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# THE IMPACT OF CURRENT CLIMATE AND ENERGY POLICIES ON THE PUBLIC BUDGET OF EU MEMBER STATES

di
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## 1. Introduction

Fighting and adapting to climate change requires a huge amount of resources as well as a change in agents' behaviour. Public policy has a key role in this process – to efficiently and fairly collect resources, finance adaptation measures and R&D investments and coordinate efforts towards new technology[1]. Governments may use a number of different types of instruments to reach environmental goals and they can roughly be classified into regulatory instruments and market-based instruments[2]. They differ in several respects, such as efficacy, efficiency, impact on prices, household welfare and economic activity. Above these economic prerogatives, political acceptability has proven to be an essential point in order to understand why an economic instrument is effectively implemented[3]. Moreover, an often undervalued feature, strictly linked to political acceptability, can be added: the impact of instruments on the public budget balance. Market-based instruments, in the majority of cases, impact on the budget balance, although with different intensity: taxes and charges always generate revenues, while tradable permits can generate immediate revenue only if they are auctioned by public authorities. However, all instruments have at least an indirect impact on budget outlays or revenues: regulation in the form of standards can imply a loss of profits for the industries affected and this can lead to a decrease in corporation tax or an increase in compensatory measures (lump-sum tax credits or abatement in capital tax rates). Moreover, regulation activity per se adds a cost to the general government expenditure.

In this paper, an overview of the evidence on current environmental policy instruments that can be identified in the Budget of EU 27 Member Countries is provided[4]. Unfortunately quantifying environmental revenues and subsidies is not an easy task and the evidence is necessary incomplete. The analysis focuses on energy-related public expenditures and revenues, because they are directly linked to the implementation of the EU climate package, although there are several relevant links between environmental instruments and all the other items in the public budget.

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[1] The central role of public policy in promoting green technology is also stressed by growth models. See, among others, Aghion et al. (2009).

[2] For an overview of environmental instruments see Perman et al (2003).

[3] See the 2006 special issue of Energy Policy on Social and political responses to ecological tax reform in Europe. Moreover, since Buchanan and Tullock (1976), it has been widely accepted that firms prefer regulation to taxes and for this reason politicians tend to choose command and control instruments.

[4] This paper constitutes background work for the project "The Impact of Climate and Energy Policies on the Public Budget of EU Member States" developed by Think Tank. See http://www.eui.eu/Projects/THINK/Home.aspx for further information on the project.

After reviewing environmental revenues (section 2) and subsidies (section 3), the paper discusses the link between the need for public resources and the current public finance situation, where Member state governments are being forced to make significant fiscal efforts to stabilize public debt (section 4).

## 1. Environmental taxation and Emission Trading Scheme

Much support for market-based instruments can be found in European policy (and in the Kyoto Protocol) as opposed to the traditional command and control approach[5]. Environmental taxes and the market for emission permits are the means of setting a price for carbon, with the aim of including all the externalities in energy prices and providing the right signal for agents' behaviour. While the European Carbon Trading Scheme represents a major success of recent European policy, no comparable success has been achieved in the tax area and, despite several efforts to design a European Carbon Tax, a supranational environmental tax is still lacking. In this field all European countries act autonomously under the energy tax directive[6], which sets minimum levels of taxation for some energy products in order to avoid harmful fiscal competition. The following paragraphs focus on environmental and energy taxes[7], the data for which are generally readily available and comparable across countries.

From 1998 to 2004, the share of environmental taxes out of total taxation showed minor changes; afterwards the ratio has steadily declined. As shown in graph 1, in 1999 the EU-27 ratio was 7% and it gradually decreased to 6.1% in 2008. However, behind this EU-27 trend some countries experienced quite extreme movements[8].

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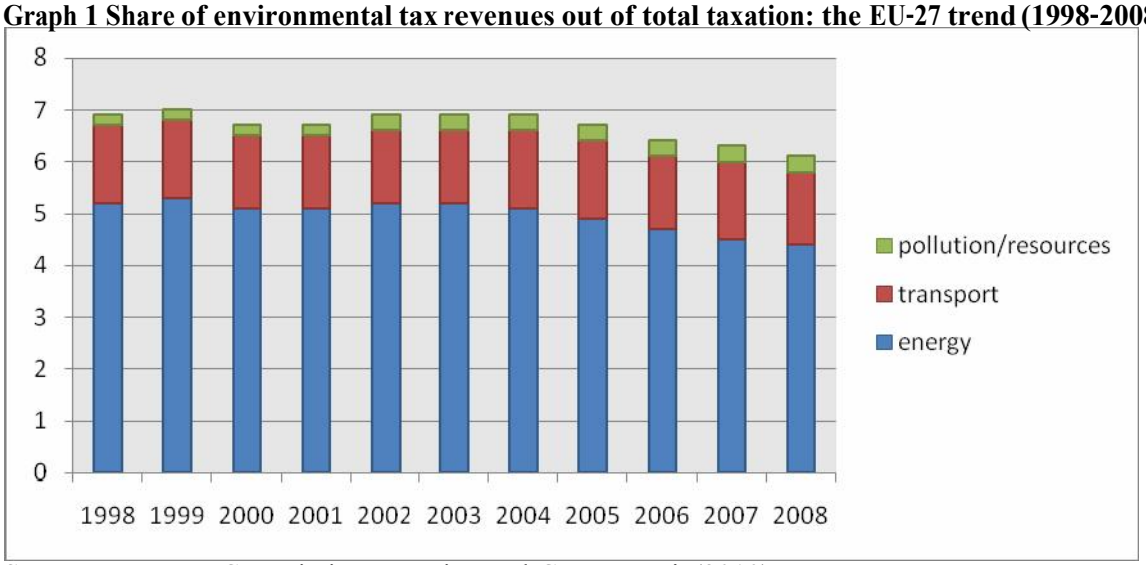
5 According to OECD (1997), economic instruments can be defined as "those policy instruments which may influence environmental outcomes by changing the costs and benefits of alternative actions open to economic agents ... economic instruments create incentives that encourage people acting more or less in their own best interests, simultaneously, to treat the environment in a way that is in the best interests of society". See also Green Paper on Market Based Instruments, European Commission (2007).

6 Directive 2003/96/EC.

7 Eurostat uses the following definition of an environmental tax: *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* (Jarass L. and G.M. Obermair 1996). Environmental taxes are usually classified in four main groups (Energy, Transport, Resource and Pollution) according to Eurostat guidelines (Eurostat 2001).

8 For instance, in Ireland the total environmental tax ratio out of total taxation decreased from 9,4% in 1998 to 7,9% in 2001, but it remained almost static from 2002 to 2005 (with ratios that ranged between 8,1% and 8,3%). Estonia, on the contrary, was characterized by a steadily rising trend from 1995 onwards, reflecting the need to adjust excise duties up to the EU minimum rates, and specific policy implemented in order to finance cuts in personal income taxes.

**Graph 1 Share of environmental tax revenues out of total taxation: the EU-27 trend (1998-2008)**

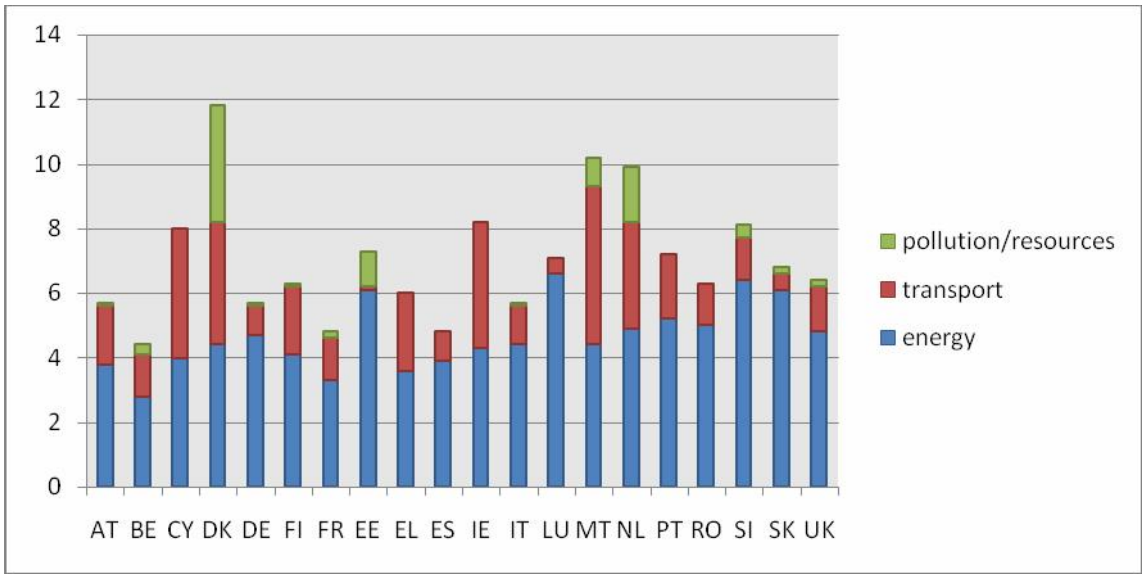



Source: European Commission, Taxation and Custom Unit (2010)

The importance of environmental taxes varies significantly across Member States. The situation in 2008 is depicted in graph 2. It shows relatively high ratios in the Netherlands, where the share of revenue from environmental taxation out of total taxation was 9.9%, and in Malta, where environmental taxes generated 10.2% of total revenue – especially due to the high level of transport tax. The highest ratio was recorded in Denmark, which reached 11.9%, 5.8 percentage points above the EU-27 average (6.1%).

Finland, Romania, the UK, the Slovak Republic, Luxembourg, Portugal, Estonia, Cyprus, Slovenia and Ireland formed another group of countries with a relatively high contribution of environmental taxes to total revenue from taxes and social contributions, all with ratios above 6.2%. Conversely, the Member States that stand below the EU-27 average are Greece, Germany, Italy, Austria, France, Spain and Belgium. In Germany and Italy the contribution of environmental taxes to total taxation revenues is 5.7%, while in France and Spain it remains significantly below the EU-27 average, at 4.9%. Belgium is the EU-27 country with the lowest ratio (4.4%). In terms of the relationship between environmental taxes and GDP, the findings are similar.

**Graph 2 Environmental tax revenue by aggregate tax category as percentage of total taxation (2008)**



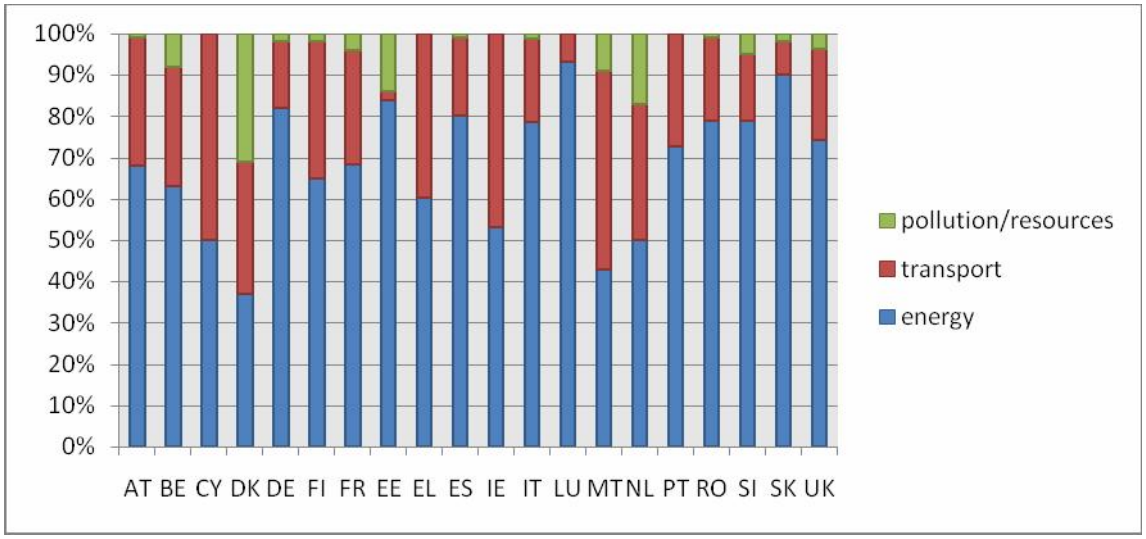

Source: European Commission, Taxation and Custom Unit (2010)

In almost all Member States, a strong concentration of environmental taxes in the field of energy can be observed: in 2008, energy taxes accounted for 4.4% of total tax revenues in EU-27 and for almost 72% of the total revenue from environmental taxes.

## *2.1 Energy taxes*

As shown in graph 3, Denmark and Malta are the only EU countries where energy taxes generated less than 50% of total revenues from environmental taxes. Conversely, Luxembourg and the Slovak Republic have the highest share of total revenues from environmental taxes (93% and 90% respectively).

**Graph 3 Environmental taxes by categories in 2008**

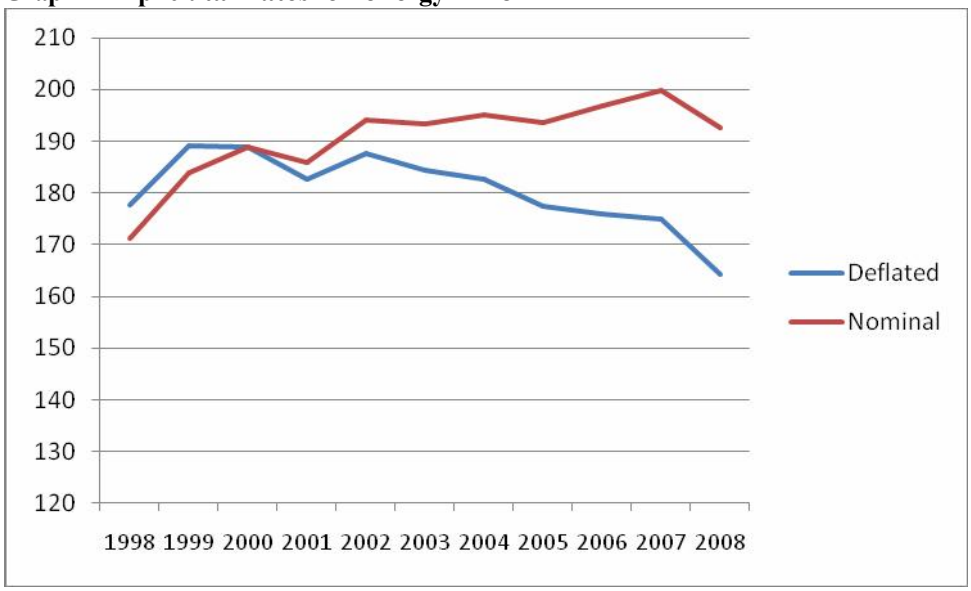



Source: Taxation and Custom Unit (2010)

Cyprus is the only EU country where revenues collected through transport taxes were close to those collected via energy taxes, representing 50% of the environmental taxation. Significant contributions from transport taxes (more than 30%) are observed in Austria, Denmark, Finland (due to heavy vehicle taxation), Greece, Ireland, Malta and the Netherlands. The role of pollution taxes is marginal in most Member States.

The aforementioned declining share of environmental taxes out of total revenue is mainly linked to a decrease in energy taxation. Graph 4 shows that the implicit tax rate on energy (calculated as energy taxes over energy consumption) steadily increased, but fell in 2008.

**Graph 4 Implicit tax rates[9] on energy in EU 27**

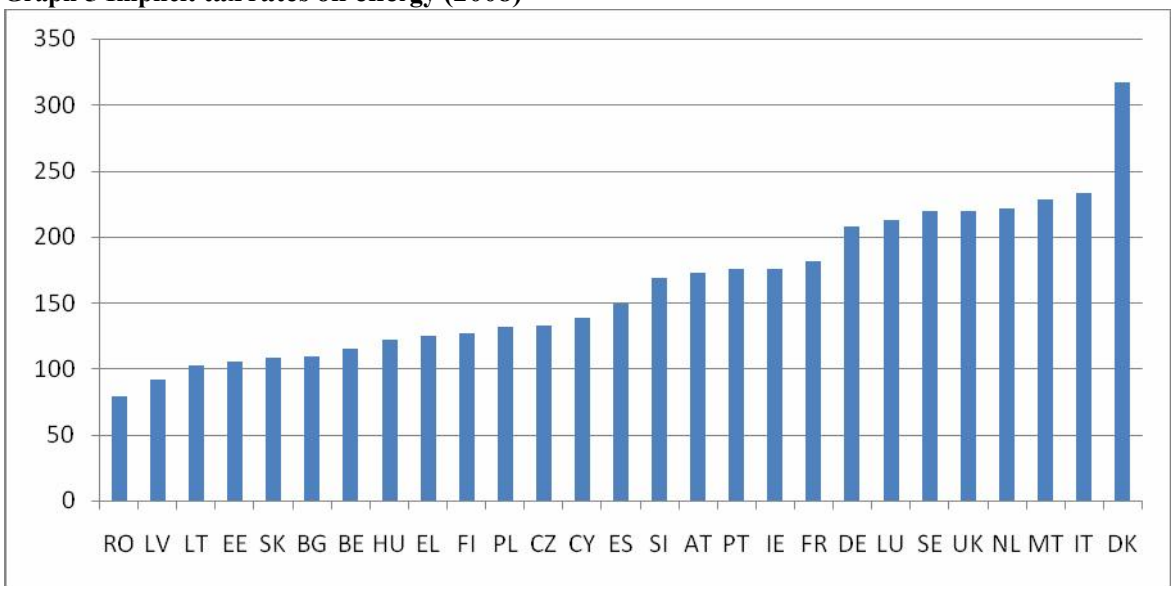



Source: European Commission, Taxation and Custom Unit (2010)

However, the picture changes with deflated revenues, where the implicit tax rate on energy shows a declining trend after 2000, as revenues increased less than inflation[10]. This is due to the fact that energy taxes are excise taxes and a constant nominal tax rate corresponds to a decreasing effective tax rate[11].

Graph 5 illustrates the ample range of total energy implicit tax rates of member states for 2008: the implicit tax rate in Romania represents a quarter of that prevailing in Denmark. This variation is connected to different nominal tax rates, different energy mixes and to different tax exemption regimes.

**Graph 5 Implicit tax rates on energy (2008)**




Source: European Commission (2010)

9 Euros per ton of oil equivalent (TOE)

10 Implicit tax rates are computed as energy taxes in Euros per ton of oil equivalent (TOE), base year 2000. The increase in the nominal implicit tax rate is partly reinforced by stationary energy consumption.

11 However, it is important to stress that energy taxation in these graphs does not include VAT on energy products. VAT tax on energy increases if energy prices increase.

This high dispersion of implicit tax rates hampers the economic effectiveness of carbon pricing. Only a sufficiently high, homogeneous and stable policy signal would be an incentive for private R&D in new green technologies, energy saving and emission-reducing investments[12].

A common characteristic of Member States' energy tax policies is that energy-related revenues are highly concentrated on fossil products. Table 1 shows that taxes on fossil fuels are on average 90% of total energy taxation. Exceptions are Denmark Germany and Sweden, where taxes on electricity or nuclear power have a noticeable importance.

**Table 1**
**Energy taxes and fossil fuel share (2008)**

| | | Energy Taxes | | | | |
|---|---|---|---|---|---|---|
| | Energy Taxes/ Environm. Taxes | Total Mineral Oils | Natural Gas | Coal and Coke | Electricity | Total |
| BE | 63.0% | 96.9% | 1.3% | 0.8% | 1.1% | 100.0% |
| BG | 87.0% | 98.6% | 0.0% | 0.3% | 1.2% | 100.0% |
| CZ | 93.0% | 97.1% | 1.2% | 0.5% | 1.2% | 100.0% |
| DK | 37.0% | 58.1% | 11.4% | 4.4% | 26.1% | 100.0% |
| DE | 82.0% | 81.6% | 4.6% | 0.0% | 13.8% | 100.0% |
| EE | 84.0% | 91.8% | 1.9% | 0.0% | 6.4% | 100.0% |
| IE | 52.0% | 100.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| EL | 60.0% | 100.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| ES | 80.0% | 90.7% | 0.0% | 0.0% | 9.3% | 100.0% |
| FR | 68.0% | 99.0% | 1.0% | 0.0% | 0.0% | 100.0% |
| IT | 78.0% | 85.4% | 9.3% | 0.2% | 5.1% | 100.0% |
| CY | 50.0% | 100.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| LV | 85.0% | 99.6% | 0.0% | 0.2% | 0.3% | 100.0% |
| LT | 93.0% | 99.8% | 0.0% | 0.2% | 0.0% | 100.0% |
| LU | 93.0% | 99.2% | 0.5% | 0.0% | 0.3% | 100.0% |
| HU | 73.0% | 94.7% | 4.2% | 0.0% | 1.1% | 100.0% |
| MT | 43.0% | 98.2% | 0.0% | 0.0% | 1.8% | 100.0% |
| NL | 50.0% | 64.0% | 23.3% | 0.1% | 12.6% | 100.0% |
| AT(*) | 68.0% | 84.6% | 15.4% | 0.0% | 0.0% | 100.0% |
| PL | 87.0% | 89.8% | 0.0% | 0.0% | 10.2% | 100.0% |
| PT | 73.0% | 100.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| RO | 79.0% | 97.3% | 1.6% | 0.1% | 1.0% | 100.0% |
| SI | 79.0% | 98.8% | 0.4% | 0.0% | 0.8% | 100.0% |
| SK | 90.0% | 99.2% | 0.4% | 0.0% | 0.3% | 100.0% |
| FI | 65.0% | 82.3% | 2.6% | 1.7% | 13.4% | 100.0% |
| SE | 80.0% | 68.8% | 1.1% | 0.4% | 29.8% | 100.0% |
| UK | 74.0% | 97.9% | 2.1% | 0.0% | 0.0% | 100.0% |

(*) Gas figure includes coal and electricity
Source: Eurostat Taxation Trends and European Commission Energy Duties Revenue

[12] For an analysis of the effects of environmental taxation on innovation see OECD (2010).

The high share of fossil fuels reflects the idea of taxing the most damaging products[13], but at the same time shows the need to restructure the energy tax system: if the climate package achieves its goal, fossil fuel revenues will decrease sharply in the next ten years.

### 2.1.1 Energy tax rates in EU-27

Generally speaking, tax rates on high carbon energy products are expected to be higher than those imposed on other consumer goods in light of both revenue and environmental considerations (see Crawford, Keen and Smith, 2008). Countries may differentiate tax levels according to estimations of local marginal damage, revenue requirements, concerns about income distribution and industry competitiveness. However, a high level of differentiation in energy taxes can distort the level playing field, and so in order to reduce the incentive for tax competition (which damages the climate change policy) a minimum of tax harmonization has been implemented in the EU.

The Energy Taxation Directive of 27 October 2003 (Directive 2003/96/EC) sets the Community approach for the taxation of energy products. This directive widens the scope of the former EU energy taxation framework, which was defined under the Mineral Oils Directive (Directive 1992/82/EC), extending the system of minimum rates of taxation, previously confined to mineral oils, to coal, natural gas and electricity[14]. The system sets the minimum rates[15] of taxation applicable to energy products when used as motor or heating fuels and to electricity. However, the Directive allows Member States to differentiate between business and non-business use of energy products and, by way of derogation from the provisions of the directive, to continue to apply certain exemptions or reductions in the levels of taxation (See box 1 for details). It aims to reduce distortions that existed between Member States and between mineral oils and other energy products which had not been previously subject to EU tax legislation, in order to improve the operation of the internal market[16].

**Box 1 Minimum levels of taxation and exemptions.**

The following table shows the minimum level of taxation applicable to motor fuels set by the Energy Taxation Directive compared to the minimum levels imposed by the Mineral Oils Directive in 1992.

**Minimum levels of taxation applicable to heating fuels and electricity.**

| | Previous Minimum | New Minimum Excise | New Minimum Excise |
|---|---|---|---|

[13] Ideally, environmental tax rates should represent the marginal damage caused by producing or consuming a given product. After the tax, energy prices reflect the whole cost for society (social cost). However, in practice social costs are difficult to evaluate and tax rates respond more frequently to revenue-raising considerations.

[14] The Directive is the result of a series of attempts to establish a more stringent energy taxation system in Europe. In 1997 the European Commission presented a proposal for a taxation framework on energy products (including coal and gas) and electricity. After a long process of discussion and modifications of this proposal the EU Council finally adopted Directive 2003/96/EC.

[15] In the Directive the key term "Level of taxation" refers to the total charge levied in respect of all indirect taxes (except VAT) calculated directly or indirectly on the quantity of energy products and electricity at the time of release for consumption. For example, in Sweden the total excise duty on mineral oil products is composed of two elements, the energy tax and the $CO_2$ tax.

[16] The effect of this framework for the taxation of energy products has been modest, because most countries already had higher rates than the minimums. However, the minimum rates implied an increase in energy tax in all new Member States, as in most of them only transport fuels were taxed, and at a lower rate. On this see Kouvaritakis et al. (2005).

| | Excise Rates | Rates (business use) | Rates (non-business use) |
|---|---|---|---|
| Diesel (/1000 l.) | 18 | 21 | 21 |
| Heavy fuel oil (/1000 l.) | 13 | 15 | 15 |
| Kerosene (/1000 l.) | 0 | 0 | 0 |
| LPG (/1000 l.) | 0 | 0 | 0 |
| Natural Gas | - | 0.15 | 0.3 |
| Coal and coke | - | 0.15 | 0.3 |
| Electricity | - | 0.5 | 1.0 |

Minimum level of taxation applicable to motor fuels.

| | Previous * Minimum Excise Rates | Minimum Excise Rates from 1.1.2004 | Minimum Excise Rates from 1.1.2010 |
|---|---|---|---|
| Petrol (/1000 l.) | 337 | 421 | 421 |
| Unleaded Petrol(/1000 l.) | 287 | 359 | 359 |
| Diesel (/1000 l.) | 245 | 302 | 330 |
| Kerosene (/1000 l.) | 245 | 302 | 330 |
| LPG (/1000 l.) | 100 | 125 | 125 |
| Natural Gas | 100 (/1000 kg) | 2.6 (/gigajoule) | 2.6 (/gigajoule) |

Provided that they comply with the minimum levels, differentiated rates of taxation may be applied by Member States, in the following cases:

- when the differentiated rates are directly linked to product quality or depend on quantitative consumption levels (electricity and energy products used for heating purposes);
- for the following uses: local public passenger transport (including taxis), waste collection, armed forces and public administration, disabled people, ambulances;
- between business and non-business use, for the energy products and electricity referred to above.

Moreover, the Directive includes a number of general and Member-specific exemptions and transitional periods. In addition, an amendment was adopted on April 2004 by the EU's Council of Ministers that allows the EU accession countries to temporarily apply country-specific excise duty exemptions or lower rates of duty[17]. The exemptions are limited in time and last no longer than 2012.
The following are exempt from taxation:

- energy products and electricity used to produce electricity and electricity used to maintain the ability to produce electricity. However, Member States may subject these products to taxation;
- energy products supplied for use as fuel for the purpose of air navigation other than in private pleasure-flying;
- energy products supplied for use as fuel for the purposes of navigation within Community waters, including fishing, other than private pleasure craft, and electricity produced on board a craft.

In addition, Member States may apply total or partial exemptions or reductions in the level of taxation to, *inter alia*:

- energy products used under fiscal control in the domain of pilot projects for the technological development of more environmentally-friendly products or in relation to fuels from renewable sources;
- biofuels (as defined in the European Directive 2003/30/EC);
- forms of energy which are of solar, wind, tidal or geothermal origin, or from biomass or waste;
- energy products and electricity used for the carriage of goods and passengers by rail, metro, tram and trolley bus;
- energy products supplied for use as fuel for navigation on inland waterways (including fishing) other than in private pleasure craft, and electricity produced on board a craft;
- natural gas and LPG used as propellants.

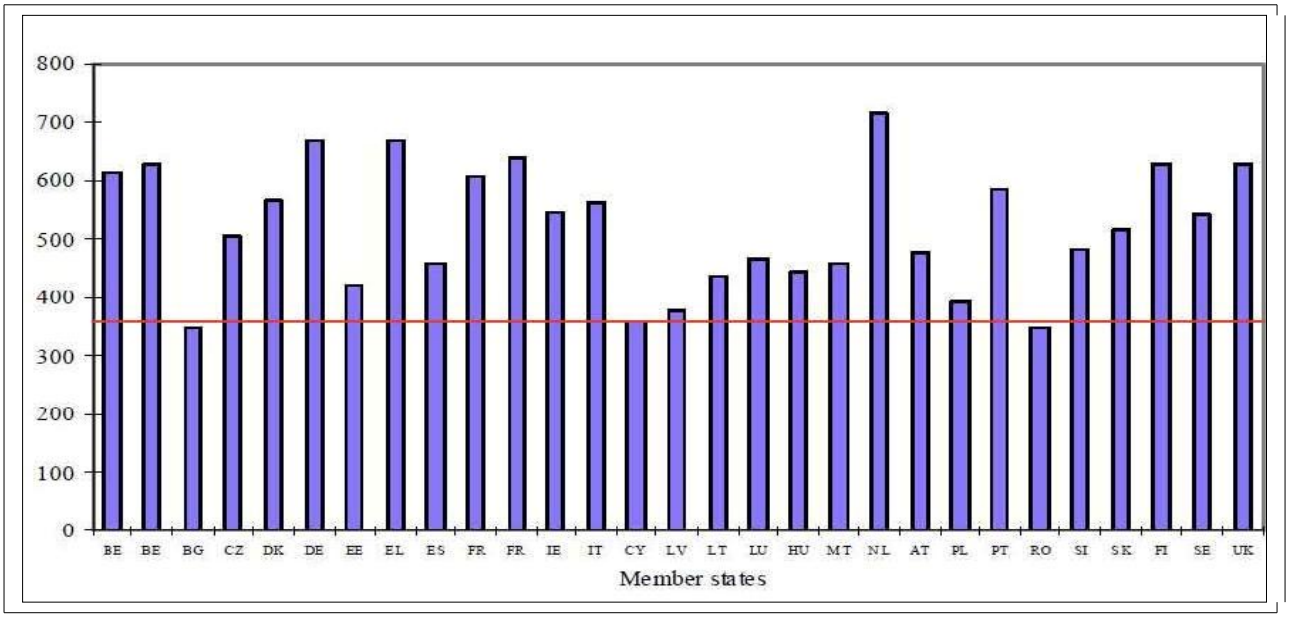
Reduced rates and exemptions from taxation applicable to Member States are set out in Annex II of the Act.

[17] Directive 2004/74/EC amends the energy Directive allowing the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia to apply temporary exemptions or reductions in the levels of taxation. Directive 2004/75/EC amends the energy Directive allowing Cyprus to apply temporary exemptions or reductions in the levels of taxation.

The Directive takes account of the competitiveness of businesses by providing measures to alleviate the tax burden on energy-intensive businesses and/or businesses that undertake plans to achieve environmental protection objectives or to improve energy efficiency.
It also provides that Member States may refund, fully or in part, taxes paid by producers that have invested in the rationalization of their energy use. This refund may be as much as 100% in the case of energy-intensive businesses, and up to 50% for other businesses[18].

The presence of minimum rates and an extensive system of exemptions has resulted in much variation in tax rates on main energy products among member states, as is illustrated in Graphs 6 and 7 for the examples of petrol and gas oil. Graph 6 shows the high variation in nominal rates for unleaded petrol set by countries. As of July 2010[19], within the European Union countries, the highest excise duty rate is fixed by the Netherlands at 713.99 Euros, almost double the minimum rate (fixed at 359 Euros per 1000 litres). Conversely, Bulgaria and Romania remain below that minimum excise duty rate, with 350.24 Euros and 348.04 Euros respectively, benefiting from a transitional period as established by their Accession Treaties[20]. On a general level, the trend in the nominal excise duty rate followed by the EU-27 countries between 2005 and 2010 shows a rise. Specifically, Greece experienced a remarkable increase in its national duty rate: in the last five years it has increased by over 110%, as an instrument to reduce the high budget imbalance. Finally, Sweden and the UK are the only countries in the EU-27 that show mixed evidence because their governments increased tax rates in national currency but the tax rates follow an opposite trend if we consider the values of the excise duty rates calculated with 2004-2009 exchange rates (National currency-Euro)[21].

**Graph 6. UNLEADED PETROL: excise duty rates in the EU Member States (as at 1 July 2010).**




Notes: Minimum excise duty: 359 Euros per 1000 litres. Values in Euros at 1/10/2009.

Source: European Commission, Taxation and Custom Unit (2010)

18 http://europa.eu/legislation_summaries/internal_market/single_market_for_goods/motor_vehicles/interactions_industry_policies/l27019_en.htm.

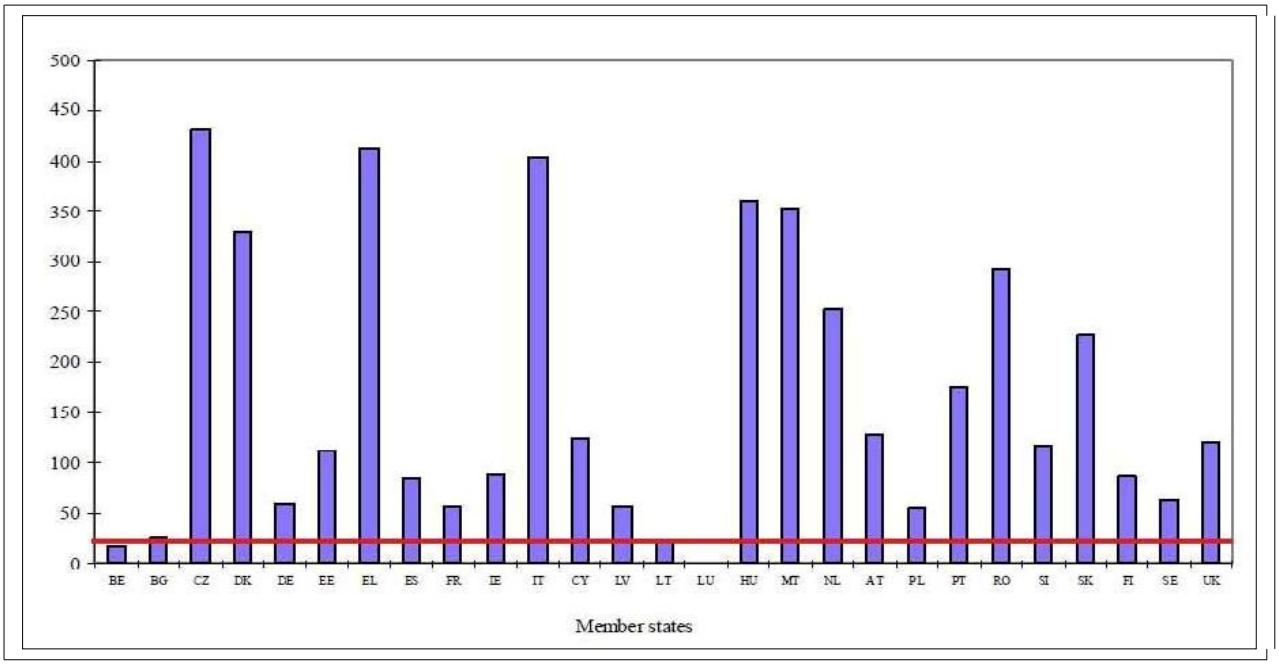
19 Data Source: European Commission (2010) "Excise duty tables-Part II: Energy products and Electricity"

20 Some countries set different rates, depending on the sulphur content of petrol.

21 Considering the excise duty rates in National Currencies, SE increased its national duty rate (2005-2010) from 3390 SEK to 3810 SEK. Similarly, the UK increased its national tax rate (2005-2010) from 501.9 GBP to 571.9 GBP on normal unleaded petrol.

With the same minimum excise duty rate fixed at 21 Euros per 1000 litres, gas oil heating data show that almost all European countries display similar values for both business use and non-business use. As shown in Graph 7, the EU Member States that have a relatively high tax rate on gas oil for business heating use are: the Czech Republic, Denmark, Greece, Italy, Hungary, Malta, the Netherlands, Portugal, Romania and Slovakia. These countries have fixed their excise duty rates above 350 Euros per 1000 litres.

**Graph 7. GAS OIL – heating, business use: excise duty rates in the EU Member States (as at 1 July 2010).**




Notes: Minimum excise duty: 21 EUR per 1000 litres. Values in EUR at 1/10/2009.

Source: European Commission, Taxation and Custom Unit (2010)

The gas oil trend (2005-2010) for both business heating use and non-business use shows that the majority of EU-27 countries increased their nominal excise duty rates, some of them experiencing remarkable variations, as in the case of the Netherlands (which almost quadrupled its rate) and Greece (+68% only for gas oil for non-business heating use).

Although excise taxes on energy are always connected to the Pigouvian framework, most countries have set – or updated – tax rates without proper reference to the marginal damage[22], focusing on revenue raising, political acceptance and inflation. According to the OECD's computation[23], the average real change in the tax rate on petrol over the last decade (2000-2010) was -8.1%, and for Austria, France, Spain, Italy, Hungary and the Slovak Republic a decrease of more than 10% was recorded. On the contrary, Ireland, Portugal and Greece showed an increase of more than 10%, but this is more to be connected to the aftermath of the financial crisis than to new estimations of external costs.

Moreover, almost all countries use exemptions and tax rebates for some sector or users, under the Directive framework. The most extensive exemptions and reductions are for agriculture on motor fuel products, but generally speaking much evidence of cross-subsidization between users and sectors can be identified for all energy products.

22 For recent analyses of the optimal tax rate on petrol, see Lin and Prince (2009) and Parry and Small (2005).

23 See Oecd (2010).

As shown by the previous examples, it is very difficult to give a general picture of energy product tax rates set by Member Countries, because tax rates vary with energy uses, product specificity, special concessions and, in some countries, by region. Moreover, in some cases tax rates include $CO_2$ taxes. In order to give a general idea of the tax burden on energy, Table 2 shows implicit tax rates, computed as the ratio of energy product revenues to gross final inland consumption.

**Table 2**
**Implicit tax rates on energy products (*)**

| | Mineral Oils | Natural Gas | Coal and Coke | Electricity | Total |
|---|---|---|---|---|---|
| BE | 0.16 | 0.003 | 0.007 | 0.006 | 0.081 |
| BG | 0.21 | - | 0.001 | 0.005 | 0.080 |
| CZ | 0.31 | 0.005 | 0.003 | 0.008 | 0.114 |
| DK | 0.32 | 0.125 | 0.049 | 0.406 | 0.235 |
| DE | 0.31 | 0.027 | 0.000 | 0.139 | 0.159 |
| EE | 0.27 | 0.008 | 0.000 | 0.034 | 0.127 |
| IE | 0.26 | - | - | - | 0.131 |
| EL | 0.17 | - | 0.003 | - | 0.117 |
| ES | 0.18 | - | - | 0.056 | 0.099 |
| FR | 0.27 | 0.006 | 0.001 | - | 0.137 |
| IT | 0.29 | 0.035 | 0.003 | 0.051 | 0.138 |
| CY | 0.10 | | - | - | 0.083 |
| LV | 0.27 | - | 0.006 | 0.002 | 0.117 |
| LT | 0.16 | - | 0.006 | - | 0.074 |
| LU | 0.31 | 0.004 | - | 0.005 | 0.196 |
| HU | 0.28 | 0.008 | - | 0.008 | 0.096 |
| MT | 0.09 | | | 0.009 | 0.074 |
| NL | 0.21 | 0.076 | 0.002 | 0.152 | 0.130 |
| AT (**) | 0.29 | 0.044 | - | - | 0.156 |
| PL | 0.26 | - | - | 0.073 | 0.081 |
| PT | 0.20 | 0.000 | - | - | 0.108 |
| RO | 0.18 | 0.003 | 0.001 | 0.005 | 0.068 |
| SI | 0.28 | 0.004 | 0.000 | 0.006 | 0.160 |
| SK | 0.26 | 0.001 | 0.000 | 0.002 | 0.074 |
| FI | 0.24 | 0.022 | 0.016 | 0.060 | 0.126 |
| SE | 0.33 | 0.087 | 0.012 | 0.183 | 0.240 |
| UK | 0.34 | 0.007 | - | - | 0.118 |

(*) Tax Revenue in millions of euros/thousand tonnes of oil equivalent (TOE) as final inland consumption.
(**) Gas figure includes coal and electricity

Source: computation on European Commission and Eurostat data

Although these implicit tax rates are a very rough approximation[24] of the energy-related tax policy of Member States, a considerable variation among countries and products can be appreciated. This variation gives a description of the tax design of Member countries (as it is linked to nominal tax rates) but at the same time it gives some hints

[24] Revenue classification among categories, provided by European Commission, can conceal some heterogeneity among member states. It is not clear, for instance, whether revenues from all levels of governments are taken into account. As regards the denominator, on the other hand, the gross final inland consumption aggregate approximates the tax base for different products differently.

on preferential treatment for some energy products. The larger the distance between nominal and implicit tax rate rankings, the larger the use of hidden tax rebates or, more generally, tax expenditures.

Lastly, it is worth stressing that five European countries have a specific tax on the $CO_2$ content of energy products: Scandinavian countries introduced this special taxation in the Nineties on the basis of a Commission proposal for a common taxation of $CO_2$, which was never approved by the Council. Finland was the first country to adopt a carbon tax, in 1990 (table 3). This tax applies to gas oil, diesel, light and heavy fuel oil, jet fuel, aviation gasoline, coal, and natural gas. Although it was initially based purely on carbon content, it was later changed to a 60% carbon component and a 40% energy component, but returned to being a pure carbon tax in 1997, having increased recently to €20 per metric ton of $CO_2$.

**Table 3**
**Carbon taxation in the EU**

| Country | Starting year | Rate (€ per $CO_2$ tonne) | Revenue in 2008 (millions of €) | Revenue use (other than general purpose) |
|---|---|---|---|---|
| Denmark | 1992 | 12 | 681 | Environmental protection programmes, reduction on personal income taxation and on social security contributions |
| Ireland | 2009 | 15 | 250 (estimation for year 2010) | Environment protection programmes and grants for low-income households |
| Slovenia | 2007 | 16 | 30 | None |
| Finland | 1990 | 20.41 | 500 | Environmental protection programmes |
| Sweden (*) | 1991 | 108 | 2647 | Environment protection programmes, reduction on personal income taxation |

(*) Standard rate mainly for households and services; lower rates apply to industry.

Ireland, at the other extreme, introduced a new carbon tax in 2009 after a long debate as part of a general package of fiscal consolidation. This carbon tax applied to petrol and diesel (from late 2010) and to kerosene, marked gas oil, liquid petroleum gas (LPG), fuel oil and natural gas (from May 2010). Participants in the EU emissions trading scheme (ETS) are exempt from the tax. As regards tax rate, four countries out of five have a tax rate that ranges between 12 and 20 Euros, not far from the carbon price that has frequently emerged from the ETS. A very different approach was adopted by Sweden, which has recently increased the tax rate on $CO_2$ to a level of 108 Euros, obtaining revenues of over 2 billion. However, Swedish industry is provided with many rebates: ETS firms are completely exempt from the $CO_2$ tax, while firms outside the ETS will be subject to it up to 60% of the standard rate only from 2015.

**Box 2 Towards a revision of the Energy Tax Directive?**

Although strongly encouraged by Delor's White Paper, the European Union has so far shown a total inability to set up European Carbon Taxation. In a draft proposal and through public meetings[25], the European Commission tried once again in 2009 to put carbon taxation at the top of the agenda as an additional instrument for fighting climate change. The draft proposal analyzed different policy approaches, which ranged from simply avoiding the negative effect of overlapping instruments (such as energy taxes and the EU Emission Trading Scheme (ETS)) to the introduction of *"an additional uniform $CO_2$-related tax on top of taxes already existing under the European Energy Directive to complement EU-ETS"(p.5)*. As a new common tax appears politically unfeasible, the Commission has

25 EUROPEAN COMMISSION (2009). For a comment linked to the proposal see LAURENT ,LE CACHEX (2009)

recently set a new plan[26] to amend the common energy taxation policy in order to tax energy products with reference to climate change emissions, in addition to their energy content. At the same time the revision would exempt all sectors involved in the Emission Trading Scheme and abolish tax concessions for some sectors.

Compared to the existing Directive, it would provide important environmental tax incentives:

- minimum levels of taxation (€20 per tonne of $CO_2$ emitted) on different types of fuels linked to the intensity of their emissions, to be effective from 2013.
- a changed tax base from the metric unit of 1000 litres to the energy unit of Gigajoule, thereby relating it to the calorific (= energy content) content of each fuel.
- the exclusion from the scope of the Energy Taxation Directive of $CO_2$-related taxation of products that are biomass or are made from biomass[27].
- tax credit concerning CO2 taxation for sectors exposed to a significant risk of carbon leakage.
- the alignment of tax rates at regular intervals to take into account the evolution of their real values.

## *2.2 Public Revenues and the Emission Trading Scheme*

### 2.2.1 Revenue from auctioning

The European Emission Trading Scheme, introduced in 2003, is a cap and trade system set up to limit greenhouse emissions emitted by large industrial[28] installations in the EU. After a period of "learning by doing", the market entered into force in 2008 together with the Kyoto protocol: Member State Governments set a cap on total emissions and then distributed allowances to the firms in the scheme (mainly for free); these allowances can be traded without restraint between market participants but at the end of the year firms are required to have enough allowances to offset their emissions; consequently a carbon price that clears the market emerges as a device to match demand with the fixed supply of allowances. After the end of the Kyoto protocol (December 2012), the ETS scheme will run into a third phase in which the range of economic activities[29] will be expanded and the grandfathering allocation will be replaced by auctioning. Although on economic efficiency grounds there is no difference between allocation by auction or grandfathering (provided that no market imperfections exist), the two options have different impacts on the budget: grandfathering of permits does not satisfy the 'polluter pays' principle and represents a transfer from society to polluters in the form of foregone revenues. This is the reason why a switch toward auctioning has been decided for the third phase.

Although grandfathering is the general rule in phase 2, Member States are permitted to auction up to 10% of their allowances. However, only a few Member States (Austria, Germany, the Netherlands and the UK), have made use of this possibility so far, although Germany and the UK have auctioned significant amounts.

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[26] See European Commission (2011).

[27] http://www.euractiv.com/pdf/Energy%20Taxation%20Interservice%20proposal.pdf

[28] Not all economic sectors are involved in the scheme. Only energy activities, production and processing of ferrous metals, mineral industries and pulp and paper industries are included at the moment.

[29] Other important features of the ETS revision are the inclusion of additional greenhouse gases and the centralized and harmonized allocation methodologies. See Directive 2009/29/EC.

**Table 4**
**Estimated revenue from auctioning**

| Country | Annual quantity to be auctioned in phase II. Levels and % of national allotment |
|---|---|
| Austria | 400,000 - 1.3% |
| Germany | 40 million - 9% |
| Netherlands | 3.2 million – 3.7% |
| UK | 17 million - 7% |

Deutsche Bank (2010)

The UK will auction 7 percent of its allowances during the second phase – approximately 17 million annually, making a total of 85 million between 2008 and 2012. The public revenues resulting from the auctioning process obviously depend on prices: in its first Phase II auction (November 2008), four million allowances were distributed at a clearing price of €16.15 (£13.60), raising £54 million[30].

### 2.2.2 Tax treatment of Emission Trading Permits

The general aim of the European Emission Trading Scheme is to reduce and level the abatement costs of greenhouse gasses. For a tax system to be neutral, tax details must have no effect on the location of abatement and no arbitrage opportunities should arise. Therefore, a disparity of tax treatments among European countries could affect the efficiency of the trading scheme (making abatement efforts more costly than otherwise) and at the same time could open opportunities for tax planning and arbitrage, with severe revenue losses for many Member States. Evidence of this tax planning opportunity is the widespread VAT fraud (known as the Carousel fraud) recently discovered by several Member States, which resulted in a suspension of the ordinary VAT regime on emission allowances.

The mere existence and the trading of emission allowances gives rise to direct and indirect tax issues. Emission allowances are created by regulatory authorities as free allocations or as the result of an auction process; these allowances give the holder the right to emit a ton of carbon and must be returned to the national authority in proportion to effective carbon dioxide emissions. As a consequence, the price can vary from zero (if there is a free allocation) to a market-determined price, but their value can change during the reference period if carbon market conditions change. Moreover, emission allowances can then be traded between market participants (as some firms will need to buy additional permits, while low abatement cost firms will be able to sell). A preliminary problem that can influence direct and indirect taxation is the classification of the allowances – establishing if a carbon permit is to be considered a commodity, a financial service, an intangible asset or an item that can be put in the inventory. Classification as an intangible or tangible asset may also influence the result.

[30] Total revenue has been estimated at more than 1 billion.

As regards indirect taxation, the original transfer of allowances – as a general rule – is not subject to VAT. In the case of free allocation no VAT is due because the price is zero, whereas if an auction takes place the allocation is not under the VAT regime because it is performed by a Public Body. However, recent sentences from the European Court of Justice have ruled that states and public bodies must be subject to VAT in respect of any transactions or activities they are engaged in unless they can demonstrate that these transactions or activities does not create, or are not likely to create, a significant distortion of competition[31]. This will probably imply that VAT will be charged on future $CO_2$ permit auctions.

Subsequent transfers of allowances between taxable persons are considered a supply of service and are taxable at the place where the recipient is established. However, during the summer of 2009 a number of cases of suspected fraud were detected and this urged the European Commission[32] and Member States to take measures, including the application of a reverse charge system[33] (Ireland and the Netherlands), the removal of permits from the VAT regime (France) and the application of a zero rate to these transaction (the UK). Poland decided to classify allowances as financial services, in this way removing their trading from the VAT regime.

Selling and buying emission permits generates revenues and costs in firms' balance sheets and thus affects corporation tax. As previously discussed, the categorization of allowances chosen leads to different tax treatment implications: in the case of classification as a commodity, the allowances will be considered as costs when purchased, and as a taxable income when sold[34]. If carbon permits are treated as intangible assets, they enter into balance sheet activities but their cost is handled by the general depreciation mechanism, with a fraction of the total cost becoming deductable in each accounting period. Lastly, if allowances are considered financial assets, the tax details depend on the final motivation of the investment (whether it is a pure financial investment or an investment to meet an obligation, if the investment is performed by a financial firm etc.). In order to avoid arbitrage opportunities and fraud, a harmonization of tax principles regarding carbon allowances is urgently needed. This coordination, which like all tax-related policies in the EU will be complicated, appears a key step for the progress of the carbon market.

# 3.Energy-related subsidies

## *3.1 Defining the issue*

In spite of its importance in the public debate and political agenda, there is not yet a common and shared definition of what a "subsidy" is, regardless of the sector considered. Nonetheless, the common point of view used

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31 See for instance ECJ Case c-288/07, 16th September 2008 and COMMISSION Vs IRELAND, Case C-544/07.

32 See the Directive 2010/23/EU of 16 March 2010, amending the "VAT Directive" by introducing an optional and temporary application of the reverse charge mechanism in relation to supplies of certain services susceptible to fraud.

33 The *reverse charge* mechanism is a system where the obligation to pay VAT is shifted from the supplier to the buyer of a product/service. This system, already in place for cross-border trade in carbon credits, is extended to domestic transactions.

34 For an analysis of implication on corporate taxation in EU, see DGTAXUD (2010).

in the various attempts[35] to define the issue is that the scope of the definition should include not only the direct financial transfer that the general government makes to producers or consumers, but it should also be extended to cover both those actions directly undertaken by the general government for the energy sector[36] and all those measures which support it without an explicit public outlay[37]. Furthermore, some studies[38] have asserted that for the energy sector in particular, other aspects like the limitation of civil liability for nuclear accidents and a lack of measures that impose external costs to producers should be taken into account. The various types of government interventions possible are summarized in the following table, which also shows how the subsidy usually works:

**Table 5**
**Types of energy subsidy and their effects on production costs and consumer prices**

| Government intervention | Examples | How the subsidy usually works | | |
|---|---|---|---|---|
| | | Lowers cost of production | Raises price to producer | Lowers price to consumer |
| Direct financial transfer | Grants to producer | x | | |
| | Grants to consumers | | | x |
| | Low interest or preferential loans | x | | |
| Preferential tax treatment | Rebates or exemption on royalties, sales taxes, producer levies and tariffs | x | | |
| | Tax credit | x | | x |
| | Accelerated depreciation allowances on equipment | x | | |
| Trade restrictions | Quotas, technical restrictions and trade embargoes | | x | |
| Energy-related services provided directly by governments at less than full cost | Direct investment in energy infrastructure | x | | |
| | Public R&D | x | | |
| | Liability insurance and facility decommissioning costs | x | | |
| Regulation of the energy sector | Demand guarantees and mandated deployment | x | x | |
| | Price controls | | x | x |
| | Market-access restrictions | | x | |

Source: UNEP (2008), "Reforming Energy Subsidies"

35 See for instance: IEA (International Energy Agency) 2006, "Carros and Sticks: Taxing and Subsidising Energy", Note on Energy Subsidies and Taxes, 17 January 2006; EIA (Energy Information Administration) 1992, "Federal energy subsidies: direct and indirect interventions in energy markets", EIA Service Report, US Department of Energy, Washington, DC; "WTO Agreement on Subsidies and Countervailing Measures", art.1

36 For example, public R&D on energy technologies or public intervention in building energy-specific facilities like dams and pipelines.

37 For example, tax expenditures or market regulation.

38 EEA (2004)and EIA (2010) "

On the basis of this classification, subsidies can be classified as:

**on-budget subsidies**, which include measures which appear as outlays in the general government balance sheet, like direct financial transfers or appropriations for energy-related services directly undertaken by the government;

**off-budget subsidies**, which include those measures not featuring in the balance-sheet, like the provision of tax expenditures or benefits originating from market regulation.

Because of the difficulties in quantifying the value of some of the items above and the lack of comparable data for the EU-27 countries, only on-budget subsidies can be estimated by analyzing national accounts. Some data on tax expenditures as an example of off-budget subsidies will follow[39].

### 3.1.1 On-budget[40]

For **on-budget** measures, the estimation of subsidies is based on Eurostat's *General government expenditure by function*, where a distinction between "Direct financial transfers" and "Energy-related services provided directly" is made. This breakdown refers to the budget expenditure for all the activities in the energy sector except for R&D, which is shown in a separate row.

Table 6 shows that in 2008, the total appropriations for the energy sector in EU-27 amounted to about 13.5 billion Euros, one quarter of which was earmarked for R&D activities. A common feature is that countries prefer the use of direct financial transfers rather than directly providing energy-related services to support the energy sector. The scale of country stimulus only in part reflects the size of the economy, as it is linked more to country-specific energy source endowments: the absence of energy resources reduces the level of support in large economies like Italy. Data for R&D appropriations show (except for the UK) a higher correlation with the size of the economy, especially for the largest countries, which actually account for about 90% of the EU-27 expenditure on energy sector R&D.

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[39] The lack of official and comprehensive data on public subsidies to the energy sector is underlined by all the international institutions dealing with environmental and energy issues. The most recent data for European Member States' energy-related subsidies has been estimated for 2001 (EEA (2004). See also IEA et al. (2010) and Unep (2008) for a global analysis of the issue.

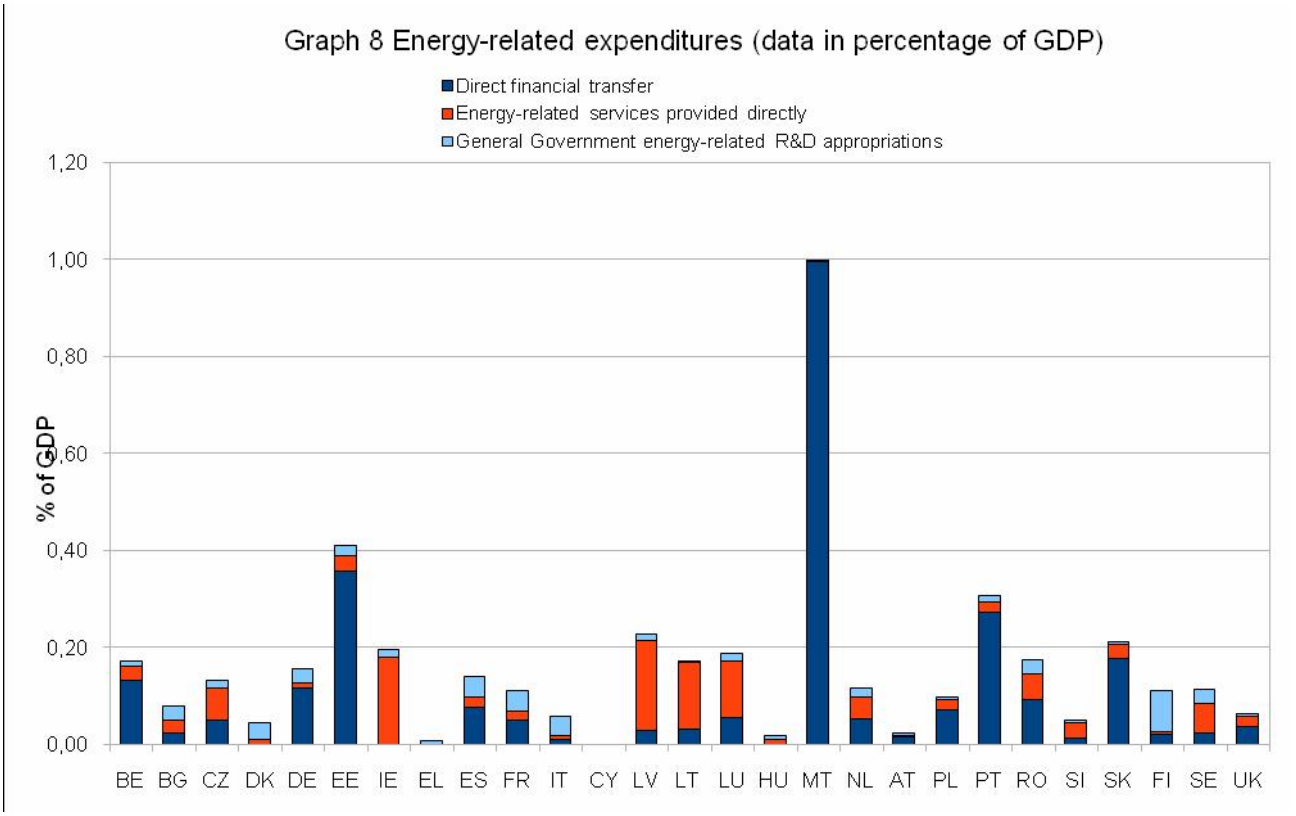
[40] From *"General government expenditure by function"*, the entries '*Subsidies*' (D.3) and '*Capital Transfers*' (D.9) have been used to estimate direct financial transfers by general government, while the entries '*Intermediate Consumption*' (P.2), '*Gross Capital Formation*' (P.5) and '*Compensation of Employees*' (D.1) have been utilized to estimate appropriations by general government for undertaking energy-related services. For each of the entries above, only the (second level) entry '*Fuel and energy*' (04.3) of Economic Affairs (04) has been taken into account. R&D expenditure comes from the dataset "*Government Budget Appropriations or Outlays on R&D*" (*gba_nabsfin07*), entry '*Energy*' (05) of the NABS (Nomenclature for the Analysis and Comparison of Scientific programmes and Budget).

**Table 6**
**Energy-related expenditure, 2008 (data in millions of euro and as % of GDP)**

| Kind of General Government intervention (excluding R&D sector) | | Direct financial transfer | Energy-related services provided directly | Subtotal by Country | General Government energy-related R&D appropriations | Total in millions of Euro | Total as a % of GDP |
|---|---|---|---|---|---|---|---|
| Country (2008) | BE | 451.8 | 95.5 | 547.3 | 36.3 | 583.6 | 0.2 |
| | BG | 7.8 | 9.2 | 17.0 | 10.0 | 27.0 | 0.1 |
| | CZ | 72.1 | 96.8 | 168.9 | 23.4 | 192.3 | 0.1 |
| | DK | 4.0 | 18.1 | 22.1 | 77.9 | 100.0 | 0.0 |
| | DE | 2850.0 | 270.0 | 3120.0 | 727.4 | 3847.4 | 0.2 |
| | EE | 57.5 | 5.0 | 62.5 | 3.3 | 65.8 | 0.4 |
| | IE | 0.0 | 319.6 | 319.6 | 28.1 | 347.7 | 0.2 |
| | EL | 0.0 | 0.0 | 0.0 | 13.6 | 13.6 | 0.0 |
| | ES | 828.0 | 208.0 | 1036.0 | 456.8 | 1492.8 | 0.1 |
| | FR | 952.2 | 324.0 | 1276.2 | 855.2 | 2131.4 | 0.1 |
| | IT | 131.0 | 142.0 | 273.0 | 589.3 | 862.3 | 0.1 |
| | CY | 0.0 | 0.5 | 0.5 | 0.0 | 0.5 | 0.0 |
| | LV | 6.2 | 42.5 | 48.7 | 3.4 | 52.1 | 0.2 |
| | LT | 9.4 | 44.7 | 54.1 | 0.6 | 54.7 | 0.2 |
| | LU | 21.7 | 46.2 | 67.9 | 5.4 | 73.3 | 0.2 |
| | HU | 0.0 | 7.8 | 7.8 | 9.4 | 17.2 | 0.0 |
| | MT | 57.3 | 0.0 | 57.3 | 0.0 | 57.3 | 1.0 |
| | NL | 296.0 | 276.4 | 572.3 | 112.6 | 685.0 | 0.1 |
| | AT | 42.3 | 1.3 | 43.6 | 18.1 | 61.7 | 0.0 |
| | PL | 248.6 | 76.6 | 325.2 | 25.4 | 350.6 | 0.1 |
| | PT | 466.6 | 36.2 | 502.8 | 20.7 | 523.5 | 0.3 |
| | RO | 125.0 | 75.5 | 200.5 | 41.0 | 241.6 | 0.2 |
| | SI | 4.1 | 12.2 | 16.3 | 2.1 | 18.4 | 0.0 |
| | SK | 113.5 | 18.1 | 131.6 | 3.7 | 135.4 | 0.2 |
| | FI | 36.0 | 7.0 | 43.0 | 159.5 | 202.5 | 0.1 |
| | SE | 75.8 | 199.9 | 275.7 | 94.2 | 369.9 | 0.1 |
| | UK | 648.0 | 373.0 | 1021.0 | 87.5 | 1108.5 | 0.1 |
| | EU-27 | 7504.9 | 2706.1 | 10211.0 | 3405.1 | 13616.1 | 0.1 |

Source: Author's calculation on Eurostat data

The share of overall on-budget energy-related expenditure out of GDP is shown in the graph below; it is evident that the weight is not sizeable, being in every country around 0.2 percent of GDP, and around a half percentage point of Total Expenditure.




**Box 3**

**Public R&D expenditure in Germany and the Czech Republic**

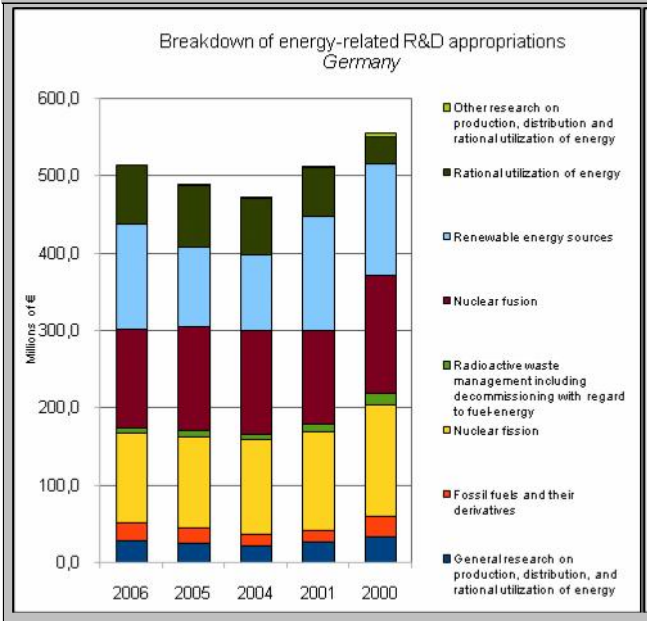
A leading role in energy-related R&D expenditure is taken by Germany. Total R&D expenditure in this area amounts to 500 million Euros, of which the greatest share is devoted to Nuclear (Fusion and Fission) and to Renewable energy sources.

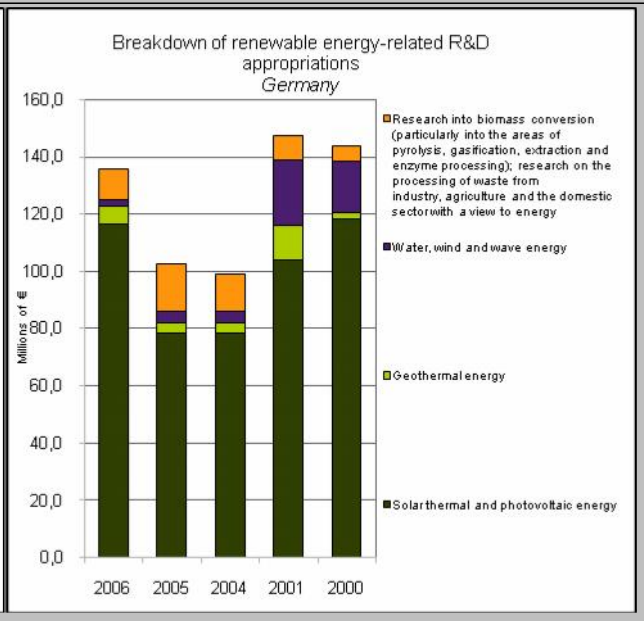
Among renewables, the sector supported most is R&D for solar, thermal and photovoltaic energy, while a sharp reduction in R&D for water, wind and wave energy can be noticed, simultaneously with an overall increase in funds earmarked for R&D in renewable sources.

| Germany (millions of euro) | | Year | | | | |
|---|---|---|---|---|---|---|
| NABS 92 Classification | | 2006 | 2005 | 2004 | 2001 | 2000 |
| General research into production, distribution, and rational utilization of energy | | 29.1 | 25.9 | 23.1 | 27.1 | 33.8 |
| Fossil fuels and their derivatives | | 23.2 | 19.9 | 14.2 | 16.0 | 25.9 |
| Nuclear fission | | 116.6 | 117.5 | 122.1 | 126.3 | 144.4 |
| Radioactive waste management including decommissioning with regard to fuel energy | | 5.7 | 7.9 | 6.7 | 11.1 | 15.3 |
| Nuclear fusion | | 127.6 | 134.8 | 134.1 | 120.9 | 153.0 |
| Renewable energy sources | | 135.8 | 102.4 | 99.1 | 147.1 | 143.6 |
| | Solar thermal and photovoltaic energy | 116.6 | 78.1 | 78.4 | 103.7 | 118.1 |
| | Geothermal energy | 6.1 | 3.8 | 3.5 | 12.4 | 2.4 |
| | Water, wind and wave energy | 2.1 | 4.1 | 3.8 | 22.5 | 18.0 |
| | Research into biomass conversion (particularly into the areas of pyrolysis, gasification, extraction and enzyme processing); research into the processing of waste from industry, agriculture and the domestic sector with a view to energy production | 11.0 | 16.4 | 13.3 | 8.5 | 5.1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Rational utilization of energy | | 76.7 | 82.1 | 74.5 | 64.1 | 34.9 |
| Other research into production, distribution and rational utilization of energy | | 0.0 | 0.1 | 0.1 | 0.7 | 5.6 |
| | | | | | | |
| Total | | 514.7 | 490.6 | 473.9 | 513.2 | 556.3 |

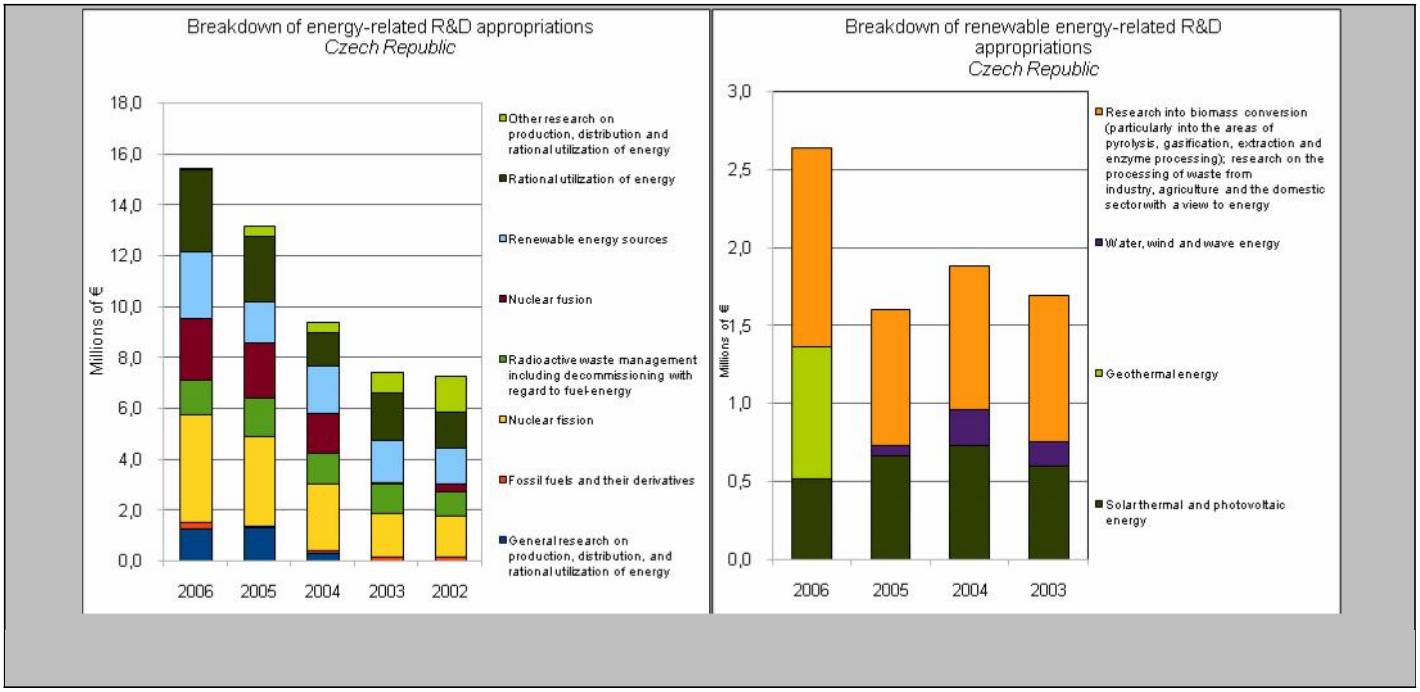
Source: *Eurostat*




***Czech Republic***: Even though the weight of appropriations for the renewable sector decreased (from about 20% to 16%), the level of support was still high in 2006, like in Germany, but the composition is completely different as the largest part is represented by research into biomass conversion; great importance is also given to geothermal energy research, which was the major recipient of the increased overall level of support in 2006, more than compensating for the loss deriving from the phase out of expenditure on research into water, wind and wave energy.

| Czech Republic (millions of euro) | | Year | | | | |
|---|---|---|---|---|---|---|
| NABS 92 Classification | | 2006 | 2005 | 2004 | 2003 | 2002 |
| General research into production, distribution, and rational utilization of energy | | 1.3 | 1.4 | 0.4 | 0.0 | 0.0 |
| Fossil fuels and their derivatives | | 0.2 | 0.0 | 0.1 | 0.2 | 0.2 |
| Nuclear fission | | 4.3 | 3.5 | 2.6 | 1.7 | 1.6 |
| Radioactive waste management including decommissioning with regard to fuel energy | | 1.3 | 1.5 | 1.2 | 1.1 | 1.0 |
| Nuclear fusion | | 2.4 | 2.2 | 1.6 | 0.1 | 0.3 |
| Renewable energy sources | | 2.6 | 1.6 | 1.9 | 1.7 | 1.4 |
| | Solar thermal and photovoltaic energy | 0.5 | 0.7 | 0.7 | 0.6 | : |
| | Geothermal energy | 0.8 | 0.0 | 0.0 | 0.0 | : |
| | Water, wind and wave energy | 0.0 | 0.1 | 0.2 | 0.2 | : |
| | Research into biomass conversion (particularly into the areas of pyrolysis, gasification, extraction and enzyme processing); research into the processing of waste from industry, agriculture and the domestic sector with a view to energy production | 1.3 | 0.9 | 0.9 | 0.9 | : |
| Rational utilization of energy | | 3.3 | 2.6 | 1.3 | 1.8 | 1.4 |
| Other research into production, distribution and rational utilization of energy | | 0.0 | 0.4 | 0.4 | 0.8 | 1.4 |
| | | | | | | |
| Total | | 15.5 | 13.2 | 9.4 | 7.4 | 7.3 |
| | | | | | | |
| Production, distribution and rational utilization of energy | | 15.6 | 13.3 | 9.4 | 7.4 | 7.3 |
| Data in millions of Euro | | | | | | |
| Source: *Eurostat* | | | | | | |




The dataset we chose does not allow us to identify the specific energy sector the support is addressed to (i.e. coal, oil, nuclear or renewable). In order to estimate these quotas, it is necessary to rely on findings from other studies. The European Environment Agency technical report "Energy Subsidies in the European Union: a brief overview" dealt with the same issue in 2004 and estimated on-budget and off-budget subsidies to the energy sector in EU-15 for each energy source[41]. Starting from EEA's estimated quotas, total subsidies can be allocated among energy sources as shown in Table 7. This evaluation would set the level of public support for solid fuels (mainly coal) at an average value of 9.5 billion Euros, while the oil and gas sector would not reach the threshold of 0.3 billion; the outlays for the nuclear field would amount (on average) to 1.5 billion and, lastly, those addressed toward renewable sources would be a little less than 1 billion (876 million Euros). Given the remarkable expansion of renewable energy industries – and the generous support they received in some countries in the last decade – these figures should only be considered a very rough starting point.

**Table 7 - Simulation of on-budget support for different kinds of fuel (millions of Euros)**

| | | Kind of Fuel[1] | | | | |
|---|---|---|---|---|---|---|
| | | Solid fuel | Oil and gas | Nuclear | Renewables | |
| | % | 78.0 | 2.4 | 12.2 | 7.3 | Total on-budget amount |
| Year | 2008 | 10627.2 | 332.1 | 1660.5 | 996.3 | 13616.1 |
| | 2007 | 9254.2 | 289.2 | 1446.0 | 867.6 | 11856.9 |
| | 2006 | 8522.0 | 266.3 | 1331.6 | 798.9 | 10918.8 |
| | 2005 | 8987.1 | 280.8 | 1404.2 | 842.5 | 11514.8 |
| | Average | 9347.6 | 292.1 | 1460.6 | 876.3 | |

[1] Electricity subsidies allocated to fuels on the basis of generation inputs

Source: EEA

[41] EEA estimation refers to 2001. Even though the two aggregates are broadly defined in the same way, the dataset, the panel of countries and the methodology are quite different.

### 3.1.2 Off-budget

Among off-budget subsidies, the reduction of VAT rates on energy products has considerable importance. Several European countries have set a reduced rate of VAT on the consumption of energy products. The difference between the standard rate and the special rate applied for some specific use and user (mainly household and agriculture) gives the magnitude of the implicit subsidy, shown in the table below by country and type. This kind of tax expenditure is widely employed in Ireland, Portugal, Luxembourg and the UK, and is limited to one product elsewhere (Spain, Belgium and Italy).

**Table 8**
**Reduced VAT rate on energy products in the EU**

| Country | Energy product | Use | User | Special VAT Rate | Standard VAT rate (2011) |
|---|---|---|---|---|---|
| Belgium | Coal and Coke | All | | 12.00% | 21.00% |
| Greece | Natural Gas | All | | 11.00% | 23.00% |
| | Electricity | All | | 11.00% | |
| Spain | Petrol | All | | 16.00% | 18.00% |
| Ireland | Gas Oil | All but propellant | | 13.50% | 21.00% |
| | | Propellant | Motor fuel for agricultural purposes | 13.50% | |
| | | | Agriculture, horticulture, pisciculture, forestry | 13.50% | |
| | | | Railways | 13.50% | |
| | Kerosene | All but propellant | | 13.50% | |
| | Heavy fuel oil | All | | 13.50% | |
| | GPL | All but propellant | | 13.50% | |
| | Natural Gas | All but propellant | | 13.50% | |
| | Coal and Coke | All | | 13.50% | |
| | Electricity | All | | 13.50% | |
| Italy | Natural Gas | Heating | Non business & up to 480 $m^3$ | 10.00% | 20.00% |
| Cyprus | GPL | All | | 5.00% | 15.00% |
| Luxembourg | Gas Oil | Heating | All | 12.00% | 15.00% |
| | GPL | All | | 6.00% | |
| | Natural Gas | All | | 6.00% | |
| | Coal and Coke | All | | 12.00% | |
| | Electricity | All | | 6.00% | |
| Portugal | Gas Oil | All but propellant | | 13.00% | 23.00% |
| | | Propellant | Motor fuel for agricultural purpose | 13.00% | |
| | | | Agriculture, horticulture, pisciculture, forestry | 13.00% | |
| | | | Railways | 13.00% | |
| | Kerosene | Heating | All | 13.00% | |
| | Heavy fuel oil | All | | 13.00% | |
| | Natural Gas | All | | 6.00% | |
| | Electricity | All | | 6.00% | |
| United Kingdom | Gas Oil | Heating | Domestic use & less than 2300 litre deliveries | 5.00% | 20.00% |
| | Kerosene | Heating | Domestic use & less than 2300 litre deliveries | 5.00% | |
| | Heavy fuel oil | Heating | Domestic use & less than 2300 litre deliveries | 5.00% | |
| | GPL | Heating | Domestic use & less than 2300 litre deliveries | 5.00% | |
| | Natural Gas | Heating | Domestic use & less than 2300 litre deliveries | 5.00% | |
| | Coal and Coke | Heating | Non business | 5.00% | |
| | Electricity | All | Non business | 5.00% | |

For an estimation of the budget impact of this kind of tax expenditure, product prices, tax rate abatement and consumption by use and users should be taken into account.

Table 9 summarizes a recent study on VAT tax expenditure by IEEP for 2004, in which gas and other fuels are considered.

Table 9 - Implicit subsidies for household consumption by reduced VAT rates (data in millions of Euros, 2004)

| Country \ Consumption | Solid fuels | Fuel oil | Natural gas | Electricity | Total by Country |
|---|---|---|---|---|---|
| Belgium | 6.7 | | | | 6.7 |
| Estonia | 0.5 | | | | 0.5 |
| Greece | | | 4.3 | 239.0 | 243.3 |
| Hungary | 1.2 | | | | 1.2 |
| Ireland | 11.5 | 30.6 | 52.9 | 152.1 | 247.1 |
| Italy | 0.3 | | 114.2 | 1532.9 | 1647.4 |
| Luxembourg | | 2.7 | 12.5 | 25.9 | 41.1 |
| Malta | | | | 10.5 | 10.5 |
| Portugal | | 26.5 | 39.0 | 556.7 | 622.2 |
| United Kingdom | 45.3 | 54.4 | 1907.8 | 2491.6 | 4499.1 |
| EU-25 total | 65.5 | 114.2 | 2130.7 | 5008.7 | |

Source: IEEP (2007)

Among subsidies to households, it is clear that the largest part is granted to the electricity and gas sector (almost 98% of the total). Moreover, it is worth stressing that these figures appear much bigger than the on-budget subsidies.

***BOX 4 - Biofuel subsidies***

*Following the long experience of biofuel use and promotion in Member States, the EU Commission started a biofuels policy in the Eighties[42], when the role of biofuels in reducing Member States' dependence on oil imports was highlighted. Since then the reduction of energy dependence has been linked to the promotion of European Agriculture and the biofuels sector was also supported through the Common Agricultural Policy.*

*The first – but unlucky - example of the use of tax instruments in this area was the proposal known as the Scrivener Directive (1992), where the exemption of liquid biofuels from fuel excise taxes was recommended. Although the Scrivener proposal did not become a Directive, it influenced Member States' national policies: from the early Nineties, France, Austria, Germany, Italy and almost all other MSs introduced some form of tax exemption or reduction[43]. After the EU signed the Kyoto protocol, a series of White Papers called for an increase in biofuel importance and a Directive of 2003 set reference values for the proportions of biofuels in petrol and diesel[44], while Directive 2009/28 increased the target to 10%. Thus, this quota system requires the use of biofuels for a given fraction of the road transport fuel mix and the possible increase in costs is shifted to consumers. As shown by the table below, several Member States employ quota obligations, tax credits or excise reductions[45].*

***Overview of main biofuel support instruments in the EU-27***

[42] Directive 85/536/EEC of 5 December 1985 on crude oil savings

[43] Although almost all Member countries have employed tax rebates for biofuels, there is a huge variation in the intensity of this kind of subsidy and in the definition of eligibility. Moreover, France and Italy have introduced a ceiling to the amount of biofuel that can qualify for tax exemption in order to limit the budget expenditure.

[44] The reference value was set at 5.75 percent market share (in energy content) of all petrol and diesel for transport purposes by 31 December 2010. Directive EC 2003/30

[45] Almost all Member countries have employed some tax rebates for biofuels, but there is a huge variation in these subsidies.

| | AT | BE | BG | CY | CZ | DE | DK | EE | ES | FI | FR | GR | HU | IE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quota obligation | x | | x | x | x | x | x | | x | x | x | | | x |
| Tax exemptions | x | X | | x | x | x | x | x | x | | x | X | x | x |

| | IT | LT | LU | LV | MT | NL | PL | PT | RO | SE | SI | SK | UK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quota obligation | | X | x | x | | x | x | x | x | | X | x | x |
| Tax exemptions | x | X | x | x | x | | x | x | x | x | X | x | x |

***Source: Ecofys (2011)***

*For 2006, GSI estimated biofuel support at more than 10 billion dollars for the main developed countries, of which more than 4 billion are estimated for the European Union.*

***Provisional total support estimates (TSE) for ethanol and biodiesel in selected OECD countries in 2006***

| OECD economy | Ethanol | | Biodiesel | | Total liquid biofuels | |
|---|---|---|---|---|---|---|
| | TSE (billions of US$) | Variable share[1] (percent) | TSE (billions of US$) | Variable share[1] (percent) | TSE (billions of US$) | Variable share[1] (percent) |
| United States[2] | 5.4 – 6.6 | 60% – 65% | 0.5 – 0.6 | ~ 85% | 5.9 – 7.2 | ~ 65% |
| EU[3] | 1.6 | 98% | 3.1 | 90% | 4.2 | 93% |
| Canada | 0.15 | 70% | 0.013 | 55% | 0.11 | 65% |
| Australia[4] | 0.035 | ~ 70% | 0.021 | ~ 70% | 0.05 | ~ 70% |
| Switzerland | >0.001 | 94% | 0.009 | 99% | 0.01 | 98% |
| Total | 7.2 – 8.4 | | 3.6 – 3.7 | | 10.8 – 12.1 | |

(1) This refers to the percentage of support that varies with increasing production or consumption, and includes market price support, production payments or tax credits, fuel-excise tax credits, and subsidies to variable inputs.

(2) The range reflects largely alternative treatment of the income fuel-tax credits (revenue loss basis vs. outlay equivalent basis).

(3) Total for the 25 member states of the European Union in 2006.

(4) Calendar year.

*Source:* GSI country reports.

*The importance of subsidies and tax exemption in biofuel development can be highlighted by the anti-dumping duty that the EU has imposed on biofuel imports from the USA[46].*

It is even more complicated to consider "hidden subsidies" in the form of tariffs paid by consumers (feed-in tariffs). In this case, the level of tariffs does not reflect the actual cost of energy, because it includes a burden imposed upon consumers, mainly devoted to financing renewable sources. This is not very different from a tax, but nonetheless this

46 See COMMISSION REGULATION (EC) No 193/2009 and 599/2009.

money does not feature in the public budget. Therefore, despite their importance from an economic point of view and for any analysis of the redistributive impact, feed-in tariffs are not included in this study.

# 4. Is there any room for environmental fiscal reform?

## *4.1 A snapshot of the budgetary fragility in the EU-27*

The recent financial crisis caused a serious economic downturn, which is still in play. This situation, heightened by doubts about the solvency of the Greek and Irish Governments and their ability to repay their outstanding sovereign debt, put pressure on bond markets and public finances throughout the European Union. The resulting general worsening of Government budgets led to a situation in which almost all Member States (except Estonia, Luxembourg and Sweden) are under the EDP (Excessive Deficit Procedure) of the European Commission. As shown in the first column in Table 10, the budget imbalance exceeds 3% of GDP in almost all cases. The short-term fiscal efforts (i.e. improvement in the budget balance) and deadlines required of each Country to comply with the 3% threshold are shown in the following columns of the table. For at least five countries (Ireland, Greece, Latvia Lithuania and presumably the UK) the fiscal effort required reaches two percentage points of GDP within the next three years. Looking at the long run, it can be noted that without fiscal consolidation the path of debt could lead to an explosive situation in 2060 (for almost all countries) and therefore the primary surplus [47] required to consolidate and stabilize the debt-to-GDP ratio is generally sizable: revenues must permanently exceed expenditures net of interest for an amount greater than 10% of GDP for Greece, Spain, the UK and Ireland (as shown by indicator S2, which includes an age-related expenditure forecast). Based on the current level of debt, projections of the 2060 debt-to-GDP ratio and the long-term fiscal consolidation requirements, the European Commission assesses the budgetary risk of countries on a three-level scale (High, Medium, Low). As shown by "Overall risk assessment" in table 10, only 5 countries (out of 27) achieved a good assessment with a low fragility risk.

[47] The "primary balance" does not take into account interest payments on outstanding debt, and "structural" means that the balance has been adjusted to not be affected by the business cycle and by "one-off" and "temporary" measures.

**Table 10**
**Long term indicators of budget balances in the EU[48]**

| | General Government balance ratio (% of GDP) | Fiscal effort (on General Government balance ratio) | | | Debt ratio (% of GDP) | Debt ratio projections on unchanged policy relative to 2009 (% of GDP) | Required structural primary balance permanent adjustment (% of GDP) | Overall risk assessment | Government Revenue (% of GDP) |
|---|---|---|---|---|---|---|---|---|---|
| | 2010 | Annual Average (% of GDP) | Starting year | Deadline | 2010 | 2060 | S2 | | 2009 |
| CZ | -5.2 | 1 | 2010 | 2013 | 40.0 | 486.7 | 7.4 | high | 40.3 |
| IE | -3.3 | 1,9 | 2011 | 2015 | 97.4 | 848.5 | 1.0 | high | 34.1 |
| EL | -9.6 | >2 | 2010 | 2014 | 140.2 | 884.0 | 1.1 | high | 36.9 |
| ES | -9.3 | >1.5 | 2010 | 2013 | 64.4 | 766.6 | 1.,8 | high | 34.7 |
| CY | -5.9 | > or = 1.5 | 2011 | 2012 | 62.2 | 335.5 | 8.8 | high | 40.3 |
| LV | -7.7 | > or = 2.75 | 2010 | 2012 | 45.7 | 898.1 | 9.9 | high | 34.0 |
| LT | -8.4 | > or = 2.25 | 2010 | 2012 | 37.4 | 545.9 | 7.1 | high | 34.1 |
| MT | -4.2 | 0.75 | 2011 | 2011 | 70.4 | 432.5 | 7.0 | high | 40.5 |
| NL | -5.8 | 0.75 | 2011 | 2013 | 64.8 | 450.3 | 6.9 | high | 46.3 |
| RO | -7.3 | 1.75 | 2010 | 2012 | 30.4 | 633.8 | 9.1 | high | 32.1 |
| SI | -5.8 | 0.75 | 2010 | 2013 | 40.7 | 831.6 | 1.2 | high | 44.4 |
| SK | -8.2 | 1 | 2010 | 2013 | 42.1 | 561.2 | 7.4 | high | 34.0 |
| UK | -1.5 | 1.75 | 2010/2011 | 2014/2015 | 77.8 | 759.2 | 1.4 | high | 40.2 |
| BE | -4.8 | 0.75 | 2010 | 2012 | 98.6 | 372.4 | 5.3 | medium | 48.2 |
| DE | -3.7 | > or = 0.5 | 2011 | 2013 | 75.7 | 318.9 | 4.2 | medium | 44.3 |
| FR | -7.7 | >1 | 2010 | 2013 | 83.0 | 431.3 | 5.6 | medium | 48.1 |
| IT | -5.0 | > or = 0.5 | 2010 | 2012 | 118.9 | 205.9 | 1.4 | medium | 46.6 |
| LU | -1.8 | | | | 18.2 | 437.5 | 12.5 | medium | 41.6 |
| HU | -3.8 | > or = 0.25 | 2010 | 2011 | 78.5 | -26.3 | -0.1 | medium | 45.8 |
| AT | -4.3 | 0.75 | 2011 | 2013 | 70.4 | 337.8 | 4.7 | medium | 48.3 |
| PL | -7.9 | > or = 1.25 | 2010 | 2012 | 55.5 | 318.4 | 3.2 | medium | 37.4 |
| PT | -7.3 | 1.25 | 2010 | 2013 | 82.8 | 389.9 | 5.5 | medium | 41.6 |
| BG | -3.8 | > or = 0.75 | 2011 | 2011 | 18.2 | 9.8 | 0.9 | low | 36.9 |
| DK | -5.1 | > or = 0.5 | 2011 | 2013 | 44.9 | 18.3 | -0.2 | low | 55.8 |
| EE | -1.0 | | | | 8.0 | 81.4 | 1.0 | low | 43.6 |
| FI | -3.1 | > or = 0.5 | 2011 | 2011 | 49.0 | 248.7 | 4.0 | low | 53.2 |
| SE | -0.9 | | | | 39.9 | 93.1 | 1.8 | low | 55.7 |

**Source: European Commission**

As fiscal consolidation will require large adjustments in fiscal balances, its growth effect is a big concern, particularly for the short run. Should fiscal consolidation be sustained by an increase in taxation or an expenditure cut? How much space is left for the 2020 strategy? In other words, the question is to what extent the achievement of climate change-related goals can help or hamper fiscal consolidation. The last column of Table 10 shows the ratio of total

[48] The table is based on several European Commission documents: *"Council recommendation to end the excessive deficit situation"*, *"European Economic Forecast Autumn 2010"*, *"Sustainability report 2009"*, *"Public finance in EMU 2010"*.

taxation to GDP, as an indicator (for the revenue side) of the residual room for manoeuvre. It can be seen that the "high-risk" countries (except for Slovenia and The Netherlands) have lower ratios compared to the "medium" and (especially) the "lower-risk" Countries.

## 4.2 *Tax ratios and tax composition*

As a very general finding, tax ratios show that countries with high risk assessment tend to have a lower tax burden, while the reverse seems true for low risk countries. However, is very difficult to design a general recipe for fiscal instruments and a reference point for general tax ratios. In the last decade new member countries adopted fiscal reforms aimed at boosting efficiency and growth, setting very low progressivity for income tax; as a consequence a space is left for future tax increases, including environment-related revenue. The same can be said for Ireland, which in the last two decades has been characterized by the lowest corporation tax rate among EU countries but introduced, as a first policy reaction to the financial crisis, a $CO_2$ tax.

Some useful insights can be drawn from tax composition and, most importantly, implicit tax rates. Table 11 shows that the tax burden and implicit tax rates usually increase with healthy public finances.

**Table 11**
**Average tax share and implicit tax rates according to risk assessment**

| | | Indirect Taxes | | | | | Direct Taxes | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Risk Assessment | Overall Tax Ratio | Indirect Taxes | - VAT | | - Energy Taxes | | Direct Taxes | - Personal Income | | - Corporate | |
| | | % of total taxes | % of total taxes | Implicit on consumption | % of total taxes | Implicit tax rates | % of total taxes | % of total taxes | Implicit labour | % of total taxes | Implicit tax rate |
| High | 37.8 | 38.1 | 22.6 | 19.5 | 5.0 | 144.2 | 31.3 | 18.0 | 30.6 | 11.0 | 19.5 |
| Medium | 44.7 | 35.5 | 18.4 | 21.4 | 4.7 | 171.3 | 31.2 | 21.6 | 38.2 | 7.7 | 21.4 |
| Low | 49.0 | 40.0 | 24.0 | 26.8 | 5.7 | 175.3 | 37.3 | 28.4 | 36.2 | 7.3 | 26.8 |

Source: Computation on Taxation Trends (2010)

The relative importance of VAT is quite similar among Member States, thanks to the harmonized regime that set homogenous tax bases and minimum tax levels. Despite this harmonization, however, implicit tax rates increase with financial robustness.

Moreover, implicit tax rates on energy highlight a considerable distance between medium and low risk countries and high risk members, even though the smallest share of energy taxes out of total taxation is shown by medium risk countries.

## 4.3 *The expenditure side of the budget: general structure*

In the current total expenditures structure, there is no correlation between present public finance fragility – as defined by the European Commission and the Stability Pact – and the extension of the welfare state. Table 12 provides a breakdown of government expenditure, where expenditures are aggregated into six categories according

to the Classification of the Functions of Government, or COFOG[49]: general public services; defence, public order and safety; economic affairs; environmental protection; housing, recreation, culture, and religion; education, health and social protection. There is a fair degree of variation in what countries prioritize, as the table shows. General public services and defence and public order amount on average to 20% of total expenditure. The "Economic Affairs" function (which includes the previously analyzed energy-related subsidies) amounts on average to 11%.

Public expenditure is mainly devoted – on average 61% – to those sectors (namely "Health", "Education" and "Social Protection") characterizing the "Welfare-State"; furthermore, disaggregated data suggest that one third of this kind of expenditure is related to "Old Age" protection (mainly pensions), while the share of unemployment benefits out of total expenditures comes to 2%. Denmark, at the upper end, allocates more than 70 percent of its government spending to social protection, while Germany, Sweden, France, Luxembourg and Finland spend more than 65 percent.

**Table 12**
**General government expenditure by function (% of total expenditure) according to risk assessment – 2008**

| Risk Assesment | 01 (General public services) | 02 (Defence) + 03 (Public order and safety) | 04 (Economic affairs) | 05 (Environmental protection) | 06 (Housing and community amenities) + 08 (Recreation, culture and religion) | 07 (Health) + 09 (Education) + 10 (Social protection) | *10.02 (Old Age)* | *10.05 (Unemployment)* | Total Expenditure by country |
|---|---|---|---|---|---|---|---|---|---|
| High | 12.6 | 8.1 | 13.3 | 2.0 | 5.5 | 58.4 | *16.2* | *1.7* | 100.00 |
| Medium | 14.7 | 5.9 | 9.6 | 1.5 | 4.2 | 64.2 | *22.3* | *2.5* | 100.00 |
| Low | 12.0 | 7.7 | 10.0 | 1.4 | 4.9 | 64.0 | *19.7* | *2.6* | 100.00 |
| Unweighted Average | 13.2 | 7.3 | 11.5 | 1.7 | 4.9 | 61.4 | *19.1* | *2.1* | 100.00 |

Source: Eurostat

Unemployment-related expenditure represents on average 2% of total public outlays, with a considerable variation among Member States. The highest value is recorded in Germany (5%); new member countries, on the other hand, generally spend less than 1%.

## 5. Concluding Remarks

Environmental policies in general, and climate change mitigation policy in particular, have not had much space in public budgets. The share of environmental taxes out of total taxes has generally decreased in recent years, notwithstanding some recent novelties in $CO_2$ taxation, and the potential to implement a complete environmental tax reform in several Member States. In this context, however, a great impact can be expected from the third phase of the European Trading Scheme, when almost all allowances will be auctioned by Member Countries. On the expenditure side, the share of environmentally-related public expenditure out of total expenditure is small in all countries, but there is a general lack of transparency that makes an appraisal of this extremely difficult. The role and

[49] Only collection of the first level of COFOG data is compulsory for Member States. This results in several missing data at the second more detailed level.

trend of subsidies are even more controversial, also because a standard definition encompassing all aspects is still absent. From an efficiency point of view, subsidies to fossil fuels should be eliminated and resources diverted to the development and deployment of renewables.

Given that a consistent amount of resources have to be invested to implement the ambitious EU climate package, new public funds need to be raised, but this requirement seems to be in conflict with the constraint imposed by European coordination among Member States' public finances. Public Finances in the EU are currently under stress due to the recent financial crisis and to the long-term effect of ageing populations on public budget balances. This situation is exacerbated by the recent EU council agreement, which committed to an increase in EU fiscal policy credibility through supplementary public finance coordination and a strengthening of the European Stability Pact.

However, climate change must be faced squarely and directly and this need cannot be put aside by governments: conciliation between financial stability and a climate package needs to be reached.

A "green golden rule", under which climate-change-related investments would be irrelevant for the definition of balances monitored by the European Stability Pact), may represent a reasonable way of dealing with both issues.

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## Glossary

**Environmental Taxes**

An **environmental tax** is a tax whose tax base is a physical unit (or a proxy of it) that has a proven specific negative impact on the environment. Following the Eurostat Statistical Guide on Environmental taxes, four subsets of environmental taxes are distinguished with the relevant tax bases. Energy taxes include levies on energy products used for both transport and stationary purposes, such as: Unleaded petrol, Leaded petrol, Diesel, Other energy products for transport purposes (e.g. LPG or natural gas), Light fuel oil, Heavy fuel oil, Natural gas, Coal, Coke, Biofuels, Other fuels for stationary use, Electricity consumption, Electricity production, District heat consumption, District heat production. As a convention, $CO_2$ taxes are also included here. Transport taxes are related to the ownership and use of motor vehicles and can be levied on: Motor vehicles – one-off import or sales taxes,

Registration or use of motor vehicles – recurrent (e.g. yearly) taxes. Resource taxes are related to the extraction and the subsequent depletion of natural resources and are charged on Water abstraction, Extraction of raw materials (except oil and gas) and Other resources (e.g. forests). Pollution taxes are related to measured or estimated emissions to air and water, the management of solid waste and noise. In some detail, they are levied on: Measured or estimated NOx emissions, $SO_2$ content of fossil fuels, Other measured or estimated emissions to air, Ozone-depleting substances (e.g. CFC or halon), Measured or estimated effluents of oxydizeable matters (BOD, COD), Other measured or estimated effluents to water, Effluent collection and treatment fixed annual taxes, Pesticides (based on e.g. chemical content, price or volume), Artificial fertilisers (based e.g. on phosphorus or nitrogen content or price), Manure, Waste management in general (e.g. collection or treatment taxes), Waste management, individual products (e.g. packaging, beverage containers), Noise (e.g. aircraft take-off and landings). For further information, see the Eurostat manual "Environmental Taxes - A statistical guide".

**Implicit tax rate**

The **implicit tax rate**, sometimes also referred to as an **average** or **effective tax rate**, is calculated by dividing the revenues from taxes on a special activity or good by an appropriate corresponding aggregate tax base.

**Tax expenditures**

According to the IMF definition (the OECD one is similar) they are "revenues forgone as a result of selective provisions in the tax code. They may include exemptions from the tax base, allowances deducted from gross income, tax credits deducted from tax liability, tax rate reductions, and tax deferrals (such as accelerated depreciation)". For further information, see the FMI "Manual on Fiscal Transparency 2007" (pag. 76) or the OECD "Journal on Budgeting", Vol IV, n. 1, 2004, (p. 130).

**Direct taxes.**

Taxes that are levied directly on personal or corporate incomes and property.

**Indirect taxes**

Taxes that are levied during the production stage, and not on the income and property arising from economic production processes. Prominent examples of indirect taxation are Value Added Tax (VAT), excise duties, import levies, energy and other environmental taxes.

**Excise duties.**

Excise duties are indirect taxes on the consumption or the use of certain products. In contrast to Value Added Tax (VAT), they are mainly specific taxes, i.e. expressed as a monetary amount per quantity of the product.

**On-budget subsidies**

Interventions which appear as outlays in the general government balance sheet, like direct financial transfers (grants to consumers/producers) or appropriations for energy-related services directly undertaken by the government.

**Energy-related services provided directly**

The definition (in table 3) covers a broad range of interventions where the General Government directly provides

services for the benefit of energy sectors: direct investments in energy specific infrastructures, energy-related R&D carried out in public (owned and funded) centres of research, and services related to the provision of Liability Insurance (in the case of nuclear plants) and facility decommissioning operations.

**Off-budget subsidies**

Interventions not featuring in the balance sheet, like provision of tax expenditures (the revenues foregone can be considered an implicit subsidy) or benefits originating from market regulation.

**Budget balance**

The balance between total public expenditure and revenue in a specific year, with a positive balance indicating a surplus and a negative balance indicating a deficit. For the monitoring of Member State budgetary positions, the EU uses a ***general government*** aggregate, which covers national government, regional and local government, as well as social security funds; public enterprises are excluded, as are transfers to and from the EU Budget.

**Primary budget balance**

The ***budget balance*** net of interest payments on ***general government*** debt.

**Structural budget balance**

The actual ***budget balance*** net of the ***cyclical component*** and ***one-off and other temporary measures***. The structural balance gives a measure of the underlying trend in the budget balance.

**Cyclical component of budget balance**

That part of the change in the ***budget balance*** that follows automatically from the cyclical conditions of the economy, due to the reaction of public revenue and expenditure to changes in the ***output gap*** (i.e. the difference between actual output and estimated ***potential output*** at any particular point in time). The potential output is the level of real GDP in a given year that is consistent with a stable rate of inflation. If actual output rises above its potential level, then constraints on capacity begin to bind and inflationary pressures build; if output falls below potential, then resources are lying idle and inflationary pressures abate. A method to estimate it is the ***production function approach,*** based on available labour inputs, the capital stock and the level of efficiency.

**One-off and temporary measures**

Government transactions having a transitory budgetary effect that do not lead to a sustained change in the budgetary position.

**Primary structural budget balance**

The ***structural budget balance*** net of interest payments.

**Fiscal effort**

In general it is an intervention required to improve the budget position. In table 7 it represents the annual required adjustment of the General Government Budget Balance ratio to GDP for the Maastricht reference value (deficit/GDP equal to or less than the threshold of 3%) to be achieved by the countries currently under the **Excessive Deficit Procedure**.

**Indicator S2**

Broadly, the concept of sustainability can be intuitively expressed as the ability of a government to assume the financial burden of its debt currently and in the future, without the debt following an "explosive path". Surveillance of the sustainability of the Member States' budgets is one of the most important tasks the European Commission undertakes (it is essential for carrying out a common monetary policy) and for this purpose certain technical tools are employed to assess States' fiscal position. Among them, the ***$S_2$ stability indicator*** *shows the size of the permanent adjustment to the structural primary balance required to fulfil the infinite horizon intertemporal budget constraint, including paying for any additional expenditure arising from an ageing population*.

Fulfilment of the infinite horizon intertemporal budget constraint implies that the discounted value of the future structural primary balances should cover the current level of debt. Mathematically:

$$D_{t_0} = \sum_{t=t_0+1}^{\infty} \frac{PB_t}{(1+r)^{t-t_0}} \quad (1)$$

where

- $t_0$ is the last year before the long-term projection;
- $D_{t_0}$ is the gross debt relative to GDP in $t_0$ (the initial level);
- $PB_t$ is the structural primary balance relative to GDP in t;
- $r$ is the differential between the nominal interest rate (R) and the nominal GDP growth rate (G), that is $1+r-\frac{1+R}{1+G}$

Given the initial level of debt, the assumption on the differential rate and the projected path of the structural primary, the condition (1) may not hold, which means an uncontrolled evolution of debt. A permanent adjustment ($S_2$) in the structural primary balance is necessary to fulfil the constraint, so that the condition (1) becomes:

$$D_{t_0} = \sum_{t=t_0+1}^{\infty} \frac{PB_t + S_2}{(1+r)^{t-t_0}} \quad (2)$$

and considering that $S_2$ is constant and $\sum_{t=t_0+1}^{\infty} \frac{1}{(1+r)^{t-t_0}} = \frac{1}{r}$ (3), with the discount rate strictly positive, it follows that:

$$S_2 = rD_{t_0} - r\sum_{t=t_0+1}^{\infty}\frac{PB_t}{(1+r)^{t-t_0}} \quad (4)$$

A final step is required to find out the different components of the indicator. Indeed each future structural primary balance can be expressed as a change with respect to the initial one, that is $PB_t = PB_{t_0} + \Delta PB_t$ therefore:

$$S_2 = rD_{t_0} - PB_{t_0} - r\sum_{t=t_0+1}^{\infty}\frac{\Delta PB_t}{(1+r)^{t-t_0}}$$

where two components can be identified:

- $IBP = rD_{t_0} - PB_{t_0}$ the **Initial Budgetary Position**, corresponding to the gap between the initial structural primary balance and the debt-stabilising primary surplus.
- $LTC = r\sum_{t=t_0+1}^{\infty}\frac{\Delta PB_t}{(1+r)^{t-t_0}}$ the **Long-Term Change** in expenditure is the additional adjustment required as a result of expenses arising especially from the ageing of the population, so that the magnitude of the LTC component depends on both the demographic outlook for countries and their social protection arrangements.

For further information, see the European Commission "Sustainability Report 2009" or the European Central Bank "Working Paper Series 2009 n. 944".