art. 1 par. 3).

([11]) As discussed above, the focus is on MBIs shaped by the EU's environmental legislation. Directive 2003/96/EC is fiscal legislation, but is also relevant in terms of environmental protection. The directive establishes minimum tax levels on energy products and electricity, which are binding on EU Member States (in this sense, it is a binding MBI). However, the provision of Directive 2003/96/EC, Member States may apply under fiscal control total or partial exemptions or reductions in the level of taxation to, among others, electricity generated by specified renewable energy sources (RES) and electricity produced from combined heat and power generation, which has a specific environmental character, is classified as a non-binding MBI.

distributors and sales companies to be reached by 2020. Further, Member States shall ensure that the charging of transmission and distribution tariffs does not discriminate against electricity and gas from renewable sources (Directive 2009/28/EC; EU, 2009a). Finally, with regard to non-binding MBIs, Member States shall ensure, when possible, reasonable and proportionate, that final customers for electricity, natural gas, district heating and/or cooling and domestic hot water are provided with competitively priced meters that accurately reflect the final customer's energy consumption and provide information when that energy is used (Directive 2012/27/EU; EU, 2012a).

For transport and noise, the Eurovignette Directive (Directive 1999/62/EC; EU, 1999a), which is fiscal legislation, establishes common rules on distance-related tolls and time-based user charges (vignettes) for the use of certain infrastructure by heavy goods vehicles. According to recent amendments to the directive (EU, 2011), Member States may maintain or introduce external-cost charges related to the 'cost of traffic-based air pollution' — the cost of the damage caused by the release of particulate matter and ozone precursors, such as nitrogen oxide and volatile organic compounds, in the course of operation. The revenues generated from external cost charges should be used to make transport more sustainable.

In the waste sector, Member States shall take measures to ensure that all costs involved in the setting up and operation of landfill sites, including, as far as possible, the costs of the financial security and of the closure and after-care of the sites for a period of at least 30 years are covered by the price charged by the operator for the disposal of any type of waste at the site (Directive 1999/31/EC; EU, 1999b). According to Directive 2012/19/EU (EU, 2012b), which has amended the previous provisions on the use of the 'visible fees', Member States may require producers to show purchasers, at the time of sale of new products, the costs of the collection, treatment and environmentally-sound disposal of waste electrical and electronic equipment (WEEE). Directive 2000/59/EC (EU, 2000a) establishes that Member States shall ensure that the costs of port reception facilities for ship-generated waste, including the treatment and disposal of the waste, shall be covered through the collection of a fee from ships. Moreover, any fee for delivery of cargo residues shall be paid by the user of the reception facility.

According to the Water Framework Directive (Directive 2000/60/EC; EU, 2000b), Member States shall take account of the principle of recovery of the costs of water services, including environmental and resource costs. By 2010, they shall ensure:

- that water-pricing policies provide adequate incentives for users to use water resources efficiently, and thereby contribute to the environmental objectives of the directive (all surface and groundwater bodies in river basins shall achieve 'good status' by 2015);

- an adequate contribution from different water uses, disaggregated into at least industry, households and agriculture, to the recovery of the costs of water services, taking account of the polluter pays principle.

Measures deemed appropriate to apply these provisions are conceived as 'basic measures' of the programme that Member States are required to establish for each river basin to achieve 'good water status' by 2015.

Tradable permits and quotas

The most important MBI in this category is the emission trading system (ETS), shaped by Directive 2003/87/EC (EU, 2003b) and related executive measures. The EU ETS, launched in 2005, is now in its third phase, which runs from 2013 to 2020. Working on the cap-and-trade principle, the scheme covers around 45 % of total greenhouse gas emissions from the EU-28 and is aimed directly at cutting emissions by 21 % below 2005 levels by 2020. In particular, it covers carbon dioxide emissions from power and heat generation; energy-intensive industries, including oil refineries and producers of iron, steel, aluminium and other metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals; and commercial aviation. It also covers nitrous oxide from the production of nitric, adipic, glyoxal and glyoxlic acids; and perfluorocarbons from aluminium production. Under the third phase of ETS, auctioning becomes the default method of allocating allowances and at least 50 % of the revenues generated should be used for climate-related purposes ([12]).

The Effort Sharing Decision (EU, 2009b) introduces national binding targets for the reduction of greenhouse gas emissions by approximately 10 % compared to 2005 in sectors not covered by the EU ETS. To meet their annual emissions target in the most cost-effective way, Member States are allowed to make use of different methods defined in the Decision, as well as by the related executive measures, including the use, within specified limits, of United Nations Framework

([12]) http://ec.europa.eu/clima/policies/ets/index_en.htm (accessed on 5 November 2015).

Convention of Climate Change (UNFCCC) Certified Emission Reductions and Emission Reduction Units ([13]).

Transferable rights to use and/or place the regulated substances on the market are also established as binding MBIs by the new Regulation on fluorinated greenhouse gases (EU, 2014) and the Regulation on ozone depleting substances (EU, 2009c). The tradable quotas for placing hydrofluorocarbons on the market relate to a target, which requires producers and importers of these not to exceed the maximum quantity for each year in question within the 2016–2030 period and the corresponding quota.

Producer responsibility schemes

In the greenhouse gas emissions and ozone depleting substances policy area, the Regulation on fluorinated greenhouse gases (EU, 2014) requires Member States to encourage the development of producer responsibility schemes for the recovery of these and their recycling, reclamation or destruction.

Most of the waste sector's MBIs concern the application of the producer-responsibility principle to selected waste streams ([14]). Before analysing such measures, it is useful to remember that producer responsibility:

- may be applied to waste collection and/or waste management after collection — preparing for reuse; preparing prior to recovery or disposal; recovery, including recycling; and disposal;

- may be set at the individual level — each producer is responsible for collecting/managing its own waste — or collective level — producers are jointly responsible for collecting/managing their waste;

- may be applied at the physical level — responsibility for arranging waste collection/management — or financial level — responsibility for covering the costs associated with waste collection/management. Sometimes, according to EU legislation, producers are simply deemed responsible for waste collection/management, without any further definition of such a responsibility.

The Waste Framework Directive (EU, 2008) ([15]) states that any natural or legal person who professionally develops, manufactures, processes, treats, sells or imports products (producer of the product) may be given an extended producer responsibility by the Member States, in order to strengthen the reuse and the prevention, recycling and other recovery of waste. Member States may decide that the responsibility for arranging waste management is to be borne partly or wholly by the producer of the product from which the waste came, and that distributors of such a product may share that responsibility. In accordance with the polluter-pays principle, Member States may also decide that the costs of waste management are to be borne partly or wholly by the producer of the product from which the waste came, and that the distributors of such a product may share these costs. Finally, Member States may take appropriate measures to encourage the design of products in ways that reduce their environmental impacts and the generation of waste in the course of their production and subsequent use. They may also ensure that the recovery and disposal of products that have become waste take place. Eco-design is a relevant aspiration that is usually associated with the advocacy of producer responsibility.

The EU legislation provides for the application of producer responsibility to the following waste streams.

- Waste from electrical and electronic equipment (Directive 2012/19/EU; EU, 2012b): with regard to WEEE from private households (business-to-consumer or B2C WEEE), producers may set up and operate individual and/or collective take-back systems and may, where appropriate, be encouraged to finance the related costs. When supplying a new product, distributors are responsible for ensuring that such waste can be returned to them, at least free of charge when buying a replacement, as long as the equipment is of an equivalent type and fulfilled the same function as the supplied equipment.

  Member States, however, may derogate from this provision on condition that they ensure that returning WEEE is not made more difficult for the final holder and that it remains free of charge. Member States shall ensure that producers or third parties acting on their behalf set up individual or collective systems to provide for the recovery of WEEE using best available techniques. Producers are deemed financially responsible for WEEE management after collection: the financial responsibility is set at the individual level for products

([13]) http://unfccc.int/kyoto_protocol/mechanisms/emissions_trading/items/2731.php.
([14]) See for further information on producer responsibility: Bio et al., 2014.
([15]) The proposed directive on waste (EC, 2015a), which is part of the 2015 Circular Economy Package (see also Annex 1), amends Art. 8 of the Waste Framework Directive (EU, 2008) on extended producer responsibility (Art. 1 par. 8).

placed on the market after 13 August 2005, and at the collective level for products placed on the market on or before that date.

For other WEEE (business-to-business or B2B WEEE), Member States shall ensure that producers, or third parties acting on their behalf, provide for its collection, as well as for its recovery, through individual or collective systems, using best available techniques. Member States shall ensure that the financing of the costs of collection, treatment, recovery and environmentally sound disposal of new B2B WEEE is provided for by producers. For historical waste being replaced by equivalent new products or by new products fulfilling the same function, the financing of the costs shall be provided by the producers of those products when supplying them. Member States may, as an alternative, provide that users other than private households also be made partly or totally responsible for this financing. For other historical waste, the financing of the costs shall be provided by the users other than private households.

Producer responsibility for WEEE collection is explicitly connected to the implementation of WEEE collection targets — according to the directive, indeed, each Member State shall ensure the implementation of the producer-responsibility principle and, on that basis, that a minimum collection rate is achieved annually ([16]).

- Waste oils (Directive 2008/98/EC; EU, 2008): for the purposes of separate collection of waste oils and their proper treatment, Member States may, according to their national conditions, apply additional measures such as technical requirements, producer responsibility, economic instruments or voluntary agreements.

- Batteries and accumulators (Directive 2006/66/EC; EU, 2006): producers or third parties acting on their behalf shall deemed responsible for: a) taking back waste industrial batteries and accumulators from end-users, and b) setting up schemes for the collection of waste automotive batteries and accumulators from end-users or from an accessible collection point in their vicinity, where collection is not carried out under the End-Of-Life Vehicles Directive (Directive 2000/53/EC; EU, 2000c). Member States may, moreover, require producers to set up collection schemes for waste portable batteries and accumulators, in which other economic operators may participate.

  Once waste batteries/accumulators have been collected, Member States shall ensure that, no later than 26 September 2009, producers or third parties set up schemes using best available techniques, in terms of the protection of health and the environment, to provide for the treatment and recycling of such waste.

  At the financial level, producers, or third parties acting on their behalf, shall cover any net costs arising from the collection, treatment and recycling of all waste batteries and accumulators (portable and industrial) collected in accordance with the directive. They are also obliged to finance any net costs arising from public information campaigns on the collection, treatment and recycling of all waste portable batteries and accumulators.

- End-of-life vehicles (Directive 2000/53/EC; EU, 2000c): Member States shall ensure that economic operators set up systems for the collection of all end-of life vehicles and, as far as technically feasible, of waste used parts removed when passenger cars are repaired. The delivery of the vehicle to an authorised treatment facility shall occur at no cost to the last holder and/or owner as a result of the vehicle's having no or a negative market value. Producers shall meet all, or a significant part of, the costs of the implementation of this measure and/or take-back end-of life vehicles.

- Packaging and packaging waste (Directive 94/62/EC; EU, 1994): Member States shall implement preventive measures which may consist of national programmes, projects to introduce producer responsibility to minimize the environmental impact of packaging, or similar action adopted, as appropriate, in consultation with economic operators. Member States shall ensure that systems are set up to provide for: a) the return and/or collection of used packaging and/or packaging waste from the consumer, other final user, or from the waste stream in order to channel it to the most appropriate waste management option; b) the reuse or recovery, including recycling, of the packaging and/or packaging waste collected, in order to meet the objectives laid down in the directive. These systems shall be open to the participation of economic operators of sectors concerned and to competent public authorities. The directive has been implemented by EU Member States mainly through producer responsibility schemes.

([16]) Article 7.1 of Directive 2012/19/EU (EU, 2012b).

3 Definitions and rationales for environmental taxes

Environmental taxation and in particular tax-shifting programmes, also known as environmental tax reform (ETR), are high on the political agenda, as illustrated in recent EC publications and in the discussion of the Europe 2020 strategy ([17]). Environmental taxes are also the most studied environmental market-based instrument.

The effects of environmental taxes as policy instruments are well-documented in economic and political literature (for example Gago et al., 2014; Withana et al., 2013; Castellucci and Markandya, 2012; Vivid Economics, 2012; Bowen, 2011; GFC, 2009; OECD 2006; Speck et al., 2006). The positive impacts in terms of reducing environmental pollution, fostering innovation, and generating additional resources for public budgets regularly play a secondary role when assessing the effectiveness and efficiency of this type of market-based instrument. This is because potential negative effects, such as the loss of competitiveness of domestic industries and the possibilities of regressive distributional implications across society, often dominate the public discourse and agenda.

Support for environmental taxation is notable from international organisations, such as the World Bank, International Monetary Fund (IMF), Organisation of Economic Co-operation and Development (OECD) and the European Commission (Fay et al., 2015; EC, 2014a and 2015b; Heine et al., 2012; IMF, 2012; OECD, 2010 and 2013a). Nonetheless, the actual implementation of environmental taxes in countries regularly lags behind their potential.

This is *a fortiori* surprising as the experience gained by EU Member States provides some proof of the advantages of these policy instruments. One of the most compelling pieces of evidence is the absolute decoupling of economic development from greenhouse gas emissions in Sweden where gross domestic product (GDP) has grown by about 58 % since the introduction of a carbon dioxide tax that contributed to the 23 % reduction of greenhouse gas emissions between 1990 and 2013 (Åkerfeldt, 2015).

3.1 Definitions of environmental taxes

The United Nations System of Environmental-Economic Accounting (SEEA 2012, UN et al., 2012), a global statistical standard, provides a definition of environmental tax as: *a tax whose tax base is a physical unit (or a proxy of it) of something that has a proven, specific, negative impact on the environment* (UN et al., 2012 (4.150)). This definition now constitutes a component of the EU's statistical framework as stated in the Regulation (EU) No 691/2011 on European environmental economic accounts ([18]).

The definition sometimes leads to confusion as the emphasis is put on the tax base and not at all on an environmental motivation and/or purpose of implementing environmental taxes. This is because the tax base is the only objective way of identifying and comparing tax data internationally (Eurostat, 2013) ([19]).

The statistical definition of environmental taxation is widely accepted, nevertheless, countries may use different ones for national policy purposes. In the United Kingdom, for example, the government defines environmental taxes *as those that meet all of the following three principles:*

- *the tax is explicitly linked to the government's environmental objectives;*

([17]) See http://ec.europa.eu/europe2020/index_en.htm.

([18]) There is a long-standing discussion around the terms environmental taxes and environmentally related taxes. Eurostat (2013) discusses the two and their underlying concepts as follows: *the term 'environmental taxes' can be interpreted as referring to taxes with an environmental, rather than a fiscal, motivation. Since motivation is not part of the definition used for environmental tax statistics, it can be argued that the term 'environmentally related taxes' is more appropriate. This is the term used in Regulation (EU) No 691/2011 and is preferred e.g. by the OECD. As the more convenient term 'environmental taxes' is in common use, it is used in these guidelines. This term is also used in the United Nations System of Environmental-Economic Accounting (SEEA 2012) which was adopted as an international statistical standard in 2012.*

([19]) A list of relevant tax bases satisfying this definition has been compiled by Eurostat and can be found in Eurostat, 2013. It is used for carrying out international comparisons of environmental taxes.

- *the primary objective of the tax is to encourage environmentally positive behaviour change;*
- *the tax is structured in relation to environmental objectives, for example: the more polluting the behaviour, the greater the tax levied* ([20]).

This definition emphasises the environmental focus. Based on these principles, the UK government identified the following taxes as environmental: climate change levy (CCL), aggregates levy, landfill tax, EU emission trading scheme (EU ETS), carbon reduction commitment energy efficiency scheme and the carbon price support ([21]).

This narrower definition of environmental taxes corresponds to the thinking that taxes levied on petrol and diesel (transport fuels) were introduced for purely fiscal reasons and were not intended as environmental policy instruments. This line of argument ignores the fact that such environmental taxes are *very potent environmental policy instruments* (Sterner, 2006) although when they were introduced — in some countries almost a century ago — environmental purposes were not to the fore ([22]).

Environmental taxes are further classified between (1) energy, (2) vehicle and (3) pollution and resource taxes, a classification that is also used in this report. Furthermore, the international statistical framework has categorised carbon-pricing measures as energy taxation schemes (Eurostat, 2013). Another classification distinguishes between taxes, charges, fees and levies (Box 3.1) ([23]).

In terms of revenues generated from environmental taxes, energy taxes are the most significant as they contribute 76 % of total environmental tax receipts. Transport taxes account for 20 % of receipts while 4 % were collected from pollution and resource taxes in EU-28 in 2014. The split of the tax take between the three categories differs between EU Member States as national tax schemes vary but energy taxes always contribute the largest share. Malta has the lowest share of energy tax revenues, at 55 %, while it has the highest share for transport taxes, at 41 %. The countries with above-average revenues from pollution/resource taxes (more than 10 % of total environmental tax revenues) are Croatia, Estonia, the Netherlands and Slovenia. Meanwhile, Austria, Belgium, Denmark, Ireland, Malta and Finland belong

Box 3.1 Definition of environmental taxes and charges ([24])

A tax covers *any compulsory, unrequited payment to general government levied on tax bases deemed to be of particular relevance. Taxes are unrequited in the sense that benefits provided by government to taxpayers are not normally in proportion to their payments* (OECD, 2001).

The terms **charges** and **fees** are commonly used and cover compulsory and requited payments to general government or to bodies outside general government, such as environmental funds or water management boards. Examples include wastewater, abstraction, and waste charges.

Levy is a more general term covering taxes as well as charges and fees. It is commonly used, for example, in the United Kingdom (climate change levy, aggregates levy), partly to avoid the bad publicity and hence the resistance associated with the word tax.

Source: EEA, 2006.

([20]) See: https://www.gov.uk/government/news/definition-of-environmental-tax-published (accessed on 12 January 2016).
([21]) The definition is critical as the then UK government pledged to increase the revenues generated from environmental taxes, thereby referring exclusively to these taxes.
([22]) The UK government stated that changes in fuel prices as an outcome of a reduction in fuel taxes will lead to a behavioural response which is captured by an elasticity between the price of fuel and the amount consumed. A reduction in the fuel duty rate will increase demand for fuel, as vehicle owners will use more of it. This has a positive impact on receipts (HM Revenue & Customs and HM Treasury, 2014). This statement undoubtedly confirms that fuel taxes must be described as environmental policy instruments.
([23]) Tariffs — also known as user charges — can also be classified as MBIs, but they serve a different purpose from environmental taxes. The distinction based on their functions in environmental and public policy can be made as environmental taxes are an instrument for implementing the polluter pays principle compared to the latter which are founded on the user-pays principle. As Dafflon and Daguet (2012) note that while both types of MBI are compulsory payments, tariffs/user charges are paid for the provision and delivery of a specific service, in particular in the areas of water supply, wastewater and waste. For a more detailed discussion regarding the distinction between environmental taxation and user charges/tariffs, see Dafflon and Daguet (2012).
([24]) It should be stated that the differentiation between taxes and charges is not clear-cut in political reality as the use of these phrases in the wording/language of national tax legislation differs widely.

to the countries in which the share of transport tax revenues exceeded 30 % in 2014.

3.2 Rationales for environmental taxation

The economic and environmental rationales for environmental taxation are discussed extensively in mainstream economic literature. Environmental pollution and resource use impose external costs (or externalities) on society. These external costs and risks are not borne by the polluters rather levied on other groups of society and on to future generations. This reflects market failures, owing to a lack of actual markets for environmental goods or services and/or the failure of conventional markets to take into account the environmental implications of manufactured products or natural resources exploitation. In other words, prices in actual markets do not reflect the true or full cost of producing goods and services. These costs can be internalised in the prices of goods and services by utilising instruments such as environmental taxes or emission-trading schemes, since the basic motivation for their use is to correct the market failures (Kosonen and Nicodeme, 2009). The overall concept is therefore to reduce the level of environmental pollution and resource use and ensure that costs and benefits are fully taken into account in economic decision-making ([25]). They also increase the efficiency of resource use, thereby decreasing demand and reducing environmental damage.

The major aim of environmental taxes is to achieve static and dynamic efficiency gains as well as raise revenues (Barde and Godard, 2012). The discussion of the double-dividend hypothesis (Pearce, 1991), which led to an increased interest in environmental taxation in the 1990s, developed the idea of tax-shifting programmes where revenues from environmental taxes could be used to cut others. This policy approach could therefore secure a second dividend — in addition to the first dividend of environmental improvement — since they can be used to reduce distorting labour and capital taxes in a revenue-neutral way, thus increasing the overall efficiency benefits of the reform ([26]).

Environmental taxes are also tools for achieving policy goals in a cost-effective manner. They allow economic actors the flexibility to act independently as consumers and businesses can decide the best/least cost way to reduce environmental damage compared to regulation imposing specific conditions and behavioural patterns. Furthermore, environmental taxes can accelerate the diffusion of known pollution abatement technologies and provide incentives for innovation (EEA, 2011a and OECD, 2010). This is also acknowledged by the European Commission: *MBIs, such as environmental taxes, tradable permit systems or targeted subsidies, are a cost-effective way to protect and improve the environment. They provide incentives to firms and consumers to opt for greener production or products* ([27]).

Regulations are another policy tool that address environmental pollution but they are not as effective as MBIs (IMF, 2012). MBIs, in particular environmental taxes, have a distinct advantage over regulations as the authorities do not need detailed and relevant information about the cost structure of abatement technologies and economic activities of polluters ([28]). Effectively, they reduce overall administrative, and often compliance, costs compared to the costs and efforts of the implementation and monitoring of regulatory activities.

Closely linked to taxes is the call for reforming and phasing-out environmentally harmful subsidies. This is also considered as a pre-condition for the effectiveness of environmental taxation. Some progress has been reported, in particular at the global level (Whitley and van der Burg, 2015), and multilateral cooperation to support the reform of environmentally harmful subsidies, in particular with regard to fossil fuels, is on-going. The reform of fossil fuel subsidies is critical for the transition to a green economy as such subsidies are in conflict with climate policy action as well as having a negative impact on public budgets. A wide range of fossil fuel subsidies exists, making it rather problematic to provide a clear picture of the current situation. The definitions used by institutions in estimating the total sum of subsidies are *typically tailored to specific purposes and they vary considerably in terms of scope* (WTO, 2006).

The figures published by the International Energy Agency (IEA) reveal an interesting trend as they show that subsidies on fossil fuel consumption increased from USD 300 billion (EUR 275 billion ([29])) in 2009 to USD 544 billion in 2012 (EUR 500 billion) — or roughly 0.7 % of global GDP in 2012. The latest IEA report shows

([25]) For a comprehensive discussion and analysis of environmental taxation, see Fullerton et al., 2010.
([26]) See Mori et al., 2014; Fullerton and Metcalf, 1997; Bovenberg and de Mooji, 1994 and Tullock, 1967.
([27]) See http://ec.europa.eu/environment/enveco/mbi.htm (accessed on 10 January 2016).
([28]) There are differences in the administrative and institutional requirements for monitoring different types of MBIs. The monitoring, reporting and verifying of emission trading schemes have a higher administrative burden than environmental taxation schemes.
([29]) An exchange rate of USD 1.09: EUR 1 (as of January 2016) was used throughout this report.

a decrease to about USD 490 billion (EUR 450 billion) since 2009 because of reforms implemented in many countries. Without these reforms, the IEA estimates that subsidies would have increased to a staggering USD 610 billion (EUR 560 billion) (OECD/IEA, 2015).

The IMF applies a very different methodology in its analysis of fossil fuel subsidies, distinguishing between pre-tax and post-tax subsidies, with the latter amounting to USD 2 trillion (EUR 1.8 trillion) in 2011 which corresponded to 2.9 % of global GDP (Bárány and Grigonyte, 2015) ([30]). A further approach to getting the energy prices right is based on an estimation of corrective taxes so that major environmental externalities are internalised in the final price. The estimated revenue potential of these corrective taxes amount to about 2.6 % of global GDP (Parry et al., 2014) making it clear that it is critical to understand the underlying methodologies and concepts when evaluating the possible results of phasing out environmentally harmful subsidies (EHS).

The often rather blunt calls for the removal of fossil fuel subsidies should be treated with some caution. Several studies reveal that middle-class and wealthy people benefit disproportionately from subsidies, as the biggest consumers of fossil-based energy. At the same time, the removal of subsidies would affect poor households disproportionally as these spend a higher proportion of their household income on energy (IEA, OECD and World Bank, 2010) ([31]).

The EU recognised this distributional equity issue in the *2011 Roadmap for a Resource Efficient Europe* that includes the following milestone: *by 2020, EHS will be phased out, with due regard to the impact on people in need* (EC, 2011s). In essence, the removal of fossil fuel/environmentally harmful subsidies should be seen in a broader context, in particular when thinking of a transition towards a green economy, in which resource efficiency, ecosystem resilience, human well-being and societal equity considerations and trade-offs need to be balanced (EEA, 2014).

Box 3.2 Management of environmental taxes — reducing tax evasion and administrative costs

Studies show that environmental tax evasion is much lower than for other taxes. Sweden, for example, reports a carbon tax evasion rate of 1 % which is lower than for value added tax and the United Kingdom shows a rather low energy tax evasion rate of about 2 %, especially when it is related to the 17 % evasion of income tax (Fay et al., 2015). A carbon tax would be rather simple to supervise in the United States, for example, as the monitoring of fewer than 3 000 refineries, coal mines, and natural gas fields would mean that 80 % of United States greenhouse gas emissions would be covered (Metcalf and Weisbach, 2009).

The administrative costs of environmental taxes are reported to be low. Estimates from the German Ministry of Finance, for example, show that these are about 0.13 % of revenues (OECD, 2006), while the United Kingdom reports a range of 0.21–0.34 % (Pavel and Vitek, 2012). The costs for administering other taxes are higher in the United Kingdom, for example the UK VAT costs were estimated at around 0.55 % and income tax at around 1.27 % of revenues collected (White, 2008).

Furthermore, additional administrative costs should not occur when introducing new carbon dioxide taxes as they can be incorporated into existing schemes, as it was done in Sweden where the administration of a carbon dioxide tax was combined with an existing energy tax scheme in the 1990s.

([30]) For a good overview of the different methodologies measuring fossil fuel subsidies: see Bárány and Grigonyte, 2015.
([31]) This argument is debated in the economic literature. The potential negative consequences on the income of poor households may be reduced through public income transfers as governments can have additional funds as the result of the removal of subsidies. See also Sterner, 2012.

4 Implementation of environmental taxes in EEA member countries

Overall, the current strategic policy focus in the EU is directed towards growth, competitiveness and jobs ([32]) and the Europe 2020 strategy aims for the EU to become a smart, sustainable and inclusive economy ([33]). Political realities, as well as the results of theoretical modelling frameworks, reveal that market-based instruments for environmental policy are enabling factors in achieving these economic and social objectives (Andersen and Ekins, 2007).

Properly designed environmental taxes and emission trading schemes, for example, can help achieve these objectives in a cost-effective manner. Furthermore, environmental taxes can help countries to increase their overall tax take and reduce debt and borrowing, releasing countries from the need to increase other taxes, such as income taxes or corporate taxes (EC, 2015b). The overall potential of environmental tax revenue is, however, limited and not high compared to taxes on labour or other indirect taxes such as value added tax (VAT) (Table 4.1 and EC, 2014b).

Shifting taxation from labour to pollution, energy and resource use in a budgetary neutral way is a policy approach promoted by international institutions such as the Organisation for Economic Co-operation and Development (OECD), the World Bank, the International Monetary Fund (IMF) and the European Commission. Environmental taxation schemes are especially well-suited to the post-financial crisis context, in which countries wish to continue to grow while also raising revenues to plug budget gaps. Furthermore, environmental taxes have been shown to be the least detrimental to employment and growth (Wöhlbier et al., 2014; EC, 2010; OECD, 2010).

The actual number of environmental taxes implemented in EEA member countries over the past decade suggests that demands for their more extensive use have been met, albeit only partly. While the revenue generation potential of environmental taxes is not their main purpose, interest in them in the political and public debate on the promotion of tax shifting programmes is increasing (EC, 2015b).

Environmental tax revenue at the EU-28 level grew more slowly than gross domestic product (GDP) between 2002 and 2014, increasing by 9.5 % in real terms (an average increase of 0.8 % annually) compared to GDP growth of 13.9 % (an average increase of 1.1 % per year). This trend reversed for the period 2009–2014 as environmental tax revenues increased in real terms by 9.4 % and GDP by 5 %.

There are striking differences between EU Member States in terms of environmental tax revenues — some EU Member States increased their environmental tax take considerably in real terms, as well as in the ratio of environmental tax revenues to GDP. For example, between 2002 and 2014, this ratio increased in Greece from 2.24 % to 3.68 %, in Estonia from 1.99 % to 2.67 %, and in Slovenia from 3.19 % to 3.89 %. Over the same period, the ratio dropped from 2.81 % to 1.7 % in Lithuania, and from 2.16 % to 1.79 % in Slovakia (Table 4.1). The ratio also dropped in the often-quoted 1990s forerunner European countries, for example, in Denmark, from 5 % to 4.08 %; Sweden, from 2.74 % to 2.21 %; and Norway, from 3.24 % to 2.31 %.

([32]) See https://ec.europa.eu/priorities/jobs-growth-and-investment_en.
([33]) Europe 2020: the EU's growth strategy for the coming decade, see http://ec.europa.eu/europe2020/index_en.htm.

Table 4.1 **Environmental tax revenues as a percentage of GDP in EU Member States, Norway and Switzerland, 1995–2014**

	1995	1998	2002	2005	2008	2012	2013	2014
EU-28	**n/a**	**n/a**	**2.56**	**2.51**	**2.29**	**2.44**	**2.45**	**2.46**
Austria	2.16	2.31	2.63	2.59	2.37	2.42	2.40	2.43
Belgium	2.40	2.57	2.32	2.45	2.14	2.15	2.06	2.05
Bulgaria	1.67	1.97	2.29	2.90	3.27	2.68	2.80	2.73
Croatia	n/a	n/a	4.08	3.85	3.44	3.19	3.51	3.86
Cyprus	2.62	2.30	2.73	3.34	3.05	2.57	2.73	3.08
Czech Republic	2.65	2.19	2.28	2.48	2.26	2.24	2.14	2.12
Denmark	4.31	5.26	5.00	4.92	4.18	3.99	4.20	4.08
Estonia	0.88	1.90	1.99	2.27	2.32	2.72	2.55	2.67
Finland	2.86	3.23	2.98	2.97	2.60	2.98	2.93	2.88
France	2.49	2.43	2.05	2.00	1.84	1.96	2.03	2.05
Germany	2.12	2.09	2.47	2.42	2.14	2.12	2.04	2.00
Greece	3.09	2.78	2.24	2.08	1.91	3.16	3.55	3.68
Hungary	2.89	3.32	2.74	2.75	2.68	2.71	2.59	2.60
Ireland	2.96	2.93	2.27	2.48	2.30	2.38	2.45	2.43
Italy	3.46	3.24	2.93	2.90	2.56	3.49	3.42	3.60
Latvia	0.99	2.79	2.14	2.53	1.85	2.45	2.45	2.67
Lithuania	1.87	2.54	2.81	2.29	1.63	1.64	1.64	1.70
Luxembourg	2.97	2.93	2.68	3.00	2.62	2.38	2.16	1.99
Malta	3.10	3.76	3.27	3.08	3.27	2.83	2.68	2.89
Netherlands	3.28	3.41	3.29	3.56	3.48	3.28	3.31	3.36
Poland	1.78	1.89	2.46	2.69	2.66	2.49	2.39	2.51
Portugal	3.35	3.34	2.99	2.89	2.48	2.16	2.21	2.25
Romania	1.74	3.03	2.11	1.98	1.75	1.98	2.05	2.42
Slovakia	2.29	1.89	2.16	2.34	2.00	1.73	1.73	1.79
Slovenia	4.13	4.95	3.19	3.15	2.95	3.83	3.97	3.89
Spain	2.14	2.22	2.03	1.90	1.63	1.57	1.90	1.85
Sweden	2.69	2.89	2.74	2.72	2.57	2.40	2.36	2.21
United Kingdom	2.70	2.93	2.62	2.38	2.35	2.48	2.49	2.48
Norway	3.62	3.66	3.24	2.96	2.64	2.36	2.36	2.31
Switzerland	1.61	1.67	1.78	1.81	1.68	1.72	1.69	n/a

Source: Eurostat (Environmental tax revenues [env_ac_tax] as of 30 March 30 2016).

4.1 Current status of implemented environmental taxes

Table 4.2 provides an aggregated overview of the types of environmental taxes implemented in EEA member countries. Annex 2 provides more details for individual countries. Overall, the number of environmental taxes has increased since 2006 (EEA, 2006).

The most obvious developments are apparent in four main environmental tax categories — energy, transport, pollution and resources.

- There is comprehensive energy taxation in EU Member States as required by Directive 2003/96/EC on the taxation of energy products and electricity (ETD). At the same time, EU Member States are allowed to maintain tax reductions or exemptions, in particular with regard to the household sector (Section 4.2.1). The number of countries that have introduced carbon pricing schemes either through carbon taxes or greenhouse gas emission trading schemes ([34]) has increased (Section 4.2.2).

- Transport tax design (tax base and rate) varies widely between countries ([35]). They include both one-off taxes such as sales/registration taxes and recurrent ones such as annual circulation taxes. As Table 4.2 shows, sales taxes have been implemented in fewer European countries than circulation taxes: 21 out of 28 EU Member States ([36]) compared to 28 out of 28. Private vehicles, however, are not subject to annual circulation taxes in all countries: 6 out of 28 EU Member States do not levy them ([37]). In recent years, road user charges have become more common for private as well as commercial vehicles (Annex 2 and Section 4.2.3).

- A rather broad range of pollution and waste taxes is in place, as shown in Table 4.2 and discussed in Chapter 2. These include producer responsibility schemes, recycling fees and product taxes, applied for different products ([38]). Landfill taxes are not in place in three EU Member States, their coverage as well as rates varies in the other countries ([39]). Environmental tax schemes addressing water pollution also differ widely between countries (EEA, 2013).

- Water abstraction or resource extraction taxes are becoming more widespread but again the design of these schemes varies between countries. Furthermore, in some countries, such as in Germany, Italy and Spain, resource taxes as well as some energy taxes are devolved to a regional level ([40]).

- Only a few countries — Belgium, Denmark, Italy, Norway and Sweden levy tax on the use of pesticides and/or fertilisers, and indeed, several other countries have abolished them ([41]). Currently, a multifaceted form of these taxes is in place in Denmark ([42]).

([34]) GHG emission trading schemes are included in this overview tables as revenues generated from the auctioning of emission allowances are treated as tax receipts in national accounts and should also be listed under the heading energy taxes (Eurostat, 2013).
([35]) Information on tax design can be found in reports published by the European Automobile Manufacturers' Association (ACEA) and on the website of ACEA: http://www.acea.be.
([36]) Sales/registration taxes are not in place in Bulgaria, Czech Republic, Germany, Estonia, Luxembourg, Sweden and the United Kingdom.
([37]) The EU Member States without annual circulation taxes on private vehicles are: Czech Republic, Estonia, France, Lithuania, Poland and Slovakia.
([38]) For an overview of the Nordic countries: see Bragadóttir et al., 2014. Further country information can be found in reports commissioned by the European Commission, DG Environment: Bio et al., 2014.
([39]) See Bio et al., 2012.
([40]) See Bahn-Walkowiak and Steger, 2015, for a discussion of resource taxes.
([41]) See for more information: Ecotec et al., 2001.
([42]) See Hogg et al., 2015, 2016 and Bragadóttir et al., 2014.

Table 4.2 Overview of environmental taxes in EEA member countries

	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	United Kingdom	Iceland	Liechtenstein	Norway	Switzerland	Turkey
Energy (including fuel for transport)																																	
Energy products for transport purposes	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Energy products for stationary purposes	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Greenhouse gases (GHG)																																	
• Carbon content of fuels — CO_2 tax				x			x	x	x	x				x		x					x	x			x		x	x [a]	x	x	x	x	
• GHG emissions trading schemes	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Transport (excluding fuel for transport)																																	
Motor vehicles import or sale, one off/ registration tax	x	x		x	x		x		x	x		x	x	x	x	x			x	x	x	x	x	x	x	x			x	x	x	x	X
Use of motor vehicles, recurrent (yearly/ circulation taxes)	x	x	x	x	x	x [b]	x	x [b]	x	x [b]	x	x	x	x	x	x	x [b]	x	x	x	x [b]	x	x	x [b]	x	x	x	x	x	x	x	x	x	x
Road use: passenger car (distance based/ vignette)	x		x	x		x				x		x	x		x	x					x	x	x	x	x	x				x		x	
Road use: commercial/ heavy goods vehicles (HGV) (distance based/ vignette)	x	x	x	x		x	x		x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x			x	x	x
Congestion charges (cities)															x				x								x	x			x		

Table 4.2 Overview of environmental taxes in EEA member countries (cont.)

	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	United Kingdom	Iceland	Liechtenstein	Norway	Switzerland	Turkey
Pollution																																	
Measured or estimated emissions to air ([c])				x		x	x	x		x			x			x	x				x		x	x		x					x	x	
Measured or estimated effluents to water		x		x		x	x	x		x	x		x			x	x	x		x	x	x	x	x	x	x							
Waste management																																		
• Landfill	x	x	x	x		x	x	x	x	x		x	x	x	x	x	x			x	x	x	x	x	x	x	x	x		x	x	x	x
• Incinerator	x	x					x			x										x		x				x	([e])				([e])		x
• Individual products ([d])	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Non-point sources of water pollution																																	
Pesticides		x					x		([e])						x												x				x		
Fertilisers	([e])						x		([e])																		([e])						
Resources																																	
Water abstraction		x	x	x		x	x	x		x	x		x		x	x	x	x		x	x	x	x		x	x							x
Extraction of certain raw materials	x	x	x	x	x	x	x	x		x	x		x		x	x	x		x		x		x		x		x	x					x

Note: ([a]) Includes climate change levy (CCL), carbon reduction commitment (CRC) energy efficiency scheme and the carbon price support (CPS).

([b]) Annual taxes for commercial vehicles only — passenger cars are not subject to annual circulation taxes.

([c]) Czech Republic, Croatia, Lithuania, Latvia, Estonia, Poland, Romania, Slovakia have in place a quite comprehensive charging system covering different air pollution including CO_2 in some countries (Croatia, Estonia, Poland).

([d]) A whole range of different MBIs, such as taxes, recycling fees, deposit refund schemes, extended producer responsibility levied on individual products, such as packaging; batteries and/or accumulators; tyres; plastic bags; electric and electronic products; lubricating/waste oils and end-of-life vehicles, are implemented in EEA member countries and covered here. Detailed country information regarding the implementation of different MBIs can be found in Bio et al., 2014 and the Organisation for Economic Co-operation and Development (OECD) database on instruments used for environmental policy at http://www2.oecd.org/ecoinst/queries.

([e]) Tax was abolished.

Source: EEA based on references provided in Annex 2.

4.2 Analysis of selected developments in environmental taxation

This section highlights selected developments in environmental taxation, focusing on energy and carbon taxes as well as vehicle taxation schemes. These discussions are not meant to present a comprehensive overview of changes in environmental taxation schemes but rather to analyse some specific trends as well as innovative and striking examples of the application of environmental taxes in Europe ([43]).

4.2.1 Energy taxation

The following aspects are probably the most noteworthy in regard to energy taxation schemes.

- Minimum energy tax rates are laid down in Directive 2003/96/EEC 'Restructuring the Community framework for the taxation of energy products and electricity' (ETD) and are in place for all energy products. They do, however distinguish between different energy uses (transport, industrial/commercial use, heating differentiated between business and non-business use).

- EU Member States are permitted to maintain different types of taxation on energy products and electricity, for example, carbon taxes as well as other specific national taxes, such as the Polish fuel tax (*opłata paliwowa*). The sum of these different indirect taxes are taken into account when assessing compliance with the minimum ETD tax rates. An analysis of energy taxes should therefore include consideration of other types of tax levied on the same energy product since these instruments work in parallel and determine the actual tax burden of the relevant energy product.

- The policy of giving energy tax relief — in the form of exemptions or reductions — can be found across EU Member States. As shown in the detailed overview table in Annex 2, household energy use is exempt from energy taxes in several EU Member States ([44]). Partial energy and carbon tax exemptions for agriculture, industrial sectors and public transport exist in many EU Member States ([45]).

- Closely linked to the topic of tax relief is the comparison between effective and nominal energy tax rates. An interesting aspect — but often overlooked when making such comparisons — is the possibility for companies to deduct expenditures on climate-related taxes from their income tax assessments. For example, in Sweden *[M]any companies have in practice approximately 25 per cent lower costs for climate-related taxes than they pay the central government* (Swedish NAO, 2012) ([46]).

- The indexation of energy tax rates is not widespread. This is significant since the inflation-adjusted, real value of energy tax rates decreases with inflation. For example, Germany increased energy tax rates during the period 1999 and 2003 significantly but has since kept the nominal value constant resulting in an erosion of their effectiveness (Table 4.3) ([47]).

- There is an on-going discussion on the differential ([48]) between petrol and diesel tax rates, in particular in the context of reforming

([43]) See the reports of Hogg et al., 2014, 2015 and 2016 for a comprehensive overview of the application of environmental taxes in EU Member States. These reports were commissioned by DG Environment of the European Commission as part of the work on 'Greening the European Semester' (http://ec.europa.eu/environment/integration/green_semester/studies_en.htm).

([44]) For example, electricity used by households is exempt from paying tax in Bulgaria, Croatia, Hungary, Latvia, Lithuania, Slovakia and the United Kingdom; and natural gas in Bulgaria, Croatia, Hungary, Romania, the United Kingdom; and coal: Bulgaria, Lithuania, Hungary, Poland, Romania, Slovakia and the United Kingdom. (EC, DG Taxation and Customs Union (TAXUD), 'Excise Duty Tables' as of January 2016).

([45]) For more information on tax exemption, see the special tables in the bi-annual 'Excise Duty Tables' of DG TAXUD (http://ec.europa.eu/taxation_customs/taxation/excise_duties/energy_products/rates/index_en.htm) and the OECD database on instruments used for environmental policy (http://www2.oecd.org/ecoinst/queries/Default.aspx). An analysis of energy and carbon tax exemptions for industries implemented in different European countries (Denmark, Finland, the Netherlands, Germany, the United Kingdom and Slovenia) can be found in Speck, 2007.

([46]) An interesting study comparing effective carbon prices that different economic sectors face within and across countries was published by the OECD (2013a).

([47]) The indexation of tax rates is of great significance for *ad quantum* taxes, i.e. the basis of the tax is is the physical quantity of the product, compared to *ad valorem* taxes as these taxes are based on the value of the relevant taxable product. Environmental taxes are by and large *ad quantum* taxes as tax rates are expressed as EUR per litre (petrol, diesel), EUR per kilowatt-hour (electricity), etc. The majority of taxes belong to the category of *ad valorem* taxes. For example, the most common example of an *ad valorem* tax is value-added tax (VAT), which is a tax on the value of goods and products exchanged. Income tax rates are also set in relation to values — on the income or capital of taxable entities. See for further discussion Määttä, 2006.

([48]) A 'dieselation' of Europe's vehicle fleet happened in recent decades as the share of diesel in the total consumption of petroleum products by road transport increased from 52 % in 2000 to 71 % in 2013. This development had a positive effect on the total carbon dioxide emissions not on other pollutants, including nitrogen oxides. These latter pollutants significantly damage health, contributing to lung disease, heart attacks and other respiratory diseases (EEA, 2015a).

environmentally harmful subsidies. For example, the tax differential between tax levied on petrol and diesel is classified as a tax expenditure and consumer support by the Ministry of Finance in Sweden ([49]); but this is not the case in all EU Member States. As the data show, tax differences are still in place in all but one EU Member States. However, a process of aligning the tax rates is noticeable (Table 4.3).

- Additional taxes levied on energy products and electricity have been implemented in some EU Member States. These additional levies were often introduced with clearly defined objectives for the use of the revenues generated. For example, the revenues have been earmarked for financing renewables in Slovenia and the Netherlands, or for financing strategic oil reserves in Austria, Finland, Germany and Latvia.

Table 4.3 shows some developments in terms of taxation on transport fuels — petrol and diesel — and, indeed, taxes levied on them generate the greatest environmental tax revenues ([50]). The countries that joined the EU in the 2000s generally had larger increases in transport fuel tax rates, largely the result of a catching-up process as well as the need to comply with the ETD's minimum tax rates. The indexation of energy tax rates, which is policy in countries such as Sweden and the Netherlands, ensures that the *ad quantum* tax rates are not devalued in real terms. Furthermore, the tax differential between petrol and diesel was reduced in 20 of the EU Member States between 2005 and 2016.

Some new energy taxes have been introduced in the past decade. One of the most interesting is the Danish 'security of supply tax', introduced in early 2013 but then abolished at the end of 2014. The reasoning for implementing the tax is noteworthy, as the revenues were planned to offset the losses of revenue of the existing taxes levied on fossil fuels as their consumption were projected to fall (Danish Energy Agency, 2012). The tax was abandoned because of competitiveness concerns (Nordenergie, 2015). In this context, it is of interest to note that the electricity tax levied on business use in Denmark was dramatically reduced. In 2010 a rate of EUR 97 per megawatt-hour (MWh) was levied compared to a rate of about EUR 0.54 per MWh in July 2015 corresponding more or less to the ETD's minimum excise rate of EUR 0.5 per MWh ([51]). However, this alteration must be assessed within the overall energy and climate policy framework, in particular related to the EU Emission Trading System (EU ETS) and the auctioning of emission allowances, as this affects electricity prices.

The Danish policy approach of taking energy/climate into account as well as fiscal considerations will probably attract more attention in Europe when assessing the long-term revenue-generating potential of energy taxes because of the likely tax base erosion resulting from a reduction in energy products that are heavily taxed today — transport fuels. This is because the erosion of the tax base must be counterweighed by increases in energy tax rates if energy tax revenues are to remain constant and thereby continue to be significant in generating revenue for the overall fiscal system.

The Netherlands introduced an energy tax surcharge on natural gas and electricity in 2013 with the underlying rationale of generating funds for financing renewable energy production. This type of market-based instrument for promoting renewable energy and high-efficiency co-generation is also in place in Slovenia. However, Slovenia levies a surcharge on all energy products, including transport fuels and a strategic stockpile charge. The latter can be found in many countries, including Austria, Cyprus, Finland, Germany and Latvia. The purpose of this charge is rather similar across countries: it is to fund reserves of oil products for at least 90 days' worth of consumption ([52]).

A rather complex and wide-ranging system of taxes and charges affecting the production and distribution of electricity has been implemented at regional (autonomous communities) and national levels in EU Member States including Italy, Portugal and Spain ([53]).

([49]) For further information, see the analysis, data and reports published by OECD and IEA 'OECD-IEA Fossil Fuel Support and Other Analysis' at http://www.oecd.org/site/tadffss. However, this tax difference is not reported in the OECD and IEA data as a tax expenditure for the majority of EU Member States.

([50]) For more information, see Environmental tax statistics (Eurostat Statistics explained) http://ec.europa.eu/eurostat/statistics-explained/index.php/Environmental_tax_statistics (accessed on 15 January 2016).

([51]) See Excise Duty Tables of DG TAXUD (situation as of 1 January 2016).

([52]) All EU Member States are required, according to Council Directive 68/414/EEC of 20 December 1968, to have a strategic petroleum reserve equal to at least 90 days of average domestic consumption.

([53]) See the reports 'Fiscal Flash Electricity' published by Eurelectric for a comprehensive and thorough overview of MBIs affecting utilities. The reports can be found at http://www.eurelectric.org/but, unfortunately, the publication of them was discontinued in 2014. For example, a levy on networks with the rate depending on the length of the transmission lines and a levy on wind electricity production with the number of wind turbines as the taxable event is in place in the Spanish autonomous community Castilla Y Leon. The region of La Rioja is also levying a tax on the length of the network.

Table 4.3 Development of indirect taxes on petrol and diesel between January 2005 and July 2014 (changes of tax rates are shown in EUR in current and constant 2005 prices — Eurostat GDP deflator used) and tax difference between diesel and petrol prices in 2005 and 2016

	Petrol		Diesel		Difference between petrol and diesel tax rate in % (x)	
	Percentage change 2005–2014		Percentage change 2005–2014			
	Current prices	Constant 2005 prices	Current prices	Constant 2005 prices	2005	2016
Austria	16	– 1	31	12	28	20
Belgium	9	– 6	29	11	70	33
Bulgaria	43	– 2	63	12	25	10
Croatia	n/a	n/a	n/a	n/a	n/a	26
Cyprus	58	37	81	58	23	6
Czech Republic	34	9	36	11	19	17
Denmark	17	– 2	0	– 16	48	46
Estonia	47	– 4	60	5	18	8
Finland	10	– 9	44	19	84	32
France	3	– 8	3	– 9	41	27
Germany	0	– 11	0	– 11	39	39
Greece (a)	126	105	35	22	21	101
Hungary (b)	– 1	– 10	11	1	22	9
Ireland	33	36	30	33	20	22
Italy	30	13	50	31	37	18
Latvia	43	– 5	35	– 10	17	27
Lithuania	51	9	35	– 3	17	32
Luxembourg	5	– 21	26	– 4	67	38
Malta	64	31	72	37	26	16
Netherlands	14	1	31	16	75	59
Poland	5	– 12	32	11	38	14
Portugal	12	– 1	20	6	70	53
Romania	40	– 6	70	14	31	7
Slovakia	42	1	7	– 24	7	40
Slovenia	35	15	32	12	19	16
Spain	7	– 3	13	2	35	26
Sweden	23	3	39	16	36	13
United Kingdom (c)	– 2	– 6	– 8	– 12	– 6	0

Note: (x) The difference between petrol and diesel tax rates are expressed as % of diesel, i.e. positive values indicate that the petrol tax rates is by % percentage higher than diesel tax rate.

The difference in excise duty is calculated based on the tax rates expressed in EUR/1 000 litres. The percentage changes may differ when a different base year is used for the analysis. These decisions influence the results:

Greece: the tax rate on diesel was increased from 245 EUR/1 000 litres in 2005 to 412 EUR/1 000 litres in May 2010, a nominal increase of 68 % compared to an increase of 35 % as presented in the table above as the tax rates was reduced to 330 EUR/1 000 litres in October 2012 which is the actual tax rate in 2016.

Hungary: the nominal petrol tax rates increased by 19 % when expressed in Hungarian Forint.

United Kingdom: when expressing the tax rates in the national currency (UK Pound) the nominal rate increased by 15 % (unleaded petrol) and 9 % (diesel) during the period 2004–2014.

Source: EEA based on EC DG TAXUD and EC DG Energy ([54]) and Eurostat (GDP deflator used for determining constant prices).

([54]) Data on taxes levied on oil products are published by DG TAXUD (*Excise Duty Tables*) and DG Energy (*Weekly oil bulletin*). The tax rates published by DG Energy do not always correspond to the ones presented by DG TAXUD for different reasons, such as the date of publication and the coverage of indirect taxes levied on energy products. For example, the inclusion of strategic stockpile taxes or charges is not dealt with consistently.

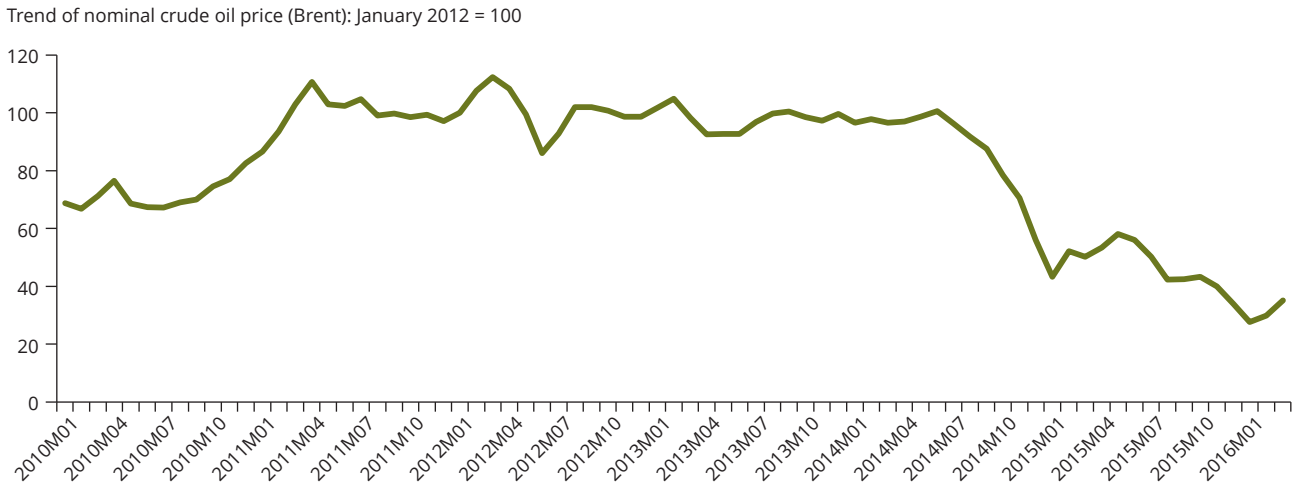
An innovative approach of setting energy tax rates was put forward by the UK government in 2012. The United Kingdom implemented rather advanced political approaches for establishing energy tax rates in the 1990s with the commitment to increase energy tax rates in real terms, above inflation, through the fuel-price escalator ([55]). This escalator resulted in an annual tax-rate increase of 3 % above inflation, later rising to 5 % and finally to 6 % above inflation in 1997 ([56]). These rather substantial increases ended in 2000. The escalator policy was re-introduced in the 2009 budget when it was announced that rates should be increased by 1 % above the inflation rate annually. However, this was not fully implemented because of increases in the international oil prices (Figure 4.1). The government announced in the 2011 budget that it would replace the fuel price escalator with the 'fair fuel duty stabiliser', the idea behind which was to link oil prices and fuel tax increases, reducing the taxes on transport fuels when oil prices rise and vice versa.

The policy was introduced when the world oil price was high (Figure 4.1) implying that the tax rate would be cut, but, if the price of oil (Brent crude) fell below a pre-determined trigger price, an increase of the tax rate by the retail price index (RPI) plus 1 penny per litre would be implemented. The underlying motive was to stabilise petrol and diesel prices and increase the taxes levied on transport fuels only when oil prices remained below USD 75 per barrel for more than three months (Seely, 2014). However, although the oil price has been below the USD 75 ceiling since December 2014, the fuel duty stabiliser has yet to be initiated.

The UK approach of linking increases of energy tax rates to the world oil price is not unique. A similar arrangement was in place from 1 October 2000 to 21 July 2002 in France. The excise tax rates (*taxe intérieure sur les produits pétroliers* (TIPP)) floated in line with price changes of crude oil using North Sea Brent prices as a benchmark. The policy was that a reduction of the benchmark price by more than 10 % would trigger an increase of the tax by the same amount. Conversely, when the benchmark price increased by more than 10 %, the tax decreased. The link between tax rates and oil price was revoked in 2002 ([57]), but French regions have the power to slightly increase the nationally determined tax rates.

The current low oil price is regularly argued as an opportunity to increase energy taxes to help achieve energy and climate policy objectives. So far, evidence for this argument is mixed among EU Member States, with 11 having increased taxes levied on transport fuels, nine leaving rates unchanged, while the indirect tax burden levied has been lowered for both petrol and diesel use in four EU Member States: Hungary, Poland, Romania and Slovenia (Table 4.4) ([58]).

Figure 4.1 Trend of nominal price of Brent crude oil, January 2010–March 2016



Source: World Bank Commodity Price Data (http://www.worldbank.org/en/research/commodity-markets).

([55]) It is also known as the fuel duty escalator.
([56]) Table 4.3 presents the increases in tax rates in constant prices between 2005 and 2014 and is useful as a benchmark for revealing the dimension of an increase of 6 % per annum in real terms (constant prices). It would mean that the tax rates would rise by 70 % during this period. Only the increase in petrol taxes in Greece exceeded this rather large increase and this increase can be attributed to the fiscal consolidation process.
([57]) For more information, see the country overview 'France' in the publication of OECD/IEA *Energy Prices and Taxes — Quarterly Statistics*.
([58]) Other European countries, such as Norway and Serbia, increased energy tax rates at the beginning of 2016.

Table 4.4 Excise tax rates (EUR and national currencies — current prices) levied on petrol and diesel in 2015 and 2016

	Petrol	Diesel	Petrol	Diesel	Petrol	Diesel
	EUR/1 000 l	EUR/1 000 l	EUR/1 000 l	EUR/1 000 l	% change 2016/2015	% change 2016/2015
	2016	2016	2015	2015		
Austria	482	397	482	397	0	0
Belgium	619	465	615	428	0.6	8.6
Bulgaria	363	330	363	330	0	0
Croatia	505	401	479	374	5.5	7.0
Cyprus	479	450	479	450	0	0
Czech Republic	472	403	467	398	1.1	1.2
Denmark	611	416	608	414	0.6	0.6
Estonia	465	448	423	393	10.0	14.0
Finland	681	506	681	506	0	0
France	641	498	624	468	2.7	6.4
Germany	655	470	655	470	0	0
Greece	670	330	670	330	0	0
Hungary	384	353	397	366	– 3.5	– 3.6
Ireland	588	479	588	479	0	0
Italy	728	617	728	617	0	0
Latvia	436	341	411	333	6.1	2.4
Lithuania	434	330	434	330	0	0
Luxembourg	462	335	462	335	0	0
Malta	549	472	519	442	5.8	6.8
Netherlands	770	484	766	482	0.5	0.5
Poland	393	344	399	349	– 1.5	– 1.5
Portugal	618	402	618	402	0	0
Romania	461	430	462	430	– 0.1	– 0.1
Slovakia	551	386	551	386	0	0
Slovenia	545	462	596	495	– 8.5	– 6.5
Spain	425	331	425	331	0	0
Sweden	676	623	646	586	4.7	6.2
United Kingdom	787	787	745	745	5.6	5.6
	National currency/1 000 l	National currency/1 000 l	National currency/1 000 l	National currency/1 000l	% change 2016/2015	% change 2016/2015
Bulgaria	710	646	710	645	0	0
Croatia	3 860	3 060	3 660	2 860	5.5	7.0
Czech Republic	12 840	10 950	12 840	10 950	0	0
Denmark	4 561	3 104	4 525	3 080	0.8	0.8
Hungary	120 000	110 350	123 300	113 555	– 2.7	– 2.8
Poland	1 669	1 459	1 669	1 459	0	0
Romania	2 035	1 897	2 035	1 897	0	0
Sweden	6 340	5 838	5 880	5 331	7.8	9.5
United Kingdom	580	580	580	580	0	0

Note: When taking variations in the exchange rate into account, the number of EU Member States with changes in the tax rates drops to 8 countries with increased and 2 with decreased tax rates as the tax rates (expressed in national currencies) remained constant in the Czech Republic, Poland, Romania and the United Kingdom.

Source: EEA based on EC, DG TAXUD, Excise Duty Tables; January 2015 and 2016.

When analysing current approaches, the most notable country is Slovenia, where energy tax rates have been revised frequently in line with overall government policy. Seven changes were made in 2012, nine in 2013, 14 in 2014 and a further seven in 2015 ([59]) (Figure 4.2). This fiscal approach stands in contrast to policies adopted in other countries. The trend of reducing energy tax rates in early 2015 is worth highlighting as, to some extent, it reversed the trend of the global oil price at the end of 2014 and the beginning of 2015. The tax rates levied on petrol and diesel increased between August 2014 and January 2015 at a time when the global oil price dropped. During the subsequent months (March–June 2015) a slight increase in the global oil price was associated with a reduction in the tax rates on petrol and diesel between February and August 2015. However, the distinct fall in the global oil price since August 2015 did not trigger any government actions and tax rates have remained constant since August 2015 apart from a marginal increase at the beginning of 2016.

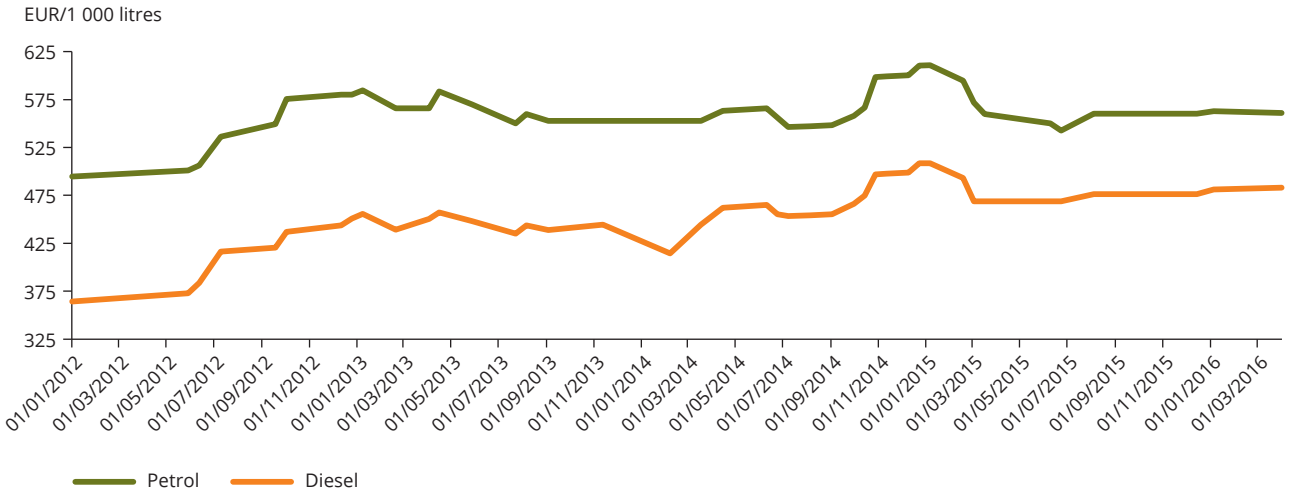
A further interesting development occurred Belgium at the end of 2015 to increase diesel tax rates and thereby close the gap between the tax rates for diesel and petrol. The Swedish government also has the objective of aligning petrol and diesel tax rates, as shown in the different percentage increases in the respective tax rates between 2015 and 2016 (Table 4.4).

4.2.2 Carbon tax schemes — a snapshot of the current situation in Europe

The pricing of carbon has become a signpost in the climate-policy debate on bringing down carbon emissions and stimulating investment in cleaner technologies. Two approaches to carbon pricing exist in Europe: emission trading (ETS) and carbon taxation schemes.

European countries have been pioneers of implementing carbon taxation schemes. At the beginning of the 1990s, Nordic countries introduced them in addition to existing energy taxes. The final user of energy products may not be aware of the difference between energy and carbon taxes since the total combined tax burden is usually reported. However, the distinction is significant as the intentions may differ: energy taxes aim mainly to decrease energy consumption, while carbon taxes aim to incentivise a shift in the energy mix away from carbon-intensive energy sources. This is the case when carbon taxes are set at a uniform rate for all energy products and users, and thereby the combined ambitions of efficiency and cost-effectiveness are fully exploited. However, carbon tax rates as implemented in European countries vary between different energy products and users, which is no surprise since both forms of carbon pricing — carbon taxes and ETSs — are applied.

Figure 4.2 Changes in petrol and diesel tax rates (current prices) in Slovenia, January 2012–April 2016



Source: EEA based on EC, DG Energy.

([59]) Retail prices for petrol, diesel and heating oil are regulated in Slovenia.

The first country in Europe to introduce a carbon tax based on the carbon content of fossil fuels was **Finland,** in January 1990. The carbon taxation scheme is now designed in such a way that the total tax burden is differentiated between an energy tax and a carbon dioxide tax component. Deviating from standard theory, the carbon dioxide tax rate now differentiates between usages: the rate on transport fuels is EUR 70 per tonne of carbon dioxide but EUR 54 per tonne for heating purpose (tax rate for light and heavy fuel oil, coal and natural gas). The differentiated rates were initially set at EUR 50 and EUR 30 respectively but when the energy/carbon taxation scheme was changed in 2011 the percentage increase applicable to heating was higher than the one for transport fuels.

In 2011, the European Commission published a proposal for re-structuring the energy taxation directive (ETD), differentiating between an energy tax component and a per tonne of carbon dioxide tax component. The proposal was withdrawn in 2015, as the negotiation between the EU Member States in the European Council was unsuccessful. The proposal also distinguished between transport fuels and energy products for heating, as is the case in Finland. However, in the proposal, the carbon dioxide tax rate per tonne would have been the same for both purposes but the energy tax rate would have varied depending on energy use.

The carbon tax scheme in **Sweden** was implemented in the early 1990s by reducing existing excise taxes so that the overall tax burden for households and services did not change, and special tax rules for energy-intensive industries were extended so that the overall industry carbon tax levels were reduced by about 75 % in 1993 (Hammar and Åkerfeldt, 2011). The carbon dioxide tax rate per tonne has increased over the past 25 years and is now by far the highest in the world at SEK 1 120 (EUR 120) per tonne CO_2 ([60]). The design of carbon taxation as well as energy taxation schemes was revised in Sweden in 2009 and the changes entered into force in steps between 2010 and 2015. These changes affected in particular industry since the industrial sectors covered by the EU ETS are now completely exempt from paying any carbon taxes — preventing double taxation (carbon pricing) — and non-EU ETS industries are facing increased carbon dioxide tax levels but low energy tax rates. In 2013, the non-EU ETS industries were subject to a carbon dioxide tax equal to 30 % of the standard carbon dioxide tax rate per tonne and this increased to 60 % in 2015. The exemption of industry outside the EU ETS is planned that will finish in 2016, implying that these industries will be subject to the standard carbon dioxide tax rate per tonne — a policy approach similar to the 2011 EC proposal.

A carbon dioxide tax on all fossil fuels as well as on electricity was introduced in **Denmark** in 1992. In 2014, the scheme on electricity was revised by including carbon dioxide in the general electricity tax. However, this change was accompanied by a reduction in the electricity tax rate for business use so that it corresponds with the minimum tax rate laid out in the ETD and is levied on electricity consumption in EU ETS sectors. As in the case of other EU Member States, Denmark applies different rates for EU ETS and non-EU ETS industrial sectors (Andersen, 2015). The carbon dioxide tax is EUR 22.8 per tonne (Hansen, 2015).

The carbon tax scheme in **Norway** established different carbon dioxide tax rates for energy products and purposes, ranging from NOK 365 (EUR 38) for mineral oil ([61]) to NOK 420 (EUR 45) per tonne of carbon dioxide for petrol and diesel in 2016 ([62]). Some sectors, such as petroleum, are subject to the carbon tax and the ETS (Bragadóttir et al., 2014). Other European countries do not adopt this policy approach, rather exempting EU ETS sectors from any payment of carbon taxes.

At the end of 2015 the Norwegian Green Tax Commission submitted its findings on *whether and how a green tax reform can be used to secure reduced greenhouse gas emissions, improved environmental conditions and sound economic growth* ([63]). One of their recommendations was that the current system of different carbon dioxide tax rates should be ended so that all emissions from the non-EU ETS sectors are subject to the same tax rate per tonne of carbon dioxide equivalent as is currently applied to petrol and diesel (NOK 420 (EUR 45) per tonne carbon dioxide).

Slovenia implemented a carbon tax in 1997 and the tax rate amounts to EUR 17 per ton of carbon dioxide equivalents. Exemptions on liquefied petroleum gas and natural gas were removed and the tax applies to fossil fuels.

([60]) The exchange rate of SEK 9.31 per EUR (as of January 2016) was used throughout the report.
([61]) The exchange rate of NOK 9.42 per EUR (as of January 2016) was used throughout the report.
([62]) Differences in the CO_2 tax rates levied on energy products have been reduced during recent years.
([63]) See the press release of Norwegian government at https://www.regjeringen.no/en/aktuelt/report-from-the-green-tax-commission/id2466332 (accessed on 5 January 2016).

In 2008, **Switzerland** launched a carbon dioxide levy on a limited number of energy products, such as gas oil and natural gas used for heating purposes, but transport fuels are exempt. This scheme includes an innovative approach as the rise in the tax rate is linked to the non-achievement of pre-defined quantitative emission reduction targets. The rate was initially set at CHF 12 (EUR 11 ([64])) per tonne of carbon dioxide in 2008, rising CHF 84 (EUR 76) in January 2016. Although carbon dioxide emissions — relevant for assessing whether the pre-determined reduction target had been met — had fallen within the period, the drop was not sufficient and the pre-set increase in the tax rate was triggered. The latest amendments of the Swiss law may lead to further increases of up to a maximum rate of CHF 120 (EUR 109) per tonne carbon dioxide for 2018 but only if pre-defined reduction targets have not been achieved. The link between price-based instruments and quantity-based reduction targets is an interesting one — the design of the carbon dioxide levy is directly related to changes in the behaviour of energy users since the rate increases if pre-determined reduction targets are not reached.

A carbon tax was introduced in **Ireland** for all energy products and users not covered by the EU ETS. The carbon tax was levied on transport fuels from mid-December 2009, and on fuel for heat from May 2010. Although initially exempt, since May 2013 solid fuels, such as coal, are also subject to the carbon tax. The rate increased from EUR 15 per tonne of carbon dioxide to its current value of EUR 20 as part of the 2012 Budget.

Fiscal reasons were one of the reasons for the introduction in 2010 of **Iceland's** carbon tax that covers the majority of transport and heating fuels but not kerosene and coal. Probably the most striking feature of this tax was the connection to the EU ETS, as the tax rate reflected the price of the EU ETS emission allowance. In 2010 the carbon tax amounted to about EUR 14 per tonne of carbon dioxide and also applied to fuels used by fishing vessels (OECD, 2014). An interesting aspect of the Icelandic climate policy is that some installations, such as small emitters, are excluded from the ETS but are subject to an emission charge which is set in accordance with the development of ETS allowance prices and was ISK 1 338 (EUR 8.26) per tonne of carbon dioxide equivalent in 2013 (Bragadóttir et al., 2014)).

In April 2014, **France** introduced a carbon tax (*taxe intérieure sur la consommation (TIC)*), in a tax neutral way, covering coal, heavy fuel oil and natural gas. From 2015 onwards transport fuels were also subject to the tax which initially was set at EUR 7 per tonne carbon dioxide but increased to EUR 14.5 in 2015 and EUR 22 in 2016. In August 2015, in probably the most remarkable recent development dealing with environmental taxation, the French parliament passed the Energy Transition for Green Growth Act, an energy bill outlining an increase in the tax rates to EUR 56 per tonne carbon dioxide in 2020 and EUR 100 in 2030.

Announcing these long-term increases in carbon tax rates is unique — the implementation of this trajectory will require average annual increases of 26 % between 2016 and 2020 and 6 % annually for the period 2021–2030. The total tax burden levied on the different energy products is the sum of the existing energy taxation scheme and a carbon tax component. The share attributed to the carbon tax is rather low for petrol and diesel compared to other energy products as it was projected that the carbon tax component for energy products such as liquid petroleum gas (LPG) and fuel oil will increase steadily (El Beze, 2014). This development is reflected in the recent sharp increases in the tax rates for heating gas oil and heavy fuel oil: the former increased by 26 % between January 2015 and January 2016 and the latter by 52 %. The continuation of the carbon tax trajectory will trigger further increases but not as steep.

Portugal introduced the most recent carbon tax in Europe. The parliament endorsed the carbon tax law in 2014, paving the way its introduction from the beginning of 2015. A Commission for Environmental Tax Reform, which was appointed by the Portuguese government, came up with a proposal for linking carbon tax rates to the allowance prices of the EU ETS. However, the government rejected the proposal and set the tax rate at EUR 5 per tonne of carbon dioxide.

Experience with carbon taxes/charges has also been gained in several Eastern European countries that have used of carbon pricing tools for many years. For example, **Croatia, Latvia** and **Poland** have comprehensive air emission charging schemes that include carbon dioxide emissions (Speck et al., 2006; OECD, 2003; REC, 2001 and 1999). **Estonia** also has a carbon tax in place and the generation of thermal energy is subject to it. In all these cases the rates are rather low, for example EUR 2 per tonne carbon dioxide in Estonia (Ecologic Institute and eclareon, 2014).

([64]) The exchange rate of CHF 1.10 per EUR (as of January 2016) was used throughout the report.

The **United Kingdom** has a rather broad and complex approach to carbon taxation schemes with three different instruments: the climate change levy (CCL), CRC Energy Efficiency Scheme (CCR, formerly the Carbon Reduction Commitment) and the carbon price floor (CPF).

- The climate change levy (CCL) was introduced in 2001 and is a tax on energy products (electricity, natural gas, LPG and solid fuels) consumed by non-domestic users and increased by 30 % between its introduction in 2001 and the latest increase in April 2016 (an average 1.8 % per year — in nominal prices). The CCL rates were increased by about 1 % (nominal; an increase in line with inflation) in April 2016 but the taxes levied on transport fuels remained at the same level although the conditions of the fair fuel duty stabilisers (oil price below USD 75 per barrel for more than three months) for an increase were met. The CCL was criticised in the past as the energy products are not taxed in proportion to their carbon contents. Originally, electricity generated from renewable sources was exempt from the CCL but this will be abolished — in the November 2015 Spending Review the UK government announced that a transitional period for electricity suppliers to apply the CCL exemption on electricity generated from renewable sources will end on 31 March 2018.

- The CRC Energy Efficiency Scheme was introduced in 2010 applying to large non-energy intensive public and private sector organisations having half-hourly meters recording total electricity consumption every half-hour and consumption greater than 6 000 MWh. The participating organisations are not part of the EU ETS and must monitor and report their energy uses which are then converted to CO_2 emissions by applying emission factors published by the Environment Agency. Based on these calculations the organisations are required to surrender allowances for their emissions and the initial allowance price was set at GBP 12 (EUR 15.8 ([65])) per tonne CO_2 and the price increased to GBP 16.90 (EUR 22.2) for the financial year 2015/2016 ([66]). The government announced in the 2016 budget that the CRC energy efficiency scheme will be abolished at the end of March 2018. Furthermore, it was stated that this will lead to an increase in CCL rates above inflation to recover the losses in tax revenues of discontinuing the CRC energy efficiency scheme (HM Revenue & Customs and HM Treasury, 2016) ([67]).

- In the 2011 budget, the UK government announced a carbon price support (CPS)/carbon price floor (CPF) mechanism operational from 1 April 2013 ([68]). The aim is to foster investment in low-carbon electricity generation technology by reducing uncertainty about the volatility of the future prices of EU ETS emission allowances. Only fuels used to generate electricity are subject to the CPS policy and the government announced a carbon price floor (CPF), set at GBP 16 (EUR 21) per tonne of carbon dioxide in 2013 and originally planned to increase it to GBP 30 (EUR 39) in 2020 ([69]). The initial CPS rate was set at GBP 4.9 (EUR 6.5) per tonne of carbon dioxide (April 2013) and this was raised to GBP 18.1 (EUR 23.8) in April 2015. The UK government reviewed the decision of the annual increase in the CPF in the 2014 Budget and capped the CPF trajectory at GBP 18 (EUR 24) for the period from 2016/17–2019/20, reasoning that this would limit competitive disadvantages for the UK economy (HM Treasury, 2014). The two components making up the CPF are the allowance price from the EU ETS and the CPS rate per tonne of carbon dioxide. The CPS rate is only imposed in the United Kingdom and utilities using fossil fuels in electricity generation face this additional cost component ([70]). Capping the CPF trajectory therefore limits the price disparity between utilities in the United Kingdom and other EU Member States as well as the cost of electricity. The CPS rate, expressed in GBP per tonne of carbon dioxide, serves as the basis for determining specific CPS rates for different fossil fuels through the application of emission coefficients and are included in the CCL regime ([71]).

([65]) The exchange GBP 0.76 per EUR (as of January 2016) was used throughout the report.
([66]) The CRC Scheme provides the option of buying allowances at the start of the compliance year in the cheaper 'forecast sale' at a rate of GBP 16.10, or in a more expensive 'compliance sale' at the end of the year at GBP 16.90 for reaching the compliance requirements.
([67]) In 2014 revenues generated from CRC amounted to about 38 % of revenues from the CCL, i.e. GBP 504 million as compared to GBP 1 506 million.
([68]) For a detailed discussion of the CPS see 'A guide to carbon price floor' published by HM Revenue & Customs: https://www.gov.uk/government/publications/excise-notice-ccl16-a-guide-to-carbon-price-floor/excise-notice-ccl16-a-guide-to-carbon-price-floor#who-has-to-pay-the-cps-rates-of-ccl (accessed on 30 March 2016).
([69]) The prices are expressed in constant (2009) prices.
([70]) Although a detailed and comprehensive analysis of the consequences of the introduction of the CPF/CPS scheme has not been undertaken, this policy is regularly mentioned as a contributing factor for planned or actual closure of coal powered utilities in the United Kingdom.
([71]) The French Government plans to introduce in France's 2017 Finance Bill a carbon floor price of EUR 30 per tonne aiming to cut carbon dioxide emissions in the follow-up of the Paris Agreement on climate change.

Many businesses currently explicitly support carbon pricing ([72]). Furthermore, an increasing number of businesses make use of internal carbon prices both as a voluntary tool for making investment decisions with regard to new technologies and *to mitigate risks from future regulation and global carbon pricing frameworks* (CDP, 2015). Businesses from many industrial sectors, including energy, finance, manufacturing and IT, are applying internal carbon prices. The range of these carbon prices is enormous, with energy companies often reporting a higher price than businesses in the financial sector. For example, Exxon uses a price of USD 80 per tonne of carbon dioxide equivalent, Statoil of USD 50, and Royal Dutch Shell of USD 40, compared to Caixa Bank and Societe Generale price of about USD 11 (CDP, 2015).

The theoretically significant distinction between carbon and energy taxes is of less relevance in political reality as both are converted into the same unit (EUR per physical unit of energy/carbon per litre, kilogram, etc.). The actual tax burden, the sum of energy and carbon taxes, determines the final end-user energy price and is more relevant than the individual tax components, in particular when the aim is to study whether the tax changes the behaviour of economic actors, namely the consumers of energy products. The exclusive focus on carbon pricing in climate discussions may provide some biased results. For example, the highest tax burden on transport fuels (petrol and diesel) is in the United Kingdom, which does not levy any carbon tax on these energy products.

4.2.3 Transport taxation

The most important taxes listed in this category are related to the ownership and use of vehicles, although taxes levied on other transport equipment and transport services are also included (Eurostat, 2013). Increased attention is being given to road user and congestion charges, which were introduced as environmental policy tools to reduce air pollution and congestion in cities as well as to generate revenues often used to repay debts issued to finance the construction, operation and maintenance of roads. Schemes exist in the majority of countries (Table 4.2 and Annex 2) which generally distinguish between private vehicles and commercial vehicles/heavy good vehicles (HGVs) ([73]). Moreover, the schemes can differ widely in their design as the charge rates may be distance-based or not (a vignette approach).

Sales and/or registration taxes on vehicles are in place in 21 of the 28 EU Member States. The countries that do not levy these one-off taxes charge may charge an administrative fee for the registration of vehicles ([74]). The status of the application of circulation (annual) taxes paints a similar picture with the majority of EU Member States making use of them. The number of countries applying circulation taxes is higher when including those levying this tax on the ownership of commercial vehicles. The design of these transport taxes differs significantly, as the taxable base can be carbon dioxide emissions, weight, engine size, price of the vehicle (sales/registration taxes) and in the case of circulation taxes: engine size, carbon dioxide emissions, weight, etc. ([75]).

There have been interesting developments in terms of vehicle taxation in the Netherlands and Denmark. These are of added significance since these countries' share of transport tax revenues in GDP is among the highest in Europe — Denmark is ranked first and in the Netherlands third in 2013.

The Dutch development is interesting as it reveals valuable insights to assessing the effectiveness and efficiency of market-based instruments. The focus is on vehicle purchase or registration tax since the design of the tax was changed in 2009. From then, the tax was not only based on the price (the tax rate was 45.2 % of the net list price) but also on the carbon-efficiency, with vehicles emitting less than 110 grams of carbon dioxide per kilometre for petrol vehicles and 95 grams for diesels exempt from the tax (Kok, 2015). In subsequent years, the cut-off limit was adjusted according to technological advances and in 2013 the registration tax was completely based on the carbon efficiency of the vehicle. The circulation tax was based on a vehicle's mass and fuel type but in 2008 carbon dioxide emissions were added as a further tax component with the same cut-off limits as for the registration tax. Vehicles below these cut-off limits were eligible for partial tax exemptions.

([72]) See for example the list of carbon pricing supporters at http://siteresources.worldbank.org/EXTSDNET/Resources/carbon-pricing-supporters-list-UPDATED-110614.pdf (accessed on 10 December 2015).

([73]) As discussed in the Eurostat statistical guide 'Environmental taxes' road-pricing schemes are treated differently in national accounts and only when that the country regards this type of MBI as a tax in national accounts, 'should it be included as a transport tax' (Eurostat, 2013). This report does not follow this guideline in detail as it includes all charging schemes, thereby disclosing the extent of charging schemes implemented in European countries.

([74]) Registration fees are not considered in the overview tables.

([75]) More information can be found on the European Automobile Manufacturers' Association (ACEA) website (www.acea.be).

The comparison of the performance of the Dutch ranking of average vehicle carbon dioxide emissions between 2007 and 2014 reveals a big change; the Netherlands was ranked 12th in Europe in 2007 ([76]) and 1st in 2014 (EEA, 2015a). It is clear that these changes cannot be exclusively due to changes in the vehicle taxation schemes but Kok stated that *… about two-thirds is explained by the introduction of CO_2-based tax incentives and about one third by exogenous factors of which the economic recession in 2008–2009 is the most prominent* (Kok, 2015).

The effectiveness of the change in policy on reducing emissions is beyond doubt, but, as the Court of Auditors of the Netherlands noted, this policy is 'relatively expensive and inefficient' as a fiscal stimulus (Brunisma and Echten, 2015) ([77]). Estimates show that for the period 2008–2013 *… the cost-effectiveness would be in the order of EUR 1 400–1 900 loss of car-related tax revenues per tonne of carbon-dioxide abatement* (Kok, 2015). The most recent data of the Dutch registration tax revenue show that the revenues dropped by about 65 % from EUR 3.6 billion in 2007 to EUR 1.1 billion in 2014 (nominal prices). This policy change clearly has budgetary implications, as stated in the latest environmental performance review of the Netherlands: *such a reduction in tax revenues certainly represents a major fiscal challenge* (OECD, 2015a).

The fiscal trend in Denmark was comparable as revenues from the vehicle registration tax dropped from DKK 24.3 billion (EUR 3.3 billion ([78])) in 2007 to DKK 13.1 billion (EUR 1.8 billion) in 2012, but has since increased to DKK 16 billion (EUR 2.1 billion) in 2014. The Danish registration tax increases the purchase price of a vehicle dramatically as the two-tier tax rate is set *at 105 % of the list price for the first EUR 10 600 and 180 % for the remaining part* (Hogg et al., 2016) ([79]).

The findings of a recent assessment of the Danish vehicle and energy taxation scheme states that *per capita road transport emissions in Denmark are among the highest in the EU, which suggests that the structure of car taxation in Denmark, currently based on low excise duties and high car registration fees, is not meeting its environmental objectives. In particular, it provides disincentives to purchase newer and more efficient cars* (EC, 2015c).

Lamine and Lõhmuste (2014) support this feature of registration taxes slowing the renewal of the car fleet ([80]). However, other research shows that changes in the design of registration taxes to include carbon dioxide emissions as a taxable component *reduced the carbon dioxide emission intensity of the average new car by 1.3 per cent, partly through an induced increase of the share of diesel-fuelled cars by 6.5 percentage points* (Gerlagh et al., 2015). The same study further concluded that taxes on transport fuels also need to be taken into account when assessing the effectiveness of environmental taxation, noting *higher fuel taxes lead to the purchase of more fuel efficient cars, but higher annual road taxes have no or an adverse effect*.

The need to regularly review the basis of tax structures is therefore of great relevance for transport taxes when they are set in relation to the carbon efficiency of cars given technological developments. Newly registered vehicles in Europe are emitting less carbon dioxide per vehicle kilometre, year on year (EEA, 2015a) and if these changes are not considered, revenues from transport taxes will reduce over time.

With this in mind, the UK government announced a complete overhaul of its existing circulation taxation scheme (vehicle excise duty (VED)) by 2017. From 1 April 2010 onwards, the first owner car is exempt from paying VED for vehicles belonging to band A-D (CO_2 emission figures of up to 130 g/km) and from the second licence onwards the VED rate zero rated only for vehicles of band A (CO_2 emission figures up to 100 g/km). After April 2017, newly purchased vehicles will be subject to a tax rate directly linked to carbon dioxide emissions (the current practice) but only vehicles with zero CO_2 emission are exempt from VED payments (zero-emission vehicles). The VED payments will be phased in with the first band reaching from 1–50 g/km ([81]).

The new scheme foresees that in subsequent years there will be only three rates. The rate for zero-emission vehicles will be zero, while the standard

([76]) As quoted in Kok, 2015.
([77]) Presentation 'Cost-effectiveness of national tax incentives in car taxation — The Netherlands as an example' given by Brunisma and Echten (Ministry of Finance of the Netherlands) at the 6th International Tax Dialogue Global Conference, Tax and the Environment, 1–3 July 2015, Paris.
([78]) The exchange DKK 7.46 per EUR (as of January 2016) was used throughout the report.
([79]) The Budget 2016 reduced the tax rate from 180 % to 150 % for the part exceeding DKK 79 000 (EUR 10 600).
([80]) Lamine and Lõhmuste (2014) studied vehicle taxation scheme and concluded: However, in 2012 and among the countries with the highest purchasing power (Germany, Belgium, the Netherlands, Finland, Italy), those with low transport taxation had the largest share of new cars (less than five years old) in their fleet. In contrast, in Finland and to a lesser extent in the Netherlands, where notably the registration tax was higher, the share of new cars was smaller, suggesting a potential negative effect of high purchase taxes on the renewal of car fleets.
([81]) See for more information on the scheme including the different emission bands: https://www.gov.uk/government/publications/vehicle-excise-duty/vehicle-excise-duty.

will be a flat rate of GBP 140 (EUR 184) applying to all vehicles independent of their carbon efficiency, and there will be a premium rate, a supplement of GBP 310 (EUR 408) a year for cars with a list price exceeding GBP 40 000 (EUR 53 000).

This move is understandable as maintaining the current scheme would lead to increased losses in tax revenues, as the tax base will erode because of technological advances in engine performance. The UK Office for Budget Responsibility (OBR) projected a sharp fall in vehicle excise duty revenues, predicting that their share in GDP would decrease from 0.4 % currently to about 0.1 % in the mid-2030s if the existing structure were maintained and the rates increased only in line with inflation (OBR, 2014).

5 Overall findings and reflections

5.1 Overall findings on environmental taxation

Progress has been made with the application of environmental taxes when one compares the actual number of environmental taxes discussed in this report (Table 4.2 and Annex 2) with the data published by the EEA in 2006 ([82]). One of the reasons for the increase is the change in the requirements of the 2003 Energy Taxation Directive (ETD) and especially the expiry of transition periods as countries were legally obliged to introduce new taxes on energy products.

In addition, environmental taxation in combination with other market-based instruments (MBIs), such as extended producer responsibilities, were introduced in the waste area in many countries — 25 of the 28 EU Member States now use landfill taxes as part of their waste management policies. Road pricing schemes are another area that have been implemented in many European countries in the past decade. It is not always clear, however, whether national road pricing/congestion charge schemes can be labelled as environmental taxes based on national taxation and national accounting principles.

The EEA's *European environment — state and outlook* report (SOER) concluded that over the past 40 years the *implementation of environment and climate policies has delivered substantial benefits for the functioning of Europe's ecosystems and for the health and living standards of its citizens* (EEA, 2015b). Market-based instruments have contributed to this, but it is also clear that the number of environmental taxes implemented does not say anything about their effectiveness in terms of reducing environmental pollution and changing the behaviour of economic actors ([83]).

Economic literature discusses the advantages of environmental taxes at length, referring to practical results and findings of empirical and theoretical modelling frameworks. In recent years, policymakers have shown an ever-increasing interest in environmental taxation and this is undoubtedly associated with its revenue-generating potential as well as to the overall fiscal outlook and the concept of environmental tax reform.

The underlying idea of introducing environmental tax reform is to change the national tax system where the burden of taxes shifts from economic functions, sometimes called 'goods', such as labour and capital to activities that lead to environmental pressures and over-use of natural resources, sometimes called 'bads' (EEA, 2006).

This tax-shifting policy approach has become even more relevant as an essential policy driver at the EU level since the launch of the Europe 2020 Strategy and European Semester process (Hogg et al., 2016, EC, 2015b and Garnier et al., 2014). The concept has been discussed for more than two decades in the EU with the underlying idea promoted in the White Paper 'Growth, Competitiveness and Employment' (COM(93)700) of December 1993.

These reform agenda has led to some changes in the overall focus of environmental taxation, away from purely a policy tool for environmental protection towards a policy instrument for simultaneously addressing environmental, socio-economic and fiscal considerations. Taxation has thereby become an enabling factor for triggering the green economy transition process at the heart of several EU policies (EEA, 2014 and Ekins and Speck, 2011). This in turn implies that the development of environmental tax revenue must play a bigger role than hitherto considered when studying the current status and impacts of environmental taxes.

The primary objective of environmental taxes, however, is not to raise public revenues but to tackle environmental challenges. This aspect is of great significance as environmental taxes will never generate

([82]) See also the OECD database on instruments used for environmental policy: http://www2.oecd.org/ecoinst/queries.
([83]) For a discussion of the current energy tax regime and the challenges in achieving energy and climate policy targets, such as GHG emission reduction, increase of renewable energy and energy efficiency, see Schlegel (2014).

large amounts of revenue but can change behaviour towards a resource-efficient circular economy, as, for example, impressively revealed by the experience of the Irish plastic-bag tax ([84]).

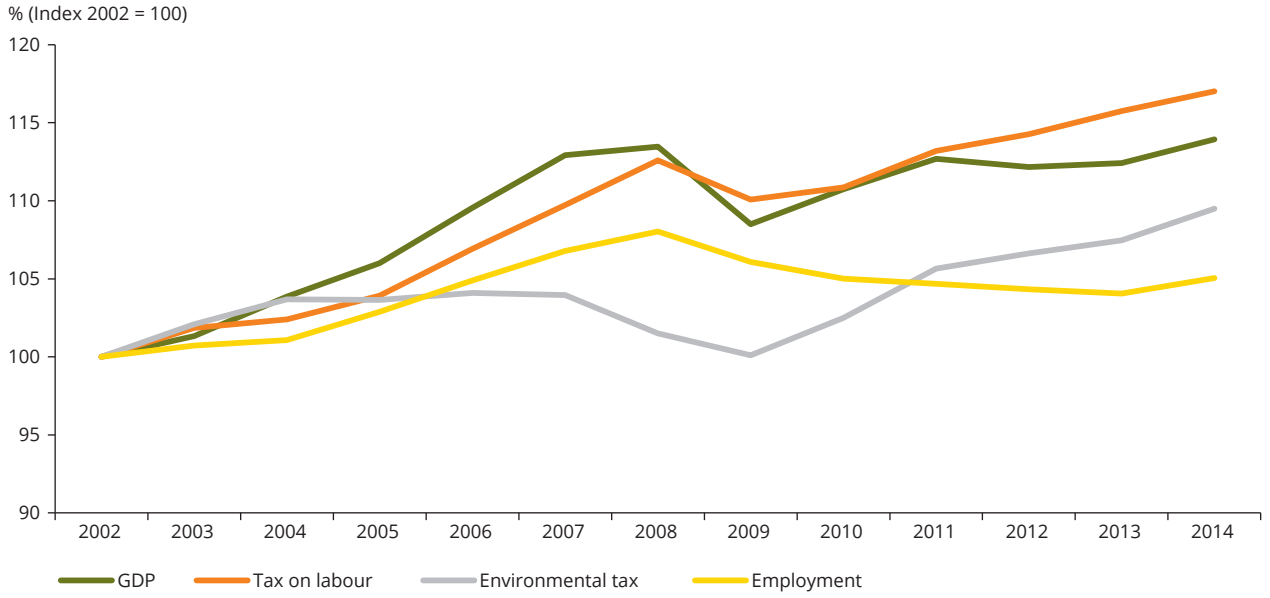
Although the actual number of environmental taxes implemented in EU Member States has increased, the revenues generated as a proportion of GDP has decreased. Trends for the tax revenues generated from labour in the 2002–2014 period reveal an even larger increase than for GDP and environmental tax revenue at EU-28 level (Figure 5.1). This picture does not correspond to the idea of implementing tax-shifting programmes.

It is worth emphasising that the growth of environmental tax revenues in the EU28 has exceeded the development of GDP and labour tax revenues since the economic and financial crisis of 2008/2009. This development is in strict contrast to the development between 2002 and 2009 when environmental tax revenues were more or less flat — there was slight growth in 2003 and 2004 and a fall of 4 % between 2007 and 2009.

The developments in EU Member States were rather diverse, with increases in environmental tax revenues exceeding GDP growth and labour taxation revenues in a number of countries including Bulgaria, Estonia, Greece, Latvia, Poland and Slovenia, between 2002 and 2014. A sharp increase in environmental tax revenues in the post-crisis years is reported for France, Greece, Finland and Italy, while the trend of a continuous rise in environmental tax revenues in Estonia, Poland and Slovenia was not broken by the economic and financial crisis of 2008/2009.

Focusing on tax revenues alone can be misleading as revenue figures do not directly show the environmental effectiveness and efficiency of taxes. A good example of the effectiveness of environmental taxes is the Dutch vehicle registration tax scheme discussed in the previous chapter that contributed to a change in the vehicle stock as many smaller (low carbon emitting) vehicles were purchased. This trend, however, also led to a reduction in tax revenues, thereby limiting the potential of tax-shifting programmes.

Figure 5.1 Trends in GDP, labour and environmental tax revenues and employment, EU-28, 2002–2014 (2002 = 100)



Note: Monetary data (GDP, labour and environmental tax revenues are in constant prices using the GDP deflator); 'Employment' is employed persons aged 15–64 years. 'Tax on labour' comprises all taxes paid by employers and employees that are linked to wages, such as payroll taxes and personal income taxes as well as social security contributions.

Source: EEA based on Eurostat and EC, DG TAXUD.

([84]) Convery et al. (2007) summarised as follows: The effect of the tax on the use of plastic bags in retail outlets has been dramatic — a reduction in use in the order of 90 %, and an associated gain in the form of reduced littering and negative landscape effects.

The call for a more widespread application of environmental taxes is omnipresent as experience shows that they can contribute to environmental improvement and reduced energy and resource consumption by improved economic performance including the stimulation of innovation (OECD, 2010). The number of environmental taxes has indeed increased over the past decade and the redesign of existing ones may have helped improve their effectiveness. However, the important element of generating revenues, which is of high relevance in the current political debate about promoting the idea of tax shifting programmes, has stagnated, although a slight increase is reported for the most recent years. There are many reasons for this stagnation, the main ones being competitiveness and social equity concerns ([85]). The rather sluggish increases in energy and carbon tax rates in recent years are a case in point given the compelling resource and climate change logic for their increased use.

5.2 Reflections on future challenges

Environmental tax reform has been implemented in several European countries and around the world in the past three decades (Andersen and Ekins, 2009 and Sustainable Prosperity, 2012). The concept of altering national tax systems in a revenue-neutral way is now of growing importance in the context of global efforts to shift economies to become more resource-efficient, green and socially inclusive.

In the past, governments introduced environmental taxes as a way of achieving particular environmental objectives, simultaneously using the additional revenues generated for reducing other taxes. Attitudes towards such environmental tax reform and environmental taxes in general have changed, however, as policymakers have become increasingly aware of the systemic links between environmental problems and the need to formulate coherent, integrated policy responses (EEA, 2014 and 2015b). This recognition is currently reflected at all levels of EU policy. Environmental tax/fiscal reforms are recommended as a means of fostering resource efficiency and economic transition in EU fiscal and budgetary, as well as environmental, policies. This is the case, in particular, in the European Semester process of the Europe 2020 strategy, and explicitly in the country-specific recommendations of its Annual Growth Survey, as well as in the EU 7th Environmental Action Programme (EAP).

One of the challenges for environment and climate policies is their medium- to long-term perspective compared with the relatively short-term challenges and requirements of economic, fiscal and social policies (EEA, 2014). Following the financial crisis, societies understandably regard job creation and social inequities as urgent issues, demanding swift action. Policymakers therefore face a significant challenge in reconciling slightly abstract, long-term policy goals with immediate political realities. This is particularly visible in the academic and political discussion of carbon pricing as a prerequisite for the transition to a low carbon and green economy. Changes in the current pricing structure are critical for the implementation of resource efficient and low carbon technologies because the widespread diffusion of new technologies are often not economically viable under current economic conditions of falling energy prices.

At the same time, this can lead to a challenge of how to combine the priorities and objectives of environment/climate policies with fiscal, economic and social policies in the short-to-medium-to-long-term. The objectives of the first are to reduce environmental pressures while for the second the overall target is to guarantee fiscal sustainability. Assessing this dichotomy is of particular interest, for example, when considering the potential implications for the fiscal system of cutting greenhouse gas emissions in the EU by 80 % by 2050 compared to 1990 levels alongside demographic changes projected for the EU over the same period.

5.2.1 Possible implications of meeting EU climate policy targets

There has been a gradual extension over time of EU policy objectives and targets relating to the reduction of greenhouse gas emissions and the transition to a low-carbon economy. For 2020, there is a 20 % reduction target for EU greenhouse gas emissions from 1990 levels, while for 2030 and 2040, 40 % and 60 % reductions are foreseen compared to 1990. The ultimate overall ambition is to cut the EU's emissions by 80 % below 1990 levels by 2050 through domestic reductions alone ([86]).

([85]) There is a range of literature assessing the potential fear of loss of competitiveness as a consequence of introducing environmental taxation unilaterally; for example: Andersen and Ekins, 2009, and Rosenstock 2014. The topic of regressive effects of environmental taxes is also covered in the literature: see Ekins and Speck, 2012, Kosonen, 2012 and EEA, 2011b.

([86]) See http://ec.europa.eu/clima/policies/strategies/2050/index_en.htm.

Transport-related greenhouse gas reduction targets were set in the Transport White Paper (EC, 2011): transport emissions to be reduced by 20 % from 2008 levels by 2030 and by at least 60 % from 1990 level by 2050 (EEA, 2014b). Furthermore, an indicative target of a 70 % reduction of transport oil consumption by 2050 on the basis of the 2008 level was used in the impact assessment accompanying the Transport White Paper (EEA, 2014b). An annual reduction of 2.8 % in transport oil consumption would be required to meet this target ([87]). This is of relevance when assessing the role of environmental taxation in the transition process towards a low carbon economy as well as the potential of tax-shifting programmes.

As already discussed, energy/carbon taxes levied on transport fuels generate the largest amount of environmental tax revenue and are therefore a critical factor when assessing any tax-shifting programmes. Sustaining the tax revenues of transport fuels at the current level (expressed as a constant share of tax revenues to GDP ([88])) would require an annual average increase of more than 4 % in constant prices as both the required reduction in fuel consumption and offsetting the projected increase in GDP are needed ([89]). An annual increase of this size would require a fundamental rethink by politicians since the absolute increase in the tax rates levied on petrol and diesel in 2005–2014 in the majority of EU Member States was much lower (Table 4.3 ([90])).

This indicative calculation of increases in transport fuel taxes illustrates the increases in the tax rates required to keep the tax revenue level of transport fuels constant, assuming no changes in transport policies and vehicle mix. It is clear that transport modes and vehicle stocks will change over time, and these changes will undoubtedly influence the future development of the tax take. The transition from oil-driven to electric vehicles can be assumed to have fiscal implications as the current system levies much higher tax rates on transport fuels than on electricity ([91]). Estimates based on the German energy tax scheme show that the tax take for petrol- and diesel-driven vehicles is on average 8 and 5 times higher respectively than the tax revenues generated from electric-driven vehicles (Teufel et al., 2015) ([92]).

Vehicle-related taxes, such as sales or registration taxes and annual vehicle taxes, also generate significant amounts of revenues in some EU Member States, such as Denmark and the Netherlands. In recent years, the general trend has been to design these taxes so that the tax base is carbon dioxide emissions. Furthermore, countries are also providing financial incentives for the purchase of electric vehicles that can have budgetary consequences, as reported for Norway. The Norwegian government incentive scheme is a success as the country is the biggest user of electric vehicles in the world — 20 % of all new vehicles sold were electric in 2015 ([93]). However, this success was accompanied by a reported loss in the budget of between NOK 3–4 billion (EUR 310–420 million ([94])). It is highly likely that the transformation of the car fleet will require a revision of vehicle taxation design in the medium to long term, as already announced in the United Kingdom.

The topic of tax-base erosion for transport fuels therefore requires special attention, bearing in mind technological improvements in terms of vehicles using less fuel per kilometre, the setting and achievement of energy consumption and greenhouse gas reduction targets, as well as changes in transport modes and vehicle stocks ([95]). These features are all relevant and significant when assessing the potential of tax shifting policies in the medium to long term.

A similar development of a shrinking tax base for other energy products can be expected as part of the overall transition to a low-carbon economy. For example, Denmark's national policy goal is to become a fossil fuel free economy by 2050, with energy consumption,

([87]) The final energy consumption of petroleum products in the transport sector increased by an annual average rate 0.7 % between 1990 and 2014 (calculation based on Eurostat data 'Simplified energy balances 3 annual data [nrg_100a] (accessed on 16 February 2016)).
([88]) The underlying assumption of long-term projections regarding tax revenue trends is to keep a constant tax-to-GDP ratio. This approach is applied in examples of sustainability analysis (OBR, 2014).
([89]) For example, GDP is projected to increase by 78 % in constant prices between 2010 and 2050, an annual increase of about 1.5 % — see the data in EC, 2013.
([90]) The countries with an annual average increase in tax rates (in constant prices) for the period 2005–2014 were Greece (petrol tax rate increased by 8.3 % per year) and Cyprus (diesel tax rate increased by 5.2 % per year).
([91]) See http://www.oecd.org/tax/taxing-energy-use-2015-9789264232334-en.htm — tax rates are expressed in EUR per gigajoule.
([92]) It is projected that about 80 % of private passenger transport activity is to be carried out with electric (plug-in or pure electric) vehicles by 2050 (EC, 2015d) which has implications for energy tax revenues — assuming that there will be no major change in the overall structure of energy taxation with high tax rates levied on transport fuels (petrol and diesel) and lower electricity tax rates.
([93]) See the article 'Norway Is a Model for Encouraging Electric Car Sales' in *The New York Times* (15 October 2015 at http://www.nytimes.com/2015/10/17/business/international/norway-is-global-model-for-encouraging-sales-of-electric-cars.html?_r=0).
([94]) See http://www.reuters.com/article/2015/04/20/us-norway-autos-idUSKBN0NB1T520150420. The exchange rate NOK 9.62 per EUR (as of February 2016) was used throughout the report.
([95]) For further discussion, see EEA, 2015c.

including in the transport sector, based on renewables (Danish Government, 2013) and discussions are underway to ban the use of coal from 2025 and not as initially planned from 2030. Similar discussions about ending the consumption of fossil fuels are underway in other EU Member States, including Sweden and the United Kingdom.

A relevant study when considering the potential of energy tax base erosion was undertaken in the United Kingdom, analysing the macro-economic effects of decarbonising the UK economy through a series of carbon budgets (CE, 2014). The period covered in the study is the first four carbon budgets, up to 2027 for which a target of a 50 % reduction in greenhouse gas emissions relative to 1990 levels is set. A striking result of the macro-econometric modelling exercise is the scenario result related to the fiscal and budgetary implications — a *net increase in annual government revenue of GBP 5.7billion by 2030 due to a stronger economy* (CE, 2014) is projected. However, the environmental tax take will be lower although revenues from auctioning of EU emission trading system (ETS) allowances and from the carbon prices support mechanism will increase. These increases in revenues, however, are not enough to offset the reduction of transport fuel tax revenues as petrol and diesel sales fall. The overall increase in government revenue will come from an increase in revenues from income tax and value added tax.

One of the most interesting findings of this study is that an increase of environmental tax revenues cannot be expected in the future if greenhouse gas reduction targets are met and a substitution process from petrol-and diesel-powered cars to electric vehicles occurs as one of the components of the transition to a low-carbon economy. The projections of the UK Office for Budget Responsibility (OBR) also provide interesting insights into this discussion as they show a decreasing trend in revenues from petrol and diesel taxation although tax rates will be increased in line with inflation (OBR, 2014).

The projected results depend critically on the assumptions about the fuel efficiency of cars as the central scenario assumes *that new car fuel efficiency will improve over the projection period in line with recent trends. In this scenario, average new car fuel efficiency reaches 78 grams per kilometre in 2029–30* compared to a more fuel-efficient scenario *which is consistent with the recommendation of the Committee on Climate Change (CCC) that new car efficiency needs to reach 50 g/km by 2030 and trend towards zero emissions by 2035* (OBR, 2014). Historic data show that fuel duty revenues amounted to about 1.8 % of GDP in 2009/2010 and they are projected to fall to about 1.1 % in 2033/2034 and to less than 1 % of GDP under the more fuel-efficient scenario, achieving the fuel efficiency target recommended by the Committee on Climate Change.

These projections underline the fact that the combination of environmental taxes and regulatory policies do work in parallel as environmental policy tools. However, the revenue potential of energy taxes and carbon pricing policies should not necessarily be at the forefront in assessments as environmental taxes have many other positive features including that they can stimulate the development and diffusion of eco-innovations (OECD, 2010). Another central feature of environmental taxation is the potential for offsetting a rebound effect (Barker et al., 2009; Kosonen and Nicodème, 2009; Sorrel, 2007) ([96]).

5.2.2 The potential for environmental tax reform, given expected demographic trends

Environmental tax reform, as a policy tool for shifting taxes away from labour towards environmental factors that are less detrimental to growth, aims at a more efficient tax system as this policy shifts the burden from distorting taxes, such as on labour, to less distorting taxes, such as on pollution and energy consumption (EC, 2015b). However, the amounts generated by these taxes differ substantially: the share of revenues from labour taxes (including security contributions) of total tax revenues in the EU-28 in 2014 was 51 % (weighted average) compared with 6 % from environmental taxes ([97]). There are some differences in the overall fiscal budget (taxes and social security contributions) between EU Member States, with, for example, Sweden and Germany relying more heavily on labour taxation (59 % and 57 % in 2014, respectively) compared to Malta (34 %), Bulgaria (35 %) and the United Kingdom (38 %).

This aspect is of significance when studying the projected demographic changes of EU Member States. The projection is that the EU-28 population will increase from 507 million in 2013 to 526 million in 2050, an increase of nearly 4 % (EC, 2015e). As expected, the

([96]) When resource efficiencies provide some the gains in income that is then spent on more consumption, for example, driving further in more fuel efficient cars, so that the total consumption of energy and resources actually increase following improvements in eco-efficiency. This is the rebound effect.

([97]) See http://ec.europa.eu/taxation_customs/taxation/gen_info/economic_analysis/data_on_taxation/index_en.htm (accessed on 9 June 2016).

trends differ between Member States: for example, an 8 % decline in the Germany population is projected, in sharp contrast to a 21 % increase in the United Kingdom. What EU Member States have in common is that the share of the population that is elderly (65 and over) will increase from 18 % of total in 2013 to 28 % in 2050, an increase of 59 % in absolute numbers ([98]). However, the development of the labour force, defined as people aged between 15 and 64, does not show a homogenous and consistent pattern between EU Member States. The projected changes differ widely from a reduction of 34 % in Bulgaria and 7 % in the EU-28 overall, to increases of 24 % in Sweden and even 80 % in Luxembourg between 2013 and 2050. All these figures illustrate the challenges that the EU is facing as the old-age dependency ratio (people aged 65 or more relative to those aged 15–64) is projected to increase from 28 % to 50 % in the EU by 2050 ([99]).

These projected trends will have implications for fiscal systems. The budgetary requirements are projected to increase by about 2 percentage points (pp) of GDP ([100]) because of an increase in public age-related expenditure (pensions, health care, long-term care and education). The demographic changes will not only affect public spending, since revenues may also be affected because of an overall reduction in the labour supply and revenues from labour taxes. The trajectory of the projections shows a more or less stable level of labour supply in the EU between 2013 and 2023 (age group 20–64) followed by a decline of about 6 % between 2023 and 2050. The projected figures on the employment level show a decline of about 3 % during 2013–2050 under the given assumptions ([101]).

A squeeze on the public budget is likely, considering the projected increase in expenditures and a simultaneous potential erosion of the tax base because of the fall in employment. Labour taxation, including social security contributions, is key to the overall tax take. A reduction in employment could be offset by either an increase in the tax base (wages) or an increase in tax rates (personal income tax rate and/or the rates of social security contributions) ([102]), if the overall take of labour taxes, expressed as a share of total tax revenue of GDP, is to be kept constant ([103]). The trend of a shrinking revenue base may have consequences for the budgets of countries that rely heavily on labour taxation ([104]). This development will not happen in the immediate future as it is projected that employment and the working-age population will only decline after 2023 onwards (EC, 2015e).

5.2.3 Tax base erosion over the long term

The coming 5–10 years may provide room for tax-shifting programmes by increasing the tax take from environmental taxes and reducing labour taxation, but the question arises whether this policy approach will be at the disposal of policymakers in the longer term.

([98]) These figures are projections of future developments and are therefore highly uncertain, as with any modelling exercises. Nevertheless, they provide some background information for assessing potential future trends and are therefore useful when studying transition processes. These results depend critically on underlying assumptions and methodologies as well as the current policies in place that may change over time, influencing the overall outcome of these projections. In summary, projections are illustrative and not precise calculations but support policymakers in developing longer-term strategic policy approach.

([99]) This projection implies that Germany would move from a ratio of about three working-age people for every elderly person in 2013 to fewer than two in 2050.

([100]) All monetary data in EC, 2015e are in constant prices (base year 2013); this increase shows the result of the baseline scenario and for the period 2013–2060. The projected trends differ widely between EU Member States as the estimates show a fall in total age-related expenditures in eight countries, in ten countries an increase of up to 2.5 percentage points of GDP is expected and for the remaining ten a rise of between 2.5 and 6.8 percentage points of GDP is projected (EC, 2015e). The uncertainty is clearly reflected in the findings that the latest projections of age-related public spending show more favourable expected development relative to the past, the burden on public finances is still expected to be significant (EC, 2016).

([101]) The underlying assumptions of the EC ageing report (EC, 2015e) do not always comply with the political realities as several EU Member States, including Belgium, Germany, France, Ireland, the Netherlands and the United Kingdom, have already implemented changes to the retirement age. This implies that the employment cohort of people aged below 64 as currently used in the report does not reflect actual political development and is too small. But at the same time average life expectancy is also projected to increase and this may imply changes in the number of elderly persons.

([102]) The social security contributions (SSCs) paid by employers and employees in Germany are projected to increase from 18.7 % of gross income (2015) to 21.4 % in 2028, making labour more expensive for the employer and reducing the net income of employees (BMAS, 2014). This increase in the SSC rates is not necessarily consistent with the concept of the policy of shifting the tax burden from labour to resource use and pollution.

([103]) In recent years the growth in real wages in developed countries, including EU Member States, was rather low — see ILO, 2015.

([104]) A thought-provoking report presenting impacts of an aging population on tax receipts was done for the US (Felix and Watkins, 2013). The report assesses the implications for tax revenues by studying income tax revenues across age cohorts, revealing that the income tax revenue from people aged 65 and over declines steeply compared to the income tax revenue of people in active employment. The report also discusses that spending patterns change throughout lifetimes, which also affects the public budget as the elderly population have lower expenditures, thereby affecting sales tax revenues. These findings are also relevant for Europe as personal income tax rates levied on pensions is typically less than the income tax rate on earned income (OECD, 2013b). Changes in spending patterns of age cohorts would affect value added tax revenues (VAT) in EU Member States that are very significant in terms of revenues generated. In 2014, the EU-28 average of VAT revenues was 18 % of total tax revenues, ranging from about 34 % in Croatia and 32 % in Bulgaria to 15 % in France and 14 % in Italy.

There are at least two aspects to assess in answering this question:

(1) the reduction in the tax base for energy and carbon taxation schemes as currently implemented considering energy and climate policy reduction targets are met and technological progress, such as improvements in energy efficiency, as well as changes in transport modes and vehicle stock;

(2) the potential decline of the tax base of labour taxation because of demographic changes and the projected increase in age-related expenditure by the public purse.

Both these aspects need to be addressed when studying the potential for tax-shifting programmes between labour and environmental/energy taxes in the medium to long term as well as when considering a resilient fiscal system for the future ([105]).

The demographic part of this fiscal challenge has been discussed for several years. For example, it was noted in a report published by the EC in 2007 that *The demographic transition and ageing population in the EU raises many challenges and issues in terms of the structure of taxation … The coming challenge of ageing is likely to increase the need for these categories of social spending and to decrease the labour tax base. … What seems a likely development for the future is that the financing of the welfare state may have to rely less on labour taxes* (Carone et al., 2007).

The issue of energy tax base erosion as a complement of the transition to a low-carbon economy has gained some momentum. For example, the Organisation for Economic Co-operation and Development (OECD) recently stated that, in the near term, fluctuations in energy-related tax revenues are the result of changes in economic cycles (OECD, 2015). But, for the longer term, the report concludes that *with much lower CO_2 emissions anticipated in the second half of the century, and therefore lower fossil fuel use, the question* (of stable budgetary resources) *will gain importance* (OECD, 2015). This view is shared by Vollebergh who, assessing the Dutch energy taxation system, summarises that *another, more important trend is that fossil fuel use is expected to decline as a result of environmental and energy policies aimed at mitigating climate change and air pollution. … In the long run, these policies will inevitably undermine the present energy tax bases for natural gas, electricity and motor fuels. … leading to tax base erosion, in the long term* (Vollebergh, 2014) ([106]).

It is the consideration of both issues together — energy/carbon tax base and labour tax erosion — that brings new questions and more systemic policy challenges to the fore. Also relevant are the rather long time-frames required for revising or adapting fiscal systems as for example observed in the many attempts at revising the energy taxation scheme by introducing an energy/carbon tax which started in 1992 when the European Commission put forward the first proposal (Klok, 2005).

Taken together, although 2050 appears far in the future in policy terms, it might be wise for European policymakers to start thinking from today about the implications of these combinations of issues for the design of resilient fiscal systems for the long term.

([105]) For example, Auerbach (2010) describes the demands on a fiscal system as: *A tax base should reflect an economy's capacity to fund public expenditures, meaning that as the economy grows, the tax base should grow with it. Otherwise, it will be necessary to raise tax rates and, in doing so, worsen economic distortions*. This claim is somehow contrary to the rationale for implementing environmental taxation, in particular, when considering the fact that the majority of environmental taxes are *ad quantum* taxes. The situation is different for personal income taxes as it is expected that earnings will increase faster than the overall price level because of productivity growth. This implies that income earners are taxed at higher tax rates as their income moves into higher tax bands. This situation is known as fiscal drag.

([106]) An interesting study for the US was done by Palmer et al. (2012) showing that increases in a tax rate lead to falling tax revenues as the tax base starts to erode with diminishing reliance on fossil fuels and greater use of renewables and nuclear.

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Annex 1 EU environmental targets and objectives

A1.1 Environmental targets and objectives: an update

Environmental targets and objectives are often correlated with market-based instruments (MBIs), as MBIs are one of the instruments that policymakers can use to support the achievement of the targets and objectives. Sometimes only indirect links can be identified, while in other cases the relationship between the targets/objectives and the MBIs is directly made evident by the EU legislator (e.g. the EU emission trading scheme is expressly aimed at cutting greenhouse gas emissions).

This section provides an update of the EU environmental targets and objectives set out in EEA Report No 8/2013 (EEA, 2013). The update has the same aims, structure, and limitations as that report ([107]), and can be summarised as follows:

- The update only covers nine environmental and resource policy areas: energy; greenhouse gas emissions and ozone-depleting substances; air pollution and air quality; transport (greenhouse gas emissions and air pollutants) and noise; waste; water; sustainable consumption and production; chemicals; biodiversity and land use.
- Time-frame: the analysis focuses on the environmental targets and objectives related to 2013–2050.
- Targets are binding goals established by EU legislation (regulations, directives, and decisions), European Council Presidency conclusions, and international legislation to that Member States and the EU are committed to implement.
- All other goals are classified as non-binding objectives. This broad category includes goals set out in Commission communications and environmental action programmes. They can also be shaped by European Council Presidency conclusions or incorporated into EU legislation, including indicative targets, target values or targets subject to subsequent confirmation. Non-binding objectives are, therefore, quite heterogeneous and can vary greatly in their stringency and political strength (Figure A1.1).
- Exclusions:
  - Only new targets and objectives not included in the EEA Report No 8/2013 (EEA, 2013), are addressed in this annex (the cut-off date of the previous study was autumn 2012).
  - Most of the reported objectives and targets are aimed directly at reducing pollution and resource use, and improving environmental quality. Objectives concerned with other indirect measures, such as collecting information and data, registration or classification procedures, monitoring, or establishing programmes and plans (which all play an important role in EU environmental policy and legislation) are outside the scope of the study.
  - Only targets and objectives provided with a specific deadline for implementation are taken into account. Where targets or objectives are set by legislation, the update only includes those that are set for a future date, i.e. after the date of entry into force or of transposition (where necessary).
  - Apart from the EU greenhouse gas emission reduction target under the Kyoto Protocol and its successor agreements, the analysis does not present the objectives and targets of multilateral environmental agreements to which the EU or its Member States are party, or those established by related protocols and decisions of the executive organs of those agreements, except where they have been integrated into EU policy.

([107]) See EEA, 2013, pp.8–10.

- The review is based on a broad analysis of the EU legislation in force (excluding legislative proposals) and the main political and strategic documents of the past decade. The most important sources include the European Commission's Summaries of EU legislation (EC, 2015a), the websites of the Commission's directorates-general (for environment, mobility and transport, energy, climate action, etc.) and EEA reports.

- The EU's environmental objectives and targets are continually being supplemented and adjusted. The cut-off date for the present study was spring 2015.

Based on EEA Report No 8/2013 (EEA, 2013), a total of 63 legally binding targets and 69 non-binding objectives were identified across the nine environmental policy areas for the 2010–2050 period. Many of the binding targets were set for 2015 and 2020 in the areas of energy, air pollution, transport emissions, and waste. The great majority of non-binding objectives were set for 2020, with sustainable consumption and production and resource efficiency playing a larger role, together with biodiversity and land use.

Compared to the 2013 EEA Report, 35 new targets and 31 new non-binding objectives have been introduced by the EU legislation and strategic-political documents, in the nine environmental policy areas considered, for the 2013–2050 period. Some objectives and targets have been removed, giving a net total of 82 binding targets and 84 non-binding objectives established in response to these challenges for the period 2013–2050 (see Figure A1.2).

Most of the new targets concern policy on greenhouse gas emissions and ozone-depleting substances. In particular, the 2014 Regulation on fluorinated greenhouse gases (EU, 2014) introduces a substantial set of targets, as a contribution by the fluorinated gas sector to the EU's objective of cutting its overall greenhouse gas emissions by 80 % of 1990 levels by 2050. Relevant binding targets have also been established in the biodiversity and land use policy area by the new Regulation on the Common Fisheries Policy (EU, 2013b) and in the chemicals sector by the amendments to REACH Regulation (EU, 2006b) and the legislation on active substances contained in biocidal product types (EU, 2012a).

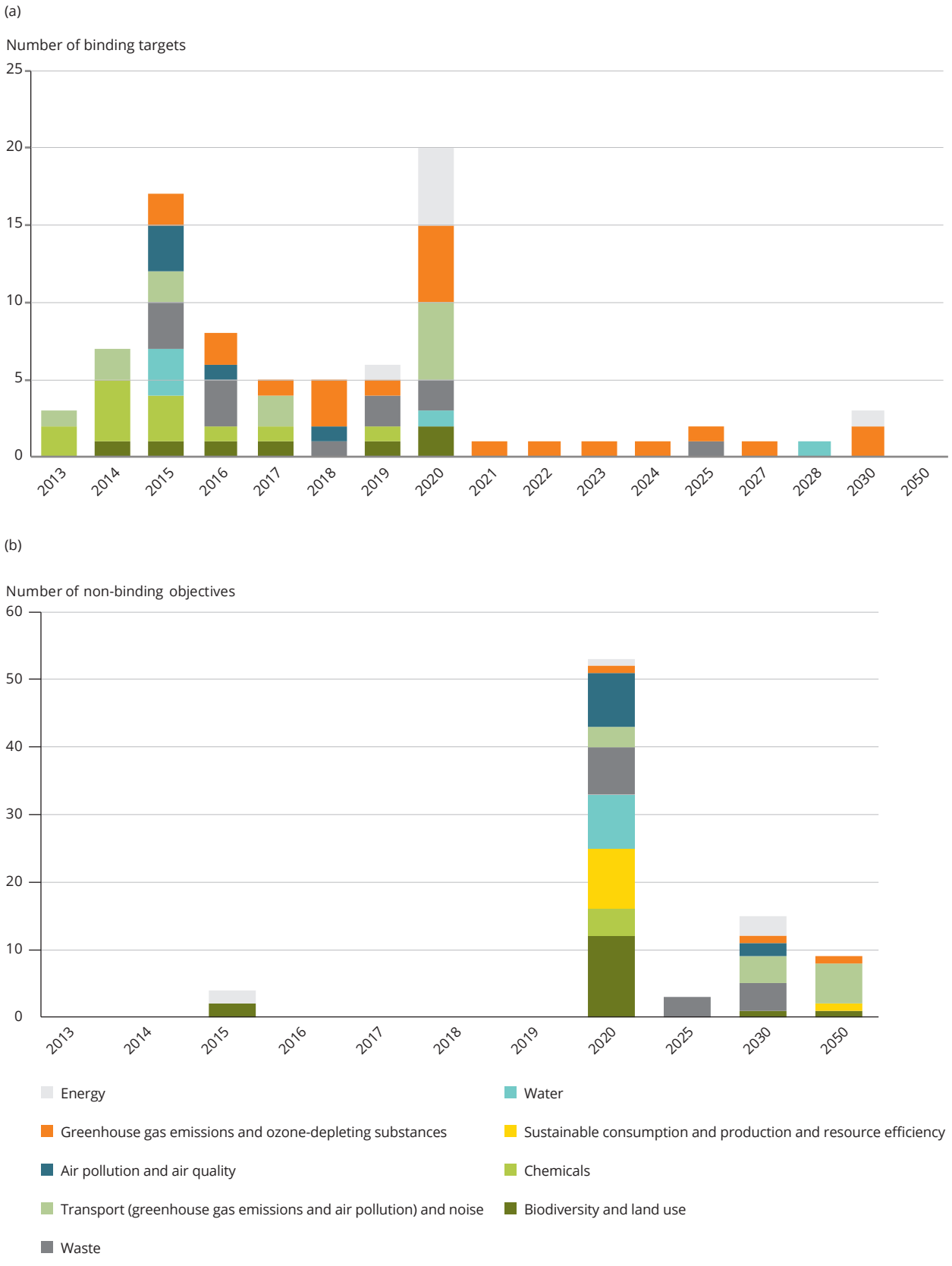
Most of the non-binding objectives have been shaped by the 7th Environment Action Programme (7th EAP; EU, 2013a), to be reached by 2020. Other relevant strategic objectives are embodied in the Presidency conclusions of the European Council of October 2014 for the energy sector, in the Clean air programme for Europe (EC, 2013) for the air pollution and quality, and in the 2015 Circular Economy Package (EC, 2015b-f) for the waste sector.

With specific reference to each environmental and resource policy area, the following can be observed.

Figure A1.1 Objectives and targets addressed in this report

Source: Based on EEA, 2013.

Figure A1.2 Binding targets (a) and non-binding objectives (b) in EU environmental policy, by sector and year, 2013–2050



Source: EEA-ETC/WMGE based on the analysis of EU environmental legislation in force.

Energy: with regard to energy efficiency, four non-binding objectives have recently been introduced. In particular, according to the 7th EAP (EU, 2013a), innovative approaches for sustainable buildings and energy efficiency are expected to be adopted by 2020. Moreover, the European Commission has proposed an energy saving objective of 25 % by 2030 (EC, 2014a), which was later raised to 30 % (EC, 2014d). Based on the Commission proposals, the European Council, in October 2014, set an indicative target (not to be translated into nationally binding targets) at the EU level of at least a 27 % improvement in energy efficiency in 2030 compared to projections of future energy consumption. This will be reviewed by 2020, with the aim of increasing it at an EU level to 30 % (European Council, 2014).

During the October 2014 meeting, the European Council also adopted a binding commitment to increase the share of renewable energy consumed in the EU-28 to 27 % by 2030. The target is binding at the EU level, but not on the Member States individually.

Table A1.1 Timeline for the new objectives and targets for energy (2013–2050)

Objectives	Sources	Deadline for implementation
		2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2027 2030
Innovative approaches for sustainable buildings and energy efficiency.	Decision 1836/2013/EU	⇒2020
Increase energy savings of 25 %.	Policy framework for climate and energy 2020–2030	⇒2030
Increase energy savings of 30 %.	Energy efficiency communication	⇒2030
27 % increase in efficiency compared to projections of future energy consumption.	Council Conclusion, October 2014	⇒2030
Increase renewable energy to 27 % of EU energy consumption (EU-28).	Council Conclusion, October 2014	⇒2030

Note: Non-binding objectives (including national indicative targets, target values and targets to be confirmed, set by EU legislation) are in blue; binding targets are in red.

Greenhouse gas emissions and ozone-depleting substances: during the European Council of October 2014, EU leaders endorsed, as a binding target, the reduction of greenhouse gas emissions by 40 % compared to 1990 levels by 2030 (with reductions in the EU emission trading scheme (ETS) and non-ETS sectors amounting to 43 % and 30 % compared to 2005, respectively; European Council, 2014). Another relevant set of binding targets has been established by the 2014 Regulation on fluorinated greenhouse gases (EU, 2014)**,** as a contribution by the fluorinated gas sector to the EU's objective of cutting its overall greenhouse emissions by 80 % of 1990 levels by 2050, confirmed by the 7th EAP (EU, 2013a). Pursuant to the Regulation, the placing on the market of fluorinated greenhouse gases and gases listed in Annex II shall be prohibited by 2015, while Annex III, differentiating according to the type or global warming potential of the gas, lists specific products and equipment containing fluorinated greenhouse gases that cannot be placed on the market and the related date of prohibition which ranges from 2015 to 2025. From 2017, refrigeration, air conditioning and heat pump equipment charged with hydrofluorocarbons (HFCs) shall not be placed on the market unless accounted for within the quota system established by the Regulation. Another binding target concerns the use of fluorinated greenhouse gases to service or maintain refrigeration equipment. Finally, in order to reduce the quantity of HFCs placed on the market, producers and importers shall not exceed the maximum quantity for the year in question, calculated in accordance with Annex V and the corresponding quota. The percentage to calculate the maximum quantity of HFCs to be placed on the market and corresponding quotas shall be 93 % for 2016–2017, 63 % for 2018–2020, 45 % for 2021–2023, 31 % for 2024–2026, 24 % for 2027–2029 and 21 % for 2030 onward.

A non-binding objective to make decisive progress in adapting to the impact of climate change by 2020 has been shaped by the 7th EAP (EU, 2013a).

Table A1.2 Timeline for the new objectives and targets for greenhouse gas emissions and ozone-depleting substances, 2013–2050

Objectives	Deadline for implementation
	2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2027 2030
The placing on the market of fluorinated greenhouse gases shall be prohibited.	⇒2015
The placing on the market of domestic refrigerators and freezers that contain HFCs with global warming potential (GWP) of ≥ 150 shall be prohibited.	⇒2015
The placing on the market of fire protection equipment containing HFC-23 shall be prohibited.	⇒2016
The percentage to calculate the maximum quantity of HFCs to be placed on the market and corresponding quotas shall be 93 %.	⇒2016
Refrigeration, air conditioning and heat pump equipment charged with HFCs shall not be placed on the market unless accounted for within the quota system.	⇒2017

Table A1.2 Timeline for the new objectives and targets for greenhouse gas emissions and ozone-depleting substances, 2013–2050 (cont.)

Objectives	Deadline for implementation
	2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2027 2030
The placing on the market of technical aerosols that contain HFCs with GWP ≥ 150 shall be prohibited.	⇒2018
The use of sulphur hexafluoride in magnesium die-casting and in the recycling of magnesium die-casting alloys in installations using a quantity of sulphur hexafluoride below 850 kilograms per year is prohibited.	⇒2018
The percentage to calculate the maximum quantity of HFCs to be placed on the market and corresponding quotas shall be 63 %.	⇒2018
Decisive progress in adapting to the impact of climate change.	⇒2020
Ban on the placing on the market of specific equipments containing HFCs ([108]).	⇒2020
The use of fluorinated greenhouse gases, with a GWP ≥ 2 500 to service or maintain refrigeration equipment with a charge size ≥ 40 tonnes of CO_2 equivalent shall be prohibited.	⇒2020
The percentage to calculate the maximum quantity of HFCs to be placed on the market and corresponding quotas shall be 45 %.	⇒2021

([108]) The placing on the market of the following shall be prohibited:
- refrigerators and freezers for commercial use containing HFCs with GWP ≥ 2 500;
- stationary refrigeration equipment containing HFCs with GWP ≥ 2 500;
- movable room air-conditioning equipment containing HFCs with GWP ≥ 150;
- foams containing HFCs with GWP≥ 150 — extruded polystyrene.

Table A1.2 Timeline for the new objectives and targets for greenhouse gas emissions and ozone-depleting substances, 2013–2050 (cont.)

Objectives	Deadline for implementation
	2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2027 2030
The placing on the market of a) refrigerators/freezers for commercial use containing HFCs with GWP ≥ 150 and b) multipack centralised refrigeration systems for commercial use with a rated capacity ≥ 40 kW containing fluorinated greenhouse gases with GWP ≥ 150 shall be prohibited.	⇒2022
The placing on the market of foams containing HFCs with GWP ≥ 150 shall be prohibited.	⇒2023
The percentage to calculate the maximum quantity of HFCs to be placed on the market and corresponding quotas shall be 31 %.	⇒2024
The placing on the market of single split air-conditioning systems containing less than 3 kilograms of fluorinated greenhouse gases that contain fluorinated greenhouse gases with GWP ≥ 750 shall be prohibited.	⇒2025
The percentage to calculate the maximum quantity of HFCs to be placed on the market and corresponding quotas shall be 24 %.	⇒2027
Reduce GHG emissions by 40 % compared to 1990 levels (with the reductions in the ETS and non-ETS sectors amounting to 43 % and 30 % by 2030 compared to 2005, respectively).	⇒2030
The percentage to calculate the maximum quantity of HFCs to be placed on the market and corresponding quotas shall be 21 %.	⇒2030

Note: Non-binding objectives (including national indicative targets, target values and targets to be confirmed, set by EU legislation) are in blue; binding targets are in red.

Air pollution and air quality: four new environmental objectives have been adopted in this policy area. The 7th EAP (EU, 2013a) should ensure that, by 2020, air pollution (and its impact on ecosystems and biodiversity) is reduced and outdoor and indoor air quality is improved, making reference to World Health Organization (WHO) recommended levels and guidelines. The Clean air programme for Europe (EC, 2013) sets two new air policy objectives for 2030 relative to 2005: reduce health impacts (premature mortality due to particulate matter and ozone) by 52 % and reduce ecosystem area exceeding eutrophication limits by 35 %.

Table A1.3 Timeline for the new objectives and targets for air pollution and air quality, 2013–2050

Objectives	Sources	Deadline for implementation
Reduce air pollution and its impact on ecosystems and biodiversity.	Decision 1386/2013/EU	⇒2020
Improve outdoor and indoor air quality (making reference to WHO recommended levels/guidelines).	Decision 1386/2013/EU	⇒2020
Reduce health impacts (premature mortality due to particulate matter and ozone) of 52 % relative to 2005.	A Clean Air Programme for Europe	⇒2030
Reduce ecosystem area exceeding eutrophication limits by 35 % relative to 2005.	A Clean Air Programme for Europe	⇒2030

2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2027 2030

Note: Non-binding objectives (including national indicative targets, target values and targets to be confirmed, set by EU legislation) are in blue; binding targets are in red.

Transport and noise: the 7th EAP (EU, 2013a) sets two strategic objectives to be reached by 2020: achieve a significant decrease in noise pollution, and adopt innovative approaches for urban transport and mobility.

The 2012 amendment to Directive 1999/32/EC on the sulphur content of certain liquid fuels (EU, 2012b), requires Member States to take all necessary measures to ensure that marine fuels are not used in the areas of their territorial seas, exclusive economic zones and pollution control zones, if the sulphur content of those fuels by mass exceeds: (a) 3.5 % as from 18 June 2014; (b) 0.5 % as from 1 January 2020.

Table A1.4 Timeline for the new objectives and targets for transport and noise, 2013–2050

Objectives	Sources	Deadline for implementation
Reduce maximum sulphur content of marine fuels to (at least) 3.5 %.	Directive 1999/32/EC amended by Directive 2012/33/EU	⇒2014
Innovative approaches for urban public transport and mobility.	Decision 1386/2013/EU	⇒2020
Noise pollution has significantly decreased.	Decision 1386/2013/EU	⇒2020
Reduce maximum sulphur content of marine fuels to 0.5 %.	Directive 1999/32/EC amended by Directive 2012/33/EU	⇒2020

2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2027 2030

Note: Non-binding objectives (including national indicative targets, target values and targets to be confirmed, set by EU legislation) are in blue; binding targets are in red.

Waste: new non-binding objectives have recently been shaped for waste policy. According to the 7th EAP (EU, 2013a), by 2020, landfilling is to be limited to non-recyclable materials. The European Commission Communication Zero waste programme for Europe (EC, 2014c) introduced a wide set of waste objectives ([109]) that were incorporated into a proposal for a new directive (EC, 2014b). The proposal, withdrawn in December 2014, was replaced, in December 2015, by the Circular Economy Package, consisting of the EU Action Plan for a Circular Economy (EC, 2015f) and four legislative proposals (EC, 2015b-e) which establish new waste targets updating the ones provided in the Zero waste programme for Europe (EC, 2014c) ([110]). Since they are, currently, only proposed targets, they are considered by the present paper as environmental objectives. In particular, Member States should, by 2030:

- increase the rate of packaging waste prepared for reuse and recycled to 75 % (65 % by 2025 as an interim target);
- achieve the following minimum targets by weight for preparing for reuse and recycling for the following materials contained in packaging waste: (i) 75 % of wood; (ii) 85 % of ferrous metal; (iii) 85 % of aluminium; (iv) 85 % of glass; (v) 85 % of paper and cardboard (interim targets by 2025: (i) 55 % of plastic; (ii) 60 % of wood; (iii) 75 % of ferrous metal; (iv) 75 % of aluminium; (v) 75 % of glass; (vi) 75 % of paper and cardboard);
- increase the reuse and recycling of municipal waste to a minimum of 65 % (60 % by 2025 as interim target).
- ensure that the amount of municipal waste landfilled is reduced to 10 % of the total amount of municipal waste generated.

The 2015 amendment to Directive 94/62/EC on packaging and packaging waste introduced binding targets aimed at reducing the consumption of lightweight plastic carrier bags (EU, 2015). In particular, Member States are required to meet either or both of the following targets: a) ensure that the annual consumption level does not exceed 90 lightweight plastic carrier bags per person by 31 December 2019 and 40 lightweight plastic carrier bags per person by 31 December 2025 (or equivalent targets set in weight); b) ensure that, by 31 December 2018, lightweight plastic carrier bags are not provided free of charge at the point of sale of goods or products, unless equally effective instruments are implemented.

([109]) According to the EC Communication Zero waste programme for Europe (EC, 2014c), the EU waste policy, in strategic terms, was aimed at: 1) by 2020, reducing marine litter by 30 %, which applies to the ten most common types of litter found on beaches, as well as for fishing gear found at sea; 2) by 2025, banning the landfilling of plastic bags, as well as of recyclable plastics, metals, glass, paper/cardboard, and biodegradable wastes. Food waste in specified sectors is to be reduced by at least 30 % within the same deadline; 3) by 2030, increasing the recycling rate of packaging waste to 80 % (to 60 % by 2020 and 70 % by 2025 as interim targets) and increasing the reuse and recycling of municipal waste to a minimum of 70 %.

([110]) Note that the targets provided for by the 2015 Circular Economy Package (EC, 2015b-f) do not meet the selection criteria on which the present overview of the EU environmental targets/objectives is based (in particular, according to Annex 1.1, only legislation in force is covered and the cut-off date for the study is spring 2015). However, they have been included, as an exception, since the objectives set by the European Commission Communication Zero waste programme for Europe (EC, 2014c), following the withdrawal of the related legislative proposal (EC, 2014b), are out of date.

Table A1.5 Timeline for the new objectives and targets for waste, 2013–2050

Objectives	Sources	Deadline for implementation
Landfilling is limited to non-recyclable and non-recoverable waste.	Decision 1386/2013/EU	⇒2020
Increase the rate of packaging waste prepared for reuse and recycled to 65 % (interim target).	2015 Circular Economy Package	⇒2025
Increase reuse and recycling of municipal waste to a minimum of 65 % (interim target).	2015 Circular Economy Package	⇒2025
Minimum targets by weight for preparing for reuse and recycling: • 55 % of plastic; • 60 % of wood; • 75 % of ferrous metal; • 75 % of aluminium; • 75 % glass; • 75 % paper and cardboard.	2015 Circular Economy Package	⇒2025
Reduction in the consumption of lightweight plastic carrier bags (2018–2025) (*).	Directive 94/62/EC as amended by Directive 2015/720/EU	⇒2025
Increase the rate of packaging waste prepared for reuse and recycled to 75 % (final target).	2015 Circular Economy Package	⇒2030
Increase reuse and recycling of municipal waste to a minimum of 65 %.	2015 Circular Economy Package	⇒2030
Reduce the amount of municipal waste landfilled to 10 % of the total amount of municipal waste generated.	2015 Circular Economy Package	⇒2030
Minimum targets by weight for preparing for reuse and recycling: • 75 % of wood; • 85 % of ferrous metal; • 85 % of aluminium; • 85 % glass; • 85 % paper and cardboard.	2015 Circular Economy Package	⇒2030

Note: Non-binding objectives (including national indicative targets, target values and targets to be confirmed, set by EU legislation) are in blue; binding targets are in red.

(*) The measures taken by Member States shall include either or both of the following:
a: the adoption of measures ensuring that the annual consumption level does not exceed 90 lightweight plastic carrier bags per person by 31 December 2019 and 40 lightweight plastic carrier bags per person by 31 December 2025, or equivalent targets set in weight. Very lightweight plastic carrier bags may be excluded from national consumption objectives;
b: the adoption of instruments ensuring that, by 31 December 2018, lightweight plastic carrier bags are not provided free of charge at the point of sale of goods or products, unless equally effective instruments are implemented. Very lightweight plastic carrier bags may be excluded from these measures.

Water: in the water sector, the 7th EAP (EU, 2013a) specifies new non-binding objectives to be reached by 2020. In particular, the EU should significantly reduce the impact of pressures on transitional, coastal, and freshwaters; reduce the impact of pressures on marine waters; manage the nutrient cycle in a more sustainable and resource efficient way; prevent or significantly reduce water stress; and adopt high standards for safe drinking and bathing waters.

Sustainable consumption and production: according to the 7th EAP (EU, 2013a), the EU should by 2020 significantly reduce the overall environmental impact of all major economic sectors and of consumption and production in the food, housing, and mobility sectors.

Table A1.6 Timeline for the new objectives and targets for water, 2013–2050

Objectives	Sources	Deadline for implementation
		2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2027 2030
Significantly reduce the impact of pressures on transitional, coastal and freshwaters.	Decision 1386/2013/EU	⇒2020
Reduce the impact of pressures on marine waters.	Decision 1386/2013/EU	⇒2020
Manage the nutrient cycle in a more sustainable and resource-efficient way.	Decision 1386/2013/EU	⇒2020
Prevent or significantly reduce water stress.	Decision 1386/2013/EU	⇒2020
High standards for safe drinking and bathing waters.	Decision 1386/2013/EU	⇒2020

Note: Non-binding objectives (including national indicative targets, target values and targets to be confirmed, set by EU legislation) are in blue; binding targets are in red.

Table A.1.7 Timeline for the new objectives and targets for sustainable consumption and production and resource efficiency, 2013–2050

Objectives	Sources	Deadline for implementation
		2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2027 2030
Significantly reduce the overall environmental impact of all major sectors of EU economy.	Decision 1386/2013/EU	⇒2020
Reduced overall environmental impact of production and consumption in the food, housing and mobility sectors.	Decision 1386/2013/EU	⇒2020

Note: Non-binding objectives (including national indicative targets, target values and targets to be confirmed, set by EU legislation) are in blue; binding targets are in red.

Chemicals: with regard to binding targets, based on Regulation No (EU) 1602/2014 (EC, 2014e), the list of active substances contained in selected biocidal product types to be phased out (i.e. for which a decision of non-inclusion into Annex I has been adopted pursuant to Regulation EU 528/2012; EU, 2012a) has been progressively extended. Considering the 2013–2050 period, according to the available information ([112]), compared to EEA (2013), new substances had to be phased out in 2013, 2014, and 2015. Likewise, Annex XIV of the REACH Regulation (EU, 2006) has been amended, so that the number of substances of very high concern it lists, which are subject to authorisation obligations, have gone up from 14, as reported by EEA (2013), to 31, with new 'sunset dates', making reference to the 2013–2050 period, in 2016, 2017, and 2019. Also the list of restrictions on the manufacture, placing on the market and use of certain dangerous chemical substances, mixtures and articles, contained in Annex XVII of the REACH Regulation, has been extended and new restrictions apply to mercury starting from 2014.

In strategic terms, the 7th EAP (EU, 2013a) states that, by 2020, risks associated with the use of hazardous substances, including in chemical products, are to be minimised; plant protection products are to be sustainably used, without any harmful effect on human health; and safety concerns related to nanomaterials are to be effectively addressed.

Table A1.8 Timeline for the new objectives and targets for chemicals, 2013–2050

Objectives	Sources	Deadline for implementation
		2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2027 2030
Phase out of several active substances contained in selected biocidal product types.	Regulation 528/2012/EU	⇒2013
Phase out of several active substances contained in selected biocidal product types.	Regulation 528/2012/EU	⇒2014
REACH restrictions concerning mercury.	Regulation 1907/2006/EC, consolidated version	⇒2014
Phase out of several active substances contained in selected biocidal product types.	Regulation 528/2012/EU	⇒2015
'Sunset date' for the following substances of very high concern (SVHCs): trichloroethylene.	Regulation 1907/2006/EC, consolidated version	⇒2016

([112]) The list of active substances and related dates by which products containing these active substances shall no longer be placed on the market for the relevant product types is available at: http://ec.europa.eu/health/biocides/active_substances/non_inclusion/index_en.htm (consolidated list as of 26.02.2013) and http://echa.europa.eu/web/guest/information-on-chemicals/biocidal-active-substances.

Table A1.8 Timeline for the new objectives and targets for chemicals, 2013–2050 (cont.)

Objectives	Sources	Deadline for implementation
		2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2027 2030
'Sunset date' for the following SVHCs: chromium trioxide, acids generated from chromium trioxide, sodium dichromate/ chromate, potassium dichromate/chromate, methylenedioxy-amphetamine (MDA), arsenic acid, Bis(2-methoxyethyl) ether, 1-Ethyl-3-(3-dimethylaminopropyl) carbodiimide (EDC), 4,4'-Methylenebis(2-chloroaniline) (MOCA).	Regulation 1907/2006/EC, consolidated version	
'Sunset date' for the following SVHCs: dichromium tris (chromate), strontium chromate, potassium hydroxyoctaoxodizin-catedichromate, pentazinc chromate octahydroxide.	Regulation 1907/2006/EC, consolidated version	
Risks associated with the use of hazardous substances, including chemicals in products, are minimised.	Decision 1386/2013/EU	
Sustainable use of plant protection products, without any harmful effect on human health.	Decision 1386/2013/EU	
Safety concerns related to nanomaterials are effectively addressed.	Decision 1386/2013/EU	

Note: Non-binding objectives (including national indicative targets, target values and targets to be confirmed, set by EU legislation) are in blue; binding targets are in red.

Biodiversity and land use: relevant binding targets have been introduced for fishing by the new Regulation on the Common Fisheries Policy (EU, 2013b). In particular, Member States were required to ensure that, from 1 January 2014, the fishing capacity of their fleets did not exceed, at any time specified, fishing capacity ceilings. Moreover, in order to avoid the practice of unwanted catches and discards, which negatively affect the sustainable exploitation of marine biological resources and marine ecosystems, a landing obligation will be gradually introduced between 2015 and 2019 for all commercial fisheries (species under total allowable catches or under minimum sizes) in European waters. Finally, the Regulation requires the maximum sustainable yield (MSY) ([113]) exploitation rate to be achieved by 2015 where possible and, on a progressive, incremental basis at the latest by 2020 for all stocks.

With regard to non-binding objectives, based on the 7th EAP (EU, 2013a), by 2020, land should be managed sustainably and innovative approaches should be adopted for urban biodiversity conservation.

Table A1.9 Timeline for the new objectives and targets for biodiversity and land use, 2013–2050

Objectives	Sources	Deadline for implementation
Fishing capacity ceilings.	Regulation 1380/2013/EU	⇒2014
Landing obligation for specified commercial fisheries.	Regulation 1380/2013/EU	⇒2015
Landing obligation for specified commercial fisheries.	Regulation 1380/2013/EU	⇒2016
Landing obligation for specified commercial fisheries.	Regulation 1380/2013/EU	⇒2017
Landing obligation for specified commercial fisheries.	Regulation 1380/2013/EU	⇒2019
Manage land sustainably.	Decision 1386/2013/EU	⇒2020
Innovative approaches for urban biodiversity conservation.	Decision 1386/2013/EU	⇒2020
Fishing within maximum sustainable yield exploitation rate for all stocks (2015–2020).	Regulation 1380/2013/EU	⇒2020

Note: Non-binding objectives (including national indicative targets, target values and targets to be confirmed, set by EU legislation) are in blue; binding targets are in red.

([113]) According to the Regulation, MSY means the highest theoretical equilibrium yield that can be continuously taken on average from a stock under existing average environmental conditions without significantly affecting the reproduction process.

A1.2 Summary

Since the publication of the 2013 report disclosing the situation as of autumn 2012, 35 new binding policy targets and 31 non-binding objectives were introduced through EU environmental legislation and policy. The higher number of binding targets can be found in the area of greenhouse gas emissions and ozone-depleting substances, while the higher number of objectives concerns the waste area. All the new targets and objectives cover the period up to 2030 which may imply that the time period for current policymaking has a lead time of about 15 years. This is interesting in relation to the 7th EAP as this will guide European environmental policy until 2020 but at the same time spells out a vision *of where it wants the Union to be by 2050* ([114]).

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Annex 2 Overview of environmental taxes in EEA member countries

Table A2.1 closely follows the categorisation as stressed in the Eurostat report '*Environmental taxes — A statistical guide*' (2013).

Data in brackets show the year of the introduction of the tax. The table applies the term 'tax' to mean taxes, charges, levies, duties as national legislative provisions do not always correspond to the widely accepted distinction between these terms. Countries are applying different market-based instruments (MBIs), such as taxes, recycling fees, deposit refund schemes and extended producer responsibility (EPR) schemes, levied on individual products, such as packaging; batteries and/or accumulators; tyres; plastic bags; electric and electronic products; lubricating/waste oils; and end-of-life vehicles. The entries do not distinguish between the different MBIs instead revealing whether countries are making use of MBIs in this environmental field. Detailed country information regarding the implementation of different MBIs can be found in Bio et al., 2014 and the Organisation for Economic Co-operation and Development (OECD) database on instruments used for environmental policy at http://www2.oecd.org/ecoinst/queries.

An attempt was made to deliver a comprehensive overview of the current status of the application of environmental taxes using a whole range of different sources as listed below. But we do not think that the list is exhaustive, as, for example, environmental taxation may be implemented at regional levels as it is the case in Italy and Spain (see also the list of 'minor' taxes, those which are generating revenues less than 0.1 % of GDP — see DG TAXUD *Taxes in Europe* database at http://ec.europa.eu/taxation_customs/taxation/gen_info/info_docs/tax_inventory/index_en.htm.

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries

	Austria	Belgium	Bulgaria	Croatia	Cyprus
Energy (including fuel for transport)					
Energy products for transport purposes					
• Unleaded petrol	x	x	x	x	x
• Leaded petrol	x	x	x	x	x
• Diesel	x	x	x	x	x
• Other energy products for transport purposes (e.g. liquid petroleum gas (LPG), natural gas, kerosene or fuel oil)	x	x	x	x	
Energy products for stationary purposes					
• Light fuel oil	x	x	x	x	x
• Heavy fuel oil	x	x	x	x	x
• Natural gas	x	x	x (2012: household use is exempt)	x (2013: household use is exempt)	x
• Coal/coke	X	x	x (2007: household use is exempt)	x	x
• Electricity consumption	x	x	x (2007: household use is exempt)	x (household use is exempt)	x (2008: tax on energy conservation)
• Electricity production/nuclear fuels/radioactive waste		x (tax on profits from nuclear production)	x (radioactive waste charge)		
Greenhouse gases					
• Carbon content of fuels (carbon tax)				x	
• emissions of greenhouse gases (including proceeds from emission permits recorded as taxes in the national accounts)	x	x	x	x	x
Transport (excluding fuel for transport)					
• Motor vehicles import or sale (one off/registration taxes)	x	X (new and second-hand cars are subject to the tax)	x (only for used cars)	x	x
• Use of motor vehicles, recurrent (e.g. yearly/ circulation taxes)	x	x	x	x	x
• Road use (e.g. motorway taxes, road vignette) — passenger car	x (vignette)		x (vignette)	x (distance based)	
• Road use (e.g. motorway taxes, road vignette) — commercial/ heavy goods vehicles (HGV)	x (distance based)	x (HGV: Eurovignette scheme which was replaced by a distance-based scheme on 1 April 2016)	x (vignette)	x (distance based)	
• Congestion charges and city tolls/ bridges etc.	x	x	x	x	

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Austria	Belgium	Bulgaria	Croatia	Cyprus
• Other means of transport (ships, airplanes, railways, etc.)			x	x	x
• Flights and flight tickets	x				
Pollution					
Measured or estimated emissions to air				x (air pollution charge; SO_2, NO_x, CO_2) — EU ETS installations are exempt from the CO_2 charge	
• Measured or estimated nitrogen oxide (NO_x) emissions				x	
• Measured or estimated sulphur oxide (SO_x) emissions				x	
• Other measured or estimated emissions to air (excluding carbon dioxide (CO_2))					
• Ozone-depleting substances (e.g. ozone depleting chemicals (ODC), chlorofluorocarbons (CFCs) or halons) and HFC					
Measured or estimated effluents to water		x (Flanders and Wallonia)	x	x	
• Measured or estimated effluents of oxydisable matter (biochemical oxygen demand (BOD), chemical oxygen demand (COD))					
• Other measured or estimated effluents to water					
Non-point sources of water pollution					
• Pesticides (based on e.g. chemical content, price or volume)		x			
• Artificial fertilisers (based on e.g. phosphorus or nitrogen content or price)					
• Manure		x (Flanders: abolished 2007)			
Waste management					
• Collection, treatment or disposal					
• Landfill	x	x (Flanders and Wallonia)	x (2011)	x (only for industrial waste)	
• Incinerator	x	x			

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Austria	Belgium	Bulgaria	Croatia	Cyprus
• Individual products					x (producer fee scheme)
• Packaging		x	x	x	
• Batteries/ accumulators				x	
• Tyres			x	x	
• Plastic bag		x	x (2011)	x	
• Products containing PVC/phthalates					
• Electric and electronic products (bulbs, fuses, monitors, etc.)				x	
• Lubricating oils/ waste oils				x	
• End-of-life vehicles				x	
• Noise (e.g. aircraft take-off and landings)			x (2012)		
Resources					
• Water abstraction		x (Flanders and Wallonia)	x	x	
• Harvesting of biological resources (e.g. timber, hunted and fished species)					
• Extraction of raw materials (e.g. minerals, oil and gas)	x (regional)	x (Flanders)	x	x	x

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Czech Republic	Denmark	Estonia	Finland	France
Energy (including fuel for transport)					
Energy products for transport purposes					
• Unleaded petrol	x	x	x	x	x
• Leaded petrol	x	x	x	x	x
• Diesel	x	x	x	x	x
• Other energy products for transport purposes (e.g. liquid petroleum gas (LPG), natural gas, kerosene or fuel oil)	x	x	x	x	x
Energy products for stationary purposes					
• Light fuel oil	x	x	x	x	x
• Heavy fuel oil	x	x	x	x	x
• Natural gas	x (2008)	x	x (2008)	x	x
• Coal/coke	x (2008)	x	x	x	x
• Electricity consumption	x (2008)	x	x (2008)	x	x
• Electricity production/nuclear fuels/radioactive waste	x (2011: tax on solar radiation)			x	x (tax on nuclear installations)
Greenhouse gases					
• Carbon content of fuels (carbon tax)		x (1992: CO_2 tax on electricity abolished in 2014)	x	x (1990)	x (2014)
• Emissions of greenhouse gases (including proceeds from emission permits recorded as taxes in the national accounts)	x	x	x	x	x
Transport (excluding fuel for transport)					
• Motor vehicles import or sale (one off/registration taxes)		x (commercial vehicles, trucks and buses are exempt)		x	x
• Use of motor vehicles, recurrent (e.g. yearly/ circulation taxes)	x (only for commercial vehicles)	x	x (only for commercial cars)	x	x (only for commercial cars)
• Road use (e.g. motorway taxes, road vignette) — passenger car	x (vignette)				x (distance based)
• Road use (e.g. motorway taxes, road vignette) — commercial/ heavy goods vehicles (HGV)	x (distance based)	x (HGV: Eurovignette scheme)		x	x (distance based)
• Congestion charges and city tolls/ bridges etc.		x (bridges)			x
• Other means of transport (ships, airplanes, railways, etc.)		x		x (railway tax)	

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Czech Republic	Denmark	Estonia	Finland	France
• Flights and flight tickets		x (abolished in 2007)		x (air traffic supervision charge — earmarked for administration purposes	x
Pollution					
Measured or estimated emissions to air	x (air pollution tax (NO_x, particulate matter (PM), SO_2, volatile organic compounds (VOC))	x	x (2000: air pollution charges (SO_2, CO_2, carbon monoxide (CO), NO_x, etc))		x (pollution tax — La taxe générale sur les activités polluantes (TGAP — 1999)
• Measured or estimated nitrogen oxide (NO_x) emissions	x	x	x		x
• Measured or estimated sulphur oxide (SO_x) emissions	x	x (sulphur content of fuel — exceeding 0.05 % sulphur — or SO_2 emissions)	x		x
• Other measured or estimated emissions to air (excluding carbon dioxide (CO_2))		x (1996: tax on chlorinated solvents)			
• Ozone-depleting substances (e.g. ozone depleting chemicals (ODC), chlorofluorocarbons (CFCs) or halons) and HFC	X (ODC)	x (CFC, HFC, perfluorinated compounds (PFC) and sulfur hexafluoride (SF_6))			
Measured or estimated effluents to water	x	x	x (2006: pollution charge for the discharge of pollutants into water bodies)		x
• Measured or estimated effluents of oxydisable matter (biochemical oxygen demand (BOD), chemical oxygen demand (COD))	x	x	x		X (set by Water Agencies)
• Other measured or estimated effluents to water	x	x (nitrogen, phosphorous, organic material)	x	x (water protection charge — abolished in 2000)	
Non-point sources of water pollution					
• Pesticides (based on e.g. chemical content, price or volume)		x (1996 'ad-valorem tax'; revised and new tax design 2013)		x (abolished 2007)	
• Artificial fertilisers (based on e.g. phosphorus or nitrogen content or price)		x (1998: nitrogen fertiliser — for small users; 2005; mineral phosphorous		x (abolished 1994)	
• Manure					
Waste management					
• Collection, treatment or disposal					
• Landfill	x	x	x	x (1996)	x (TGAP)
• Incinerator		x (2010: design was changed and is now following the energy tax scheme)			x (TGAP)

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Czech Republic	Denmark	Estonia	Finland	France
• Individual products					
• Packaging		x	x	x (packaging outside of Deposit Refund Scheme (DRS))	
• Batteries/ accumulators		x			
• Tyres		x		x (Extended Producer Responsibility (EPR) financed through recycling fee)	
• Plastic bag		x			x (TGAP)
• Products containing PVC/phthalates		x			
• Electric and electronic products (bulbs, fuses, monitors, etc.)		x		x (EPR financed via recycling fee)	
• Lubricating oils/ waste oils		x		x (2009)	x (TGAP)
• End-of-life vehicles				x (EPR financed via recycling fee)	
• Noise (e.g. aircraft take-off and landings)				x	
Resources					
• Water abstraction	x	x (piped water)	x		x (set by Water Agencies)
• Harvesting of biological resources (e.g. timber, hunted and fished species)			x		
• Extraction of raw materials (e.g. minerals, oil and gas)	x	x	x		x

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Germany	Greece	Hungary	Ireland	Italy
Energy (including fuel for transport)					
Energy products for transport purposes					
• Unleaded petrol	x	x	x	x	x
• Leaded petrol	x	x	x	x	x
• Diesel	x	x	x	x	x
• Other energy products for transport purposes (e.g. liquid petroleum gas (LPG), natural gas, kerosene or fuel oil)	x	x	x	x	x
Energy products for stationary purposes					
• Light fuel oil	x	x	x	x	x
• Heavy fuel oil	x	x	x	x	x
• Natural gas	x	x (2011)	x (household use is exempt)	x (2010)	x
• Coal/coke	x	x	x (household use is exempt)	x	x
• Electricity consumption	x	x (2010: renewable electricity is exempt)	x (household use is exempt)	x (2009)	x (national, regional and municipal taxes)
• Electricity production/nuclear fuels/radioactive waste	x (2011: tax on nuclear fuel rod; limited in time until 2016)	X (2010: special levy for the reduction of GHGs)			
Greenhouse gases					
• Carbon content of fuels (carbon tax)				x (2009)	x (1999: abolished soon afterwards)
• emissions of greenhouse gases (including proceeds from emission permits recorded as taxes in the national accounts)	x	x	x	x	x
Transport (excluding fuel for transport)					
• Motor vehicles import or sale (one off/registration taxes)		x	x	x	x (applicable for new and second-hand cars)
• Use of motor vehicles, recurrent (e.g. yearly/ circulation taxes)	X	x	x	x	x (tax at state and regional level)
• Road use (e.g. motorway taxes, road vignette) — passenger car		x (distance based — only on parts of the motorway)	x (vignette)		x (distance based)
• Road use (e.g. motorway taxes, road vignette) — commercial/ heavy goods vehicles (HGV)	x (distance based)	x (distance based)	x (vignette)	x	x (distance based)
• Congestion charges and city tolls/ bridges etc.		x		x	x (Rome 2001, Bologna 2005 and Milan 2008)
• Other means of transport (ships, airplanes, railways, etc.)		x (luxury tax — aircraft, etc.)			

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Germany	Greece	Hungary	Ireland	Italy
• Flights and flight tickets	x (2011)	x		x (2009, was abolished in April 2014)	
Pollution					
Measured or estimated emissions to air			x (pollution charge scheme)		X (air pollution tax)
• Measured or estimated nitrogen oxide (NO_x) emissions			x		x (1998)
• Measured or estimated sulphur oxide (SO_x) emissions			x		x (1998)
• Other measured or estimated emissions to air (excluding carbon dioxide (CO_2))					
• Ozone-depleting substances (e.g. ozone depleting chemicals (ODC), chlorofluorocarbons (CFCs) or halons) and HFC			x (ODC)		
Measured or estimated effluents to water	x		x		
• Measured or estimated effluents of oxydisable matter (biochemical oxygen demand (BOD), chemical oxygen demand (COD))	x		x		
• Other measured or estimated effluents to water			x		
Non-point sources of water pollution					
• Pesticides (based on e.g. chemical content, price or volume)					x (2000: ad-valorem pesticides tax)
• Artificial fertilisers (based on e.g. phosphorus or nitrogen content or price)					
• Manure					
Waste management					
• Collection, treatment or disposal					
• Landfill		x (2014)	x (2013)	x (2002)	x (tax at regional level)
• Incinerator					
• Individual products					
• Packaging			x		
• Batteries/ accumulators			x		
• Tyres			x		
• Plastic bag				x (2002)	

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Germany	Greece	Hungary	Ireland	Italy
• Products containing PVC/phthalates					
• Electric and electronic products (bulbs, fuses, monitors, etc.)			x		
• Lubricating oils/ waste oils			x		
• End-of-life vehicles					
• Noise (e.g. aircraft take-off and landings)			x		
Resources					
• Water abstraction	x (regional tax, administered by the Länder/states)		x		
• Harvesting of biological resources (e.g. timber, hunted and fished species)					x (water consumption tax)
• Extraction of raw materials (e.g. minerals, oil and gas)	x (regional tax, administered by the Länder/states)		x		x (regions)

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Latvia	Lithuania	Luxembourg	Malta	Netherlands
Energy (including fuel for transport)					
Energy products for transport purposes					
• Unleaded petrol	x	x	x	x	x
• Leaded petrol	x	x	x	x	x
• Diesel	x	x	x	x	x
• Other energy products for transport purposes (e.g. liquid petroleum gas (LPG), natural gas, kerosene or fuel oil)	x	x	x	x	x
Energy products for stationary purposes					
• Light fuel oil	x	x	x	x	x
• Heavy fuel oil	x	x	x	X	x
• Natural gas	x (2010)	x (2011)	x (2007)	x (no consumption)	x
• Coal/coke	x (household use is exempt)	x	x (household use is exempt)	x (no consumption)	x
• Electricity consumption	x (2007: household use is exempt as well as renewable electricity)	x (2010: household use is exempt as well as renewable electricity)	x	x	x
• Electricity production/nuclear fuels/radioactive waste	x (subsidised electricity tax — 2014 and limited to the end of 2017) x (Natural Resources Tax — use of radioactive substances)				
Greenhouse gases					
• Carbon content of fuels (carbon tax)	x (1995: air pollution tax)				
• emissions of greenhouse gases (including proceeds from emission permits recorded as taxes in the national accounts)	x	x	x	x	x
Transport (excluding fuel for transport)					
• Motor vehicles import or sale (one off/registration taxes)	x	x (imports of vehicles into Lithuania)		x	x
• Use of motor vehicles, recurrent (e.g. yearly/ circulation taxes)	x	x (only for commercial vehicles)	x	x	x
• Road use (e.g. motorway taxes, road vignette) — passenger car	x (vignette)				
• Road use (e.g. motorway taxes, road vignette) — commercial/ heavy goods vehicles (HGV)	x	x (vignette)	x (HGV: Eurovignette scheme)		x (HGV: Eurovignette scheme)

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Latvia	Lithuania	Luxembourg	Malta	Netherlands
• Congestion charges and city tolls/ bridges etc.		x		x (Valetta 2007)	x
• Other means of transport (ships, airplanes, railways, etc.)			x	x	
• Flights and flight tickets				x (abolished 2008)	x (abolished 2010)
Pollution					
Measured or estimated emissions to air	x (2004: Natural Resources Tax) — air pollutants (PM_{10}, SO_2, NO_x, etc.) including CO_2 from stationary installations)	x (1991: pollution tax levied on a range of air pollutants including NO_x, SO_2, etc.)			
• Measured or estimated nitrogen oxide (NO_x) emissions	x	x			
• Measured or estimated sulphur oxide (SO_x) emissions	x	x			
• Other measured or estimated emissions to air (excluding carbon dioxide (CO_2))					
• Ozone-depleting substances (e.g. ozone depleting chemicals (ODC), chlorofluorocarbons (CFCs) or halons) and HFC	x (substances depleting the ozone layer)				
Measured or estimated effluents to water	x (Natural Resources Tax)	x (pollution tax levied on a range of pollutants discharged into waters)	x		x (pollution levy for direct discharge into surface waters)
• Measured or estimated effluents of oxydisable matter (biochemical oxygen demand (BOD), chemical oxygen demand (COD))					x
• Other measured or estimated effluents to water					
Non-point sources of water pollution					
• Pesticides (based on e.g. chemical content, price or volume)					
• Artificial fertilisers (based on e.g. phosphorus or nitrogen content or price)					
• Manure					x (1998–2005)
Waste management					
• Collection, treatment or disposal					

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Latvia	Lithuania	Luxembourg	Malta	Netherlands
• Landfill	x	x (planned to be in force in 2016)			x (abolished in 2012 and reinstated in 2014)
• Incinerator					x (2015)
• Individual products					
• Packaging	x (Natural Resources Tax)				
• Batteries/ accumulators	x	x (pollution tax)		x (eco-contribution scheme)	x (abolished in 2013/replaced by packaging waste management charge since 2013))
• Tyres	x	x (pollution tax)		x (eco-contribution scheme)	
• Plastic bag	x	x (pollution tax)		x (eco-contribution scheme)	
• Products containing PVC/phthalates	x			x (eco-contribution scheme)	
• Electric and electronic products (bulbs, fuses, monitors, etc.)					
• Lubricating oils/ waste oils	x			x (eco-contribution scheme)	
• End-of-life vehicles	x	x			
• Noise (e.g. aircraft take-off and landings)	x				
Resources					x
— Water abstraction					
• Harvesting of biological resources (e.g. timber, hunted and fished species)	x (Natural Resources Tax)	x	x		x (tap water tax =1994 groundwater extraction tax was abolished in 2011 groundwater levy charged by provinces)
• Extraction of raw materials (e.g. minerals, oil and gas)	x (Natural Resources Tax)	x (petroleum and natural gas; as well as other natural resources)		x (tax on cement — 2011)	

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Poland	Portugal	Romania	Slovakia	Slovenia
Energy (including fuel for transport)					
Energy products for transport purposes					
• Unleaded petrol	x	x	x	x	x
• Leaded petrol	x	x	x	x	x
• Diesel	x	x	x	x	x
• Other energy products for transport purposes (e.g. liquid petroleum gas (LPG), natural gas, kerosene or fuel oil)	x	x	x	x	X
Energy products for stationary purposes					
• Light fuel oil	x	x	x	x	x
• Heavy fuel oil	x	x	x	x	x
• Natural gas	x (2013)	x (2013)	x (2007: household use is exempt)	x (2006)	x
• Coal/coke	x (2012: household use is exempt)	x	x (household use is exempt)	x (2009: household use is exempt)	Xx
• Electricity consumption	x	x (2012)	x (2007: renewable electricity is exempt)	x (2008: household use is exempt)	x (2007)
• Electricity production/nuclear fuels/radioactive waste	x (2012: tax on radioactive waste; however, Poland does not generate any nuclear power at current)	x (2014: extraordinary contribution on the energy sector)		x (2003: tax on installing nuclear equipment)	
Greenhouse gases					
• Carbon content of fuels (carbon tax)	x (1990: air pollution tax)	x (2015)			x (1996) including fluorinated greenhouse gases
• Emissions of greenhouse gases (including proceeds from emission permits recorded as taxes in the national accounts)	x	x	x	x	x
Transport (excluding fuel for transport)					
• Motor vehicles import or sale (one off/registration taxes)	x	x	x	x	x
• Use of motor vehicles, recurrent (e.g. yearly/ circulation taxes)	x (only for commercial vehicles)	x	x	x (only for commercial vehicles)	x
• Road use (e.g. motorway taxes, road vignette) — passenger car	x (distance based — on parts of the motorway)	x (distance based)	x (vignette)	x (vignette)	x (vignette)
• Road use (e.g. motorway taxes, road vignette) — commercial/ heavy goods vehicles (HGV)	x (distance based)	x (distance based)	x (vignette)	x (distance based)	x (distance based)
• Congestion charges and city tolls/ bridges etc.		x	x		
• Other means of transport (ships, airplanes, railways, etc.)			x		x

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Poland	Portugal	Romania	Slovakia	Slovenia
– Flights and flight tickets		x			
Pollution					
Measured or estimated *emissions to air*	x (1990: a range of different air emissions including SO_2, NO_2, CO_2, etc.)		x (a range of different air emissions including NO_x, SO_x, dust, cadmium))	x (a range of different air emissions including SO_2, NO_2, CO, etc.	
• Measured or estimated nitrogen oxide (NO_x) emissions	x		x	x	
• Measured or estimated sulphur oxide (SO_x) emissions	x		x	x	
• Other measured or estimated emissions to air (excluding carbon dioxide (CO_2))			x (persistent organic pollutants, dust, heavy metals)		x (VOC)
• Ozone-depleting substances (e.g. ozone depleting chemicals (ODC), chlorofluorocarbons (CFCs) or halons) and HFC	x (ODC)				x (fluorinated greenhouse gas)
Measured or estimated effluents to water	x		x (range of different water pollutants are taxed)	x	x
• Measured or estimated effluents of oxydisable matter (biochemical oxygen demand (BOD), chemical oxygen demand (COD))	x		x (BOD, COD, etc.)	x	x
• Other measured or estimated effluents to water	x		x (nitrates, arsenic, etc.)	x	
Non-point sources of water pollution					
• Pesticides (based on e.g. chemical content, price or volume)					
• Artificial fertilisers (based on e.g. phosphorus or nitrogen content or price)					
• Manure					
Waste management					
• Collection, treatment or disposal					
• Landfill	x	x	x (2014)	x	x (2004)
• Incinerator		x			
• Individual products					
• Packaging		x (EPR — 'eco-valor')	x		x
• Batteries/ accumulators	x	x (EPR — 'eco-valor')			
• Tyres		x (EPR — 'eco-valor')	x		x

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Poland	Portugal	Romania	Slovakia	Slovenia
• Plastic bag		x (2015)	x		
• Products containing PVC/phthalates					
• Electric and electronic products (bulbs, fuses, monitors, etc.)		x (2008: EPR — 'eco-valor') x (fee on low efficiency light bulbs)			x
• Lubricating oils/ waste oils		x	x		x
• End-of-life vehicles		x (EPR — 'eco-valor')			x
• Noise (e.g. aircraft take-off and landings)		x			
Resources					
• Water abstraction		x (2009: water resource fee)	x		x
• Harvesting of biological resources (e.g. timber, hunted and fished species)	x				
• Extraction of raw materials (e.g. minerals, oil and gas)	x (gravel, sand and energy products and 2012: cooper and silver)		x (2014)		x (2012)

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Spain	Sweden	United Kingdom
Energy (including fuel for transport)			
Energy products for transport purposes			
• Unleaded petrol	x	x	x
• Leaded petrol	x	x	x
• Diesel	x	x	x
• Other energy products for transport purposes (e.g. liquid petroleum gas (LPG), natural gas, kerosene or fuel oil)	x	x	x
Energy products for stationary purposes			
• Light fuel oil	x	x	x
• Heavy fuel oil	x	x	x
• Natural gas	x (2013)	x	x (household use is exempt)
• Coal/coke	x	x	x (household use is exempt)
• Electricity consumption	x	x	x (household use is exempt — Climate change levy)
• Electricity production/nuclear fuels/radioactive waste	x (2013: nuclear and hydropower) x (2013: tax on the production of radioactive waste; and 2013: tax on the storage of radioactive waste) — regional taxes	x (2000: thermal power capacity tax of nuclear power stations (replacing the nuclear power tax) and fee to nuclear fuel fund))	
Greenhouse gases			
• Carbon content of fuels (carbon tax)		x (1991)	x (climate change levy (CCL) (2001); CRC Energy Efficiency Scheme (2012), carbon price support/ carbon price floor (CSP/CPF) (2013)
• Emissions of greenhouse gases (including proceeds from emission permits recorded as taxes in the national accounts)	x	x	x
Transport (excluding fuel for transport)			
• Motor vehicles import or sale (one off/registration taxes)	x (different tax rates can be set by the autonomous communities)	x (abolished 2000)	
• Use of motor vehicles, recurrent (e.g. yearly/ circulation taxes)	x (different tax rates can be set by the autonomous communities)	x (2006)	x
• Road use (e.g. motorway taxes, road vignette) — passenger car	x (distance based)		
• Road use (e.g. motorway taxes, road vignette) — commercial/ heavy goods vehicles (HGV)	x (distance based)	x (HGV — Eurovignette scheme)	x (HGV road user levy — 2014)

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Spain	Sweden	United Kingdom
• Congestion charges and city tolls/ bridges etc.	x	x (Stockholm 2007, Gothenburg 2013) — plus charges on bridges	x (London, Durham, M6 toll road)
• Other means of transport (ships, airplanes, railways, etc.)	x	x	
• Flights and flight tickets			x
Pollution			
Measured or estimated *emissions to air*	x (implemented at regional/autonomous communities level)		
• Measured or estimated nitrogen oxide (NO_x) emissions	x (implemented at regional/autonomous communities level)	x	
• Measured or estimated sulphur oxide (SO_x) emissions	x (implemented at regional/autonomous communities level)	x	
• Other measured or estimated emissions to air (excluding carbon dioxide (CO_2))			
– Ozone-depleting substances (e.g. ozone depleting chemicals (ODC), chlorofluorocarbons (CFCs) or halons) and HFC	x (2014: fluorinated greenhouse gas)	x (ODC)	
Measured or estimated effluents to water	x (implemented at state level as well as at autonomous communities level)	x (water pollution charge for ships)	
• Measured or estimated effluents of oxydisable matter (biochemical oxygen demand (BOD), chemical oxygen demand (COD))			
• Other measured or estimated effluents to water			
Non-point sources of water pollution			
• Pesticides (based on e.g. chemical content, price or volume)		x (1984)	
• Artificial fertilisers (based on e.g. phosphorus or nitrogen content or price)		x (abolished in 2010)	
• Manure			
Waste management			
• Collection, treatment or disposal			
• Landfill	x (implemented in 9 autonomous communities)	x (2000)	x

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Spain	Sweden	United Kingdom
• Incinerator	x (implemented by autonomous communities,)	x (2006 and abolished in 2010)	
• Individual products			
• Packaging		x (EPR fee)	
• Batteries/ accumulators		x (waste management fee)	
• Tyres		x (EPR fee)	
• Plastic bag	x (implemented at regional/autonomous communities level)		x (England, Wales, Northern Ireland and Scotland)
• Products containing PVC/phthalates			
• Electric and electronic products (bulbs, fuses, monitors, etc.)		x (EPR fee)	
• Lubricating oils/ waste oils			
• End-of-life vehicles			
• Noise (e.g. aircraft take-off and landings)		x	
Resources			
• Water abstraction	x (implemented at autonomous communities level)		x (water abstraction charges managed by nations)
• Harvesting of biological resources (e.g. timber, hunted and fished species)			
• Extraction of raw materials (e.g. minerals, oil and gas)		x	x

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Iceland	Liechtenstein	Norway	Switzerland	Turkey
Energy (including fuel for transport)					
Energy products for transport purposes					
• Unleaded petrol	x	x	x	x	x
• Leaded petrol	x	x	x	x	x
• Diesel	x	x	x	x	x
• Other energy products for transport purposes (e.g. liquid petroleum gas (LPG), natural gas, kerosene or fuel oil)	x	x	x	x	x
Energy products for stationary purposes					
• Light fuel oil	x	x	x	x	x
• Heavy fuel oil	x	x	x	x	x
• Natural gas	x	x	x	x	x
• Coal/coke			x		
• Electricity consumption	x (2009, planned to expire at the end of 2015)	x	x	x	x
• Electricity production/nuclear fuels/radioactive waste	x (2009: tax on geothemal water)				x
Greenhouse gases					
• Carbon content of fuels (carbon tax)	x (2010)	X (2008)	x (1991)	x (2008)	
• Emissions of greenhouse gases (including proceeds from emission permits recorded as taxes in the national accounts)	x	x	x	x	
Transport (excluding fuel for transport)					
• Motor vehicles import or sale (one off/registration taxes)	x		x	x	x (special consumption tax)
• Use of motor vehicles, recurrent (e.g. yearly/ circulation taxes)	x	x	x	x	x
• Road use (e.g. motorway taxes, road vignette) — passenger car		x (vignette)		x (vignette)	
• Road use (e.g. motorway taxes, road vignette) — commercial/ heavy goods vehicles (HGV)		x (distance-based charging scheme)	x	x (distance-based charging scheme)	x
• Congestion charges and city tolls/ bridges etc.	x	x	x (Bergen 1986, Oslo 1990)	x	x
• Other means of transport (ships, airplanes, railways, etc.)			x	x	x (airplanes)

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Iceland	Liechtenstein	Norway	Switzerland	Turkey
• Flights and flight tickets					
Pollution					
Measured or estimated emissions to air		x (VOC)	x	x (VOC — 2000)	
• Measured or estimated nitrogen oxide (NO_x) emissions			x (2007)		
• Measured or estimated sulphur oxide (SO_x) emissions			x		
• Other measured or estimated emissions to air (excluding carbon dioxide (CO_2))					
• Ozone-depleting substances (e.g. ozone depleting chemicals (ODC), chlorofluorocarbons (CFCs) or halons) and HFC			x (trichloroethene (TRI), tetrachloroethene (PER), hydrofluorocarbons (HFC), perfluorocarbons (PFC))		
Measured or estimated effluents to water					
• Measured or estimated effluents of oxydisable matter (biochemical oxygen demand (BOD), chemical oxygen demand (COD))					
• Other measured or estimated effluents to water					
Non-point sources of water pollution					
• Pesticides (based on e.g. chemical content, price or volume)			x		
• Artificial fertilisers (based on e.g. phosphorus or nitrogen content or price)					
• Manure					
• Waste management					
• Collection, treatment or disposal					
• Landfill		x	x	x	x
• Incinerator			x (1999 and abolished in 2010)		x
• Individual products					
• Packaging	x (recycling fee)		x (1994: beverage containers)	x	x
• Batteries/ accumulators	x (recycling fee)			x	x
• Tyres	x (recycling fee)				x
• Plastic bag					

Table A2.1 Overview of environmental taxes in EU-28 Member States and non-EU EEA member countries (cont.)

	Iceland	Liechtenstein	Norway	Switzerland	Turkey
• Products containing PVC/phthalates					
• Electric and electronic products (bulbs, fuses, monitors, etc.)					x
• Lubricating oils/ waste oils	x (recycling fee)		x		x
• End-of-life vehicles	x (recycling fee)	x			x
• Noise (e.g. aircraft take-off and landings)			x		x
Resources					
• Water abstraction					x
• Harvesting of biological resources (e.g. timber, hunted and fished species)					X
• Extraction of raw materials (e.g. minerals, oil and gas)					x

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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

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

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