Taxing Energy Use

A GRAPHICAL ANALYSIS

OECD

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Foreword

Energy generation, distribution and use is critical to modern economies, both as an input to industrial production and as an important element of consumer spending. At the same time, current patterns of energy generation and use contribute significantly to environmental problems such as climate change and air pollution.

Taxation is one of the most important government policies affecting energy use. Indeed, the OECD's Green Growth Strategy *highlights the importance of pricing pollution through market-based mechanisms, such as taxes or tradable permit systems, and eliminating inefficient fossil-fuel subsidies.*

This report Taxing Energy Use: A Graphical Analysis *provides for the first time a systematic comparative analysis of the structure and level of energy taxes in OECD countries. It contributes to a better understanding of the price signals conveyed by current tax systems to consumers of fuels. It presents effective tax rates in terms of both energy content and carbon emissions for the full range of energy sources and uses in each country, along with reported tax expenditures, the size of the relevant tax base in each case, and an illustration of the revenues raised or foregone.*

Our analysis illustrates substantial differences, both across and within countries, in the tax treatment of different forms, uses and users of energy. While in some cases tax rate differentials have clear justifications, in many other cases the rationale is less obvious. This is particularly notable where effective tax rates vary across energy products that are used for the same or similar purposes. Such variations, and the low levels of taxation on fuels with substantive environmental impacts, suggest an opportunity for countries to reform their energy tax systems to achieve their environmental, economic and social policy goals more cost-effectively. At the same time, there is an opportunity to raise additional revenues in an economically efficient way and to improve public finances.

The profiles of energy taxation illustrated in this report are a data-rich tool that can help policy makers and analysts to evaluate the role and impact of current energy tax settings and to plan potential reforms. They are an important addition to the OECD toolkit of statistics, analyses and recommendations supporting country efforts to promote Green Growth. In short, it aims to support countries in promoting better and greener tax policies for better lives.

Angel Gurría
Secretary-General

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Table of contents

Tables

Figures

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Executive summary

Energy use is a critical component of modern economies: it is a key input to production and an important element of consumer spending. However, many forms of energy – particularly fossil fuels – also contribute to significant environmental problems, such as climate change and local air pollution. The taxation of energy is a key policy instrument that, whether intended or not, has a significant impact on energy prices, energy usage and the resulting environmental impacts.

This publication provides a systematic comparative analysis of the structure and level of taxes on energy use in all OECD countries. It presents effective tax rates on energy use in terms of both energy content and carbon emissions, together with detailed graphical profiles of the structure of energy use and taxes on energy in each country.

The first part of the report outlines the methodological approach taken, summarises various effective tax rates across countries, and highlights a number of key implications of these results. The second part of the report is made up of individual country sections that describe in more detail energy taxation in each country and present the graphical profiles of energy use and taxation.

Energy taxation and structure of country profiles

Governments tax energy, particularly fossil fuels, for a variety of reasons. Taxes on fuel are a powerful tool for internalising in prices the cost of environmental damage caused by emissions of CO_2 and local air pollutants from burning fossil fuels. In the case of motor vehicle fuels, taxes may also be used to approximate costs attributed to road congestion, accidents and noise. Fuel taxes are also an important source of government revenues. In some countries, the revenues are earmarked for specific purposes like road infrastructure and may be seen as a type of user charge (albeit based on some measure of average rather than marginal cost).

Regardless of their formal purpose, however, energy taxes send important price signals that influence energy use patterns. The graphical profiles illustrate on a consistent basis across countries the impact of taxes on price signals sent in relation to energy and carbon content.

The graphical profiles for each OECD country have been constructed by "mapping" the tax rate applying to each type and use of energy against the quantum of those different uses. Both the tax rates and energy use data have been converted into common units – based alternately on energy content (measured in gigajoules) and carbon emissions (measured in tonnes of CO_2 emitted).

The graphs also present tax expenditures with respect to energy use that are reported by many countries. In each case, the graphs illustrate the country "benchmark" rate of tax that would normally apply, the concessional rate, the tax revenue foregone and the significance of the related energy use in terms of energy content and CO_2 emissions. By setting tax expenditures in the context of each country's overall energy tax system, the graphs are a useful complement to the budgetary information on tax expenditures presented in the OECD's *Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels – 2013*. They are also a useful tool to aid countries in establishing or revising benchmarks for tax expenditure purposes in order to provide greater transparency regarding differences in tax rates for similar fuels and uses.

Effective tax rate differences across countries

The graphical profiles show that countries differ markedly in terms of both the composition of energy use and the way that energy use is taxed. In particular, countries differ in the range of energy products that are taxed, in tax base definitions and in tax rate levels and rebates.

Based on statutory rates in effect on 1 April 2012, overall effective tax rates on energy range from EUR 0.18 per GJ in Mexico (not taking into account the variable rate component of its fuel excise tax, which has been negative in recent years) to EUR 6.58 per GJ in Luxembourg, with a simple average for all OECD countries of EUR 3.28 per GJ and a weighted average of EUR 1.77 per GJ. Meanwhile, effective tax rates on carbon range from EUR 2.80 per tonne of CO_2 in Mexico to EUR 107.28 per tonne of CO_2 in Switzerland, with a simple average for all OECD countries of EUR 52.04 per tonne of CO_2 and a weighted average of EUR 27.12 per tonne of CO_2.

The highest overall effective tax rates tend to be in European countries, where energy-tax policy is significantly shaped by the 2003 European Union Energy Taxation Directive, which sets minimum tax rates for a variety of energy commodities. Many of the countries with the highest effective tax rates on carbon are countries with explicit carbon taxes (*e.g.* Denmark, Iceland, Ireland, Norway, Sweden, Switzerland). Explicit carbon taxes generally exist alongside other taxes on energy products, which are sometimes based on the energy content of different fuels. These countries tend to tax a broad range of energy products and to have more consistency in rates across different fuels and uses, particularly with respect to heating and process use.

Many Central European and Asian OECD member countries (*e.g.* the Czech Republic, Estonia, Hungary, Japan, Korea, Poland, the Slovak Republic, Turkey) tend to have lower effective tax rates on carbon than the countries mentioned above. The lowest effective tax rates on carbon are found in Australia, New Zealand and the Americas (Chile, Canada, Mexico and the United States). These last countries typically only tax fuels used in transport and generally do so at lower rates than the OECD average (an exception being at the provincial level in Canada).

Effective tax rate differences within countries

Within countries there are often substantial differences in the way in which different forms, uses and users of energy are taxed, whether they are compared in terms of energy content or CO_2 emissions. The report considers effective tax rates in three broad categories of energy use: transport; heating and process use; and electricity.

In almost every country, energy products used in transport (mainly gasoline and diesel) are taxed significantly more than energy products used for heating or process use, or to generate electricity. This is unsurprising given the broader range of policy goals that governments may be attempting to address in the transport category compared to other areas of energy use. While the combustion of fossil fuel will emit CO_2 and certain air pollutants regardless of use, fuels used in road transport also contribute to other externalities, such as congestion, traffic accidents and noise, which may have an even higher social cost than these emissions. In the absence of road pricing, which may be the best approach, road fuel consumption may be a rough proxy for these other external costs, since fuel use is correlated with distance driven. In addition, a number of countries formally or informally earmark road fuel taxes to fund road construction and maintenance.

Within the heating and process use category, in many countries energy products used for industrial or energy transformation purposes are taxed at lower rates (whether through explicit taxes or through emissions trading systems) than the same energy products used for residential or commercial purposes, perhaps driven by concerns about not undermining industrial competitiveness. In a number of other countries, however, the reverse holds, which may reflect a government strategy to try to protect households from high energy costs. However, since exemptions that hold down energy prices for particular sectors can distort energy use in an environmentally damaging manner, there may be better mechanisms for addressing these concerns. For example, it is usually more effective from an environmental point of view to preserve the price signal sent by fuel taxes and address other impacts on industry or low-income families by more direct means, such as cash transfers that do not directly subsidise energy use.

The third category shown in each country profile is electricity. Electricity is a secondary energy product generated from some primary energy source, like natural gas, coal or wind. Rather than simply showing the final electricity consumed, the maps show the fuels used to generate electricity, which captures the significant amount of energy lost in converting fossil energy into electricity. Countries tax electricity in two ways: by taxing the fuels used to generate electricity, and/or by taxing the consumption of electricity. The country profiles take into account both types of tax. Where the consumption of electricity is taxed, the effective tax rates are calculated as if the electricity tax were an implicit tax on the underlying fuels used to make electricity, according to their relative proportions in the mix of primary energy used for electricity generation in the particular country.

Significance of variations in effective tax rates

While some variations in effective tax rates across energy uses are clearly justified, in many cases, the rationale for the observed variations is not obvious and rates may not be reflective of the external costs associated with different forms of energy and energy use. This is particularly the case where effective tax rates vary across energy products that are

used for the same or similar purposes. Such variations may suggest that some countries have not given great weight in their tax policy design to environmental damage from fuel use, such as that caused by carbon emissions. Many differentials may, however, have simply arisen out of the piecemeal design and introduction of taxes on different energy products at different points in time. The report notes various situations that suggest a need for reappraisal of tax settings:

- The effective tax rate on diesel for road use in terms of both energy and carbon content is typically lower than the comparable rate on gasoline.
- In both the transport and the heating and process categories, oil products (predominantly gasoline and diesel) tend to be taxed significantly more heavily and more frequently than other energy products, such as natural gas and coal.
- Among heating and process fuels, there is often a very low (or zero) tax rate on coal, despite its significant negative environmental impacts, particularly its greater contribution than other fuels to greenhouse gas emissions and other air pollutants per unit of energy.
- Fuel used in agriculture, fishing and forestry is often exempt from tax, providing no signal with respect to external costs, thereby encouraging over-use.
- In the electricity category, coal, which is widely used, is often taxed at a lower rate than natural gas and biofuels and waste; and taxes on the consumption of electricity provide no signals in terms of the differing environmental impact of the various primary energy sources from which electricity may be generated.

These uneven price signals with respect to different energy products, and low rates and exemptions on some of them, suggest that some of the lowest-cost opportunities to reduce carbon emissions are being foregone. In many countries, a reappraisal may be warranted to explicitly determine whether current energy tax settings are appropriately adapted to their environmental, social and economic goals. The profiles of energy taxation in this report provide policy makers and analysts with a data-rich tool to aid in the review and reappraisal of energy tax systems.

PART I

Overview

Taxing energy use in OECD countries

1. Introduction

Energy use is a critical component of modern economies. It is a central ingredient in industrial and commercial production and in consumer consumption. Many forms of energy use, however, also contribute to significant environmental problems, such as climate change and air pollution.

Taxation affects the price, and therefore the use, of various forms of energy. Understanding the structure and level of energy taxes in a country is therefore central to policy discussions regarding energy use. Given the centrality of energy to the economy and the environment, such an understanding is a key reference point for consideration of how policy can best support "green growth" (see OECD, 2011).

This document aims to improve understanding of the relationship between energy use and taxation by illustrating the structure of energy use and taxes on energy consumption in the 34 member countries of the OECD. Specifically, it presents a set of data-rich "maps" for each country, which serve three general objectives:

- to understand the composition of energy use in each country and the carbon dioxide (CO_2) emissions associated with that use;
- to illustrate the structure of energy taxation in each country: the coverage of the various tax bases related to energy consumption; the effective tax rates in energy and carbon terms that apply to different fuels, uses of fuel, and fuel users; and the various tax expenditures that are provided; and
- to establish an analytic foundation for discussion about appropriate tax settings on energy use and for assessment of the tax treatment of different types, uses and users of energy.

The document is structured as follows. Part I – Overview – sets out the policy background to energy taxation and the issues that the maps will help to examine, explains the structure of the maps, outlines the methodology and data sources used, and presents summary results using the data obtained from the maps. Part II – Country profiles – outlines the energy tax system in each country, and presents and discusses the maps of energy use and taxation.

2. Background

2.1. Why countries tax energy

In modern economies, goods and services are often subject to broad-based consumption taxes like value-added or retail sales taxes. A relatively few goods are also subject to specific product and services taxes or excises. Among the products most commonly subject to specific taxes is energy – including fossil fuels like petroleum products, natural gas and coal, as well as secondary energy products like electricity.

There are at least three rationales that countries commonly give for taxing energy:

- Fuels are often taxed in order to internalise in prices some portion of the social cost or externalities that result when private actors burn the fuels, such as the damage caused by emissions of CO_2 and local air pollutants. Using taxes to "price externalities" is referred to as Pigouvian taxation. For externalities that have a global impact, like greenhouse gases, the damage cost may be uniform, while for local air pollutants like those that cause smog, the damage cost will vary from one location to another. Again, marginal damages can differ between stock pollutants (like greenhouse gases) the effect of which is mostly a function of their accumulation, and flow pollutants the effect of which is more closely tied to current emissions. Whether or not a tax on a good that causes external costs is explicitly intended to internalise some of those costs, it will send price signals that implicitly have that effect.
- In some cases, an energy product is taxed simply because it is an essential product the demand for which is relatively inelastic – meaning that an increase in price will cause a relatively small reduction in demand. Such a product can be an attractive tax target because demand and thus government revenue is relatively stable. Consistent with the so-called Ramsey rule of optimal commodity taxation, taxing this type of product does not significantly alter people's preferred consumption patterns. However, like all forms of taxation, energy taxes have significant income and welfare impacts.
- While energy tax revenues are most often directed into general government coffers, in some cases they are earmarked for particular uses, such as where revenues from taxes on road fuel are devoted to maintenance of the highway system.[1] In some cases like this, excise taxes may be viewed as a type of user charge (albeit one based on some measure of average rather than marginal cost).

In practice, governments often tax energy with more than one of these objectives in mind. They will also typically be concerned to meet these objectives while taking into account the role of other environmental policies and minimising negative impacts on the level of economic activity, on particular industries, and on the distribution of income among households. Box 1 discusses in more detail some insights from the optimal tax literature on the use of taxes to internalise external costs.

Regardless of the purpose for which countries tax energy, specific taxes change the relative prices of different forms of energy and thus patterns of energy use, with important economic and environmental consequences. CO_2 emissions from fossil fuel use represent more than 56% of global greenhouse gas (GHG) emissions and more than 73% of total CO_2 emissions. Fossil fuel taxation is therefore a central issue in climate change policy. It also affects net incomes and has important distributional implications. The effect of energy taxes on behaviour is discussed in Box 2.

Box 1. **Optimal commodity taxation to address externalities**

Governments tax energy products for various purposes, such as internalising external costs and raising revenues. Optimal taxation theory discusses how such varying objectives can be met, while minimising the social cost of taxation.

A negative externality or spillover arises where the production or consumption of a good (or service) imposes a cost on a third party. For example, a factory that burns coal creates a negative externality in terms of the pollution emitted. Because the environmental cost of this pollution is borne by society rather

Box 1. **Optimal commodity taxation to address externalities** *(cont.)*

than the factory, the factory will emit more than would be socially optimal. Pigou (1920) showed that the imposition of a tax on coal (or any other polluting activity) could curb emissions by internalising the social cost in the factory owner's production decision.

To fully internalise a negative externality, a "Pigouvian" tax should be imposed at a rate equal to the marginal social cost of the pollution damage, although determining that marginal damage can be difficult. For example, the social cost of carbon has been variously estimated in the range USD 10 to USD 350 per tonne of CO_2 emitted (Yohe *et al.*, 2007). Nonetheless, a Pigouvian tax that is slightly too high or slightly too low, is still likely to provide significant welfare gains compared to the absence of a tax (Heine *et al.*, 2012).

How does the desire to use commodity taxes to raise public revenues affect the level and structure of a Pigouvian tax? The Diamond-Mirrlees (1971) production-efficiency theorem indicates that in a world without externalities (and subject to certain assumptions) taxes should only be imposed on the final consumption of goods and services. The rationale is that "any distortion of production decisions reduces aggregate output, which cannot be wise so long as there is some useful purpose to which that output could be put" (Crawford *et al.*, 2010). The presence of externalities still justifies the imposition of a Pigouvian tax on the intermediate good to correct for the negative externality, but, beyond this, any additional taxation should be imposed on final consumption alone.

There is also some justification for imposing differential tax rates on final consumption which could result in optimal tax rates on polluting goods being greater than the Pigouvian level. Ramsey (1927) showed that in order to raise a given amount of revenue at the lowest cost (in terms of distortions to consumption decisions), higher tax rates should be imposed on goods for which demand is not very sensitive (inelastic) to price increases, with relatively lower tax rates on goods for which demand is more sensitive (elastic) to price increases (the so-called "Ramsey rule"). In the context of taxes on fuel, for which demand tends to be less sensitive to price changes (see Box 2), this implies that taxes on final consumption above Pigouvian levels may be optimal. One weakness, however, in applying this approach is the need for reliable and up-to-date elasticity estimates for all goods. Furthermore, as many inelastic goods (*e.g.* food and energy) may represent a large proportion of consumption by low-income families, implementing the rule may create equity concerns and require off-setting measures.

Optimal commodity tax rates also need to take account of the impact of commodity taxes on the labour market. Commodity taxes push up commodity prices and thereby reduce the consumption value of wages (meaning that fewer goods can be purchased with a given wage). By reducing the reward from working, this tends to discourage labour effort. Assuming leisure cannot be taxed to neutralise incentives, one indirect solution is to tax goods that are complements with leisure more heavily than other goods in order to make leisure less attractive (Corlett and Hague, 1953; Diamond and Mirrlees, 1971; West and Williams, 2007; Crawford *et al.*, 2010). Again, the practical implementation of this kind of differential taxation is difficult given the high administrative cost of establishing and adjusting rates based on accurate data on the complementarity of different goods with leisure, and accurate elasticity estimates. These concerns lead Crawford *et al.* (2010) to conclude that, externality issues aside, there is a strong pragmatic case for uniformity in commodity taxation.

Finally, recent literature has examined the potential for "recycling" the revenue from a Pigouvian tax (like that on fuels) to fund reductions in other distortionary taxes such as those on labour income in order to offset some or all of the efficiency cost of the Pigouvian tax (see, for example, Bovenberg and de Mooij, 1994; Bovenberg and Goulder, 2002; Jacobs and De Mooij, 2012). This includes the question of whether there is potentially a "double dividend" from both reducing environmental harm and reducing the efficiency cost of the tax system as a whole. Much depends on the structure, rates and impacts of the particular taxes being adjusted. Heine *et al.* (2012) note that the literature generally finds that the revenue recycling benefits of reducing labour income taxes are outweighed by the efficiency losses in the labour market due to higher energy prices. They conclude that "the optimal tax is below the marginal external damage, but only moderately so, implying that the Pigouvian tax is still a reasonable, rough approximation".

Box 2. **Are energy taxes an effective policy tool?**

As discussed above, energy is often an attractive tax target because energy demand by consumer and firms is relatively price inelastic – not very sensitive to changing price levels. On the other hand, energy taxes are often used to ensure that the price of energy reflects some of the external costs that energy use imposes on others – harmful emissions, congestion, etc. Used in this way, energy taxes provide a signal aimed at changing behaviour – indirectly encouraging consumers and firms to choose energy-saving or greener products and practices. How does one reconcile these two purposes – does the former imply that energy taxes are not very effective in the latter role of adjusting price signals in order to change behaviour?

Part of the answer is that the key element in achieving the second purpose is to incorporate the external costs of fossil fuel use into fuel prices. How much behaviour changes will depend on how important the activity is to people and what alternatives are available.

A "macro" approach to assessing the degree of behavioural change could be to compare the level (or the trend) of energy taxes in different economies with the energy intensity of the economy (*e.g.*, the share of energy consumption to GDP). Through this kind of analysis, a general indirect relationship can be found. However, energy intensity is a global measure influenced by other factors unrelated to taxation, such as the availability of energy resources and energy-saving technologies, and the stage of economic development in a country (Liddle, 2012). As a result, this kind of comparison can hardly give a precise indication of the efficacy of energy taxes.

The usual measure of the reactivity of demand to price changes is referred to as elasticity. A good's "own-price" elasticity is computed as the percentage change in quantity demanded in response to a one per cent increase in the price of the good (holding constant other factors). OECD (2006), summarises earlier studies which found that the short-run price elasticity of energy as a whole seems to be relatively low, with results in the range between –0.13 and –0.26. This implies that in the short-run, energy practices do not change very much given a change in price. By contrast, studies found considerably higher elasticities in the long run, in the range of –0.37 to –0.46. This implies that if changes persist, and firms and individuals have time to adjust, their behaviour will change. In the case of gasoline, elasticity estimations were even lower (–0.15 to –0.28) for the short term, but higher (–0.51 to –1.07) in the long term. Thus, if road fuel becomes more expensive, people may react by, for example, buying more efficient vehicles or choosing homes closer to where they work. While the level of reactivity differs greatly between products, countries, time spans and income groups (Dahl, 2012), in general long-term elasticities have proven to be considerably higher than shorter ones. With time, firms and consumers adjust and find ways of meeting their needs in a more energy-efficient manner. There is also a literature suggesting that in some cases the elasticity of demand in response to tax changes may be higher than with respect to other price changes (Li *et al.*, 2012; Rivers and Schaufele, 2012).

The reactivity of demand can also be evaluated through "cross-price" elasticities; the percentage change in quantity demanded of an energy-related product in response to a one per cent increase in the price of energy . An example of the importance of cross-price elasticitiy is the evidence of the increase in proportion of the vehicle fleet which uses diesel fuel as a result of more favourable taxation of diesel relative to gasoline and the greater efficiency of diesel engines.

Therefore, energy taxes can have a significant impact in the long run on energy demand and its composition. This implies that environmentally related taxes should be implemented with a long-term view, avoiding set-back due to temporary pressures (*e.g.*, when underlying energy prices increase) and with advance notice of the introduction of the tax and of gradual increases in the tax rate (OECD, 2006).

2.2. Current energy tax challenges

The taxation of energy has gained much attention in recent years. On one hand, combating climate change and addressing air pollution – and the risks they pose to our

economies and overall well-being – calls for economic systems that take into account the environmental impacts of our energy choices. OECD analysis has consistently shown that price signals – as modified through energy taxes or emission trading schemes – are one of the best policy instruments to induce more sustainable patterns of energy use (OECD, 2001, 2006, 2008, 2010a, 2013). On the other hand, after a new wave of fossil fuel price increases, the impact of high energy prices on household budgets and firm competitiveness is a cause of great concern among policy makers. In many countries, the reform of energy taxes and carbon pricing is under lively debate. Tax options take on a particular urgency in an environment where governments are struggling to restore fiscal balance.

An understanding of the role of energy taxes and their relationship to energy use is crucial to a number of broader current policy challenges:

- Politicians, concerned about relieving the adverse impact of high energy prices on low income households at a time of sluggish economic growth, need mechanisms that can address distributional issues without blunting the scarcity and environmental signals sent by energy prices and taxes.
- Similarly, to achieve environmental objectives and move their economies to a green growth path, policy makers need to ensure that appropriate price signals are sent to industry and households regarding energy use, while recognising the need to cushion adjustment impacts.
- In countries adopting (or considering) explicit carbon pricing, the respective role and scope of taxes and emission trading schemes needs to be weighed and carefully designed, recognising the advantages and disadvantages of the two policy tools, with taxes generally having some role given the difficulty of instituting trading for small players.
- Inspired partly by approaches in some Nordic countries, the European Commission has proposed to amend the European Energy Tax Directive[2] by splitting the minimum tax rates – currently based only on the energy content of products – into two components: one based on CO_2 emissions and one based on energy content, and gradually expanding coverage and rates.
- Given commitments to phase out inefficient fossil fuel subsidies, governments need analytic tools to examine the incidence, economic rationale and environmental impacts of fossil fuel preferences within their energy tax systems.

This report is intended to fill an important information gap and to provide a more sound analytic basis on which to address these kinds of policy challenges. To do so, it presents detailed "maps" of energy usage and energy tax structures in the 34 OECD countries. It is recognised that countries have different structures and rates of tax on energy products for a variety of reasons, including differences in revenue-raising needs, environmental goals and policy instruments, resource endowments, and different views about income distribution. In all cases, however, these data-rich illustrations, prepared on a common basis, are a powerful tool for examining and assessing the connections between tax policy and energy use. Why are there relatively high taxes on some energy products and little or no taxes on other energy products? In light of objectives and impacts, are some rates too low? Are other rates too high? It is hoped that the maps will contribute to sound analysis and understanding of these issues, helping policy makers to design effective policies, and increasing public understanding of alternative policy choices and their implications.

3. Structure of the maps, methodology and data sources

The maps show the composition of energy use in each OECD country covered and the effective rate of tax on various segments of energy use. Both energy use and tax rates are shown alternately in terms of energy content and carbon content. Partly inspired by the approach of Sweden's tax expenditure reports, they also depict reported tax expenditures, showing both the actual tax rate and the benchmark rate against which the value of the preference is calculated.

This section provides an overview of the methodology, assumptions, and data sources underlying the maps. Further details on these can be found in Annex A, or, where specific to a particular country, in the relevant country chapter.

3.1. Tax base – energy use

The horizontal axis of each map shows all final use of energy by businesses and individuals, including the net energy used in energy transmission and in the transformation of energy from one form to another (*e.g.*, crude oil to gasoline, coal to electricity). Energy use has been grouped into three broad categories: transport; heating and process use; and electricity. These three areas have been further disaggregated for each country, generally reflecting the particular tax base of that country. The subcategories therefore differ between countries depending on the nature of the fuel, its user, or its use.

Since different types of energy are normally measured and taxed in varying units of volume or mass (*e.g.* litres of gasoline, tonnes of coal, megawatt hours of electricity), all forms of energy are expressed in terms of a common unit (using standard conversion factors). In the first figure for each country, fuel quantities are expressed in terms of energy value (in gigajoules – GJ), reflecting that what all the products have in common is that they are sources of energy. In the second figure for each country, the quantities of the various energy sources are expressed in terms of the carbon emissions associated with their use (in tonnes of CO_2).[3] Since the emissions figures are derived rather than being directly measured, they will differ somewhat from measured emissions reported for such purposes as national greenhouse gas inventories. The re-expression of tax bases in terms of carbon content permits a focus on the structure of taxation with respect to one of the main purposes for which fuel is taxed in many countries – to reflect (at least in part) the social cost of carbon emissions. Consistent with the focus of the publication, only CO_2 emissions associated with fuel combustion are covered; emissions such as those from landfills, fields, livestock, and chemical reactions in industrial processes are not included.

Electricity is different from most of the other energy types shown in that it is a *secondary* energy which must be generated by use of some *primary* energy (*e.g.*, coal, natural gas, nuclear power, hydro). The electricity category of the map therefore shows the energy content or carbon emissions of the underlying primary fuel used to generate the electricity domestically rather than of the electricity itself. Thus, even though electricity itself does not give rise to carbon emissions, the maps illustrate the carbon emissions from generating that electricity as well as the efficiency losses incurred in the generation process (due to the fact that, for example, 100 GJ of natural gas may be required to produce 70 GJ of electricity). Depending on the particular tax system, the electricity category may be subdivided by the type of fuel used to generate the electricity, or by the user of the electricity. If the latter, the figures shown represent the particular user's share of the input fuels used to generate electricity.

Data on energy use is taken from the 2009 *Extended World Energy Balances* (IEA, 2011a).

3.2. Tax rates and tax expenditures

On the vertical axis, the maps show the rate of specific taxes and related tax expenditures that apply to energy use. The taxes covered are those such as excises levied directly on a physical measure of energy product consumed. Taxes that apply to a very broad range of goods (such as value added and retail sales taxes) are not included on the basis that since they apply equally to a wide range of goods, they do not change relative prices. On the other hand, where an energy product is subject, for example, to a concessionary rate of VAT, the concession would affect relative prices. Taxes like this, however, that are levied as a percentage of the value of the good (*ad valorum*) rather than as an amount per physical unit of the good are not taken into account because their relationship to fuel volume varies as prices fluctuate.[4] Also excluded are taxes that that may be related to energy use but that are not imposed directly on the energy product (such as vehicle taxes, road user charges or taxes on emissions such as NO_x and SO_x which do not have a fixed relationship to fuel volume. Production taxes, and royalties and other levies on the extraction of energy resources are excluded on the assumption that since they generally apply to internationally traded goods, they have little impact on prices in the domestic market.

Tax rates, which are typically set in monetary units per physical quantity of fuel (*e.g.*, litres, kilograms, kilowatt-hours, etc.) are re-calculated as effective tax rates per gigajoule of energy (in the first map for each country) and per tonne of CO_2 emissions (in the second map). Energy value has been chosen as a neutral basis for comparing tax rates on products that are normally expressed in terms of diverse physical quantities since the thing that these products have in common is their use as a source of energy. This is not meant to endorse a policy of taxing fuels based on their energy content *per se*. By contrast, there is a strong rationale for taxing fuel based on its carbon content as a means of internalising the social cost of the damage caused by CO_2 emissions.

Tax rates are shown in local currency on the left-hand axis of the maps, and in euros on the right-hand axis (converted by reference to the average market exchange rates over the 12 months ending August 2012). The tax rate applying to each fuel is mapped on the graph as a shaded bar across the portion of energy use or carbon emissions (the tax base) to which the particular rate applies. The shaded rectangle beneath this bar is an approximation of the revenue raised by the tax – the rate multiplied by the base.

The maps help to clarify that a common tax rate on different fuels in terms of physical volume will generally not equate to a common tax rate in terms of energy content or carbon emissions. This is because a given volume of different fuels generally has a different energy content and emission characteristics. Box 3 provides more information about how neutrality of tax treatment differs depending on whether tax rates are measured in terms of physical quantities, energy content or carbon content.

Taxes levied on electricity consumption have been mapped as effective taxes on the fuels used to generate the electricity. In cases where a common nominal tax rate is applied to all electricity consumption, the effective tax rate on each underlying energy source (*e.g.*, coal, natural gas, hydro) used to generate the electricity is shown. In cases where different rates of nominal electricity tax apply to consumption in different sectors (*e.g.*, residential, commercial, industrial), for each sector, the effective tax rate shown is that on the "average" basket of fuels used to generate electricity in the country.

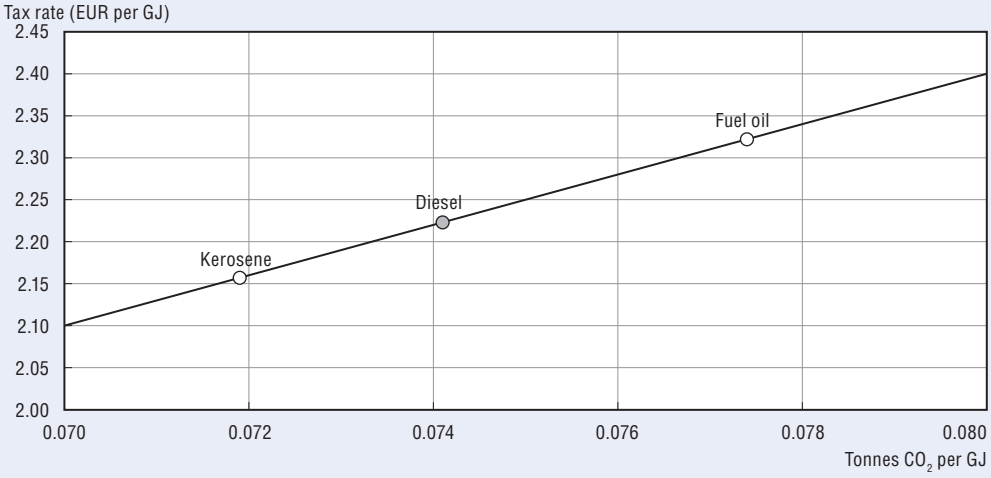
Box 3. **Neutrality in the treatment of different fuels**

A given physical quantity of different fuels generally has a different energy content and different emission characteristics. Therefore, tax rates that are equal in physical terms or in energy terms will not be equal in carbon terms and vice versa. If, for example, one is aiming to use the tax system to send a carbon price signal by internalizing some of the social cost of CO_2 emissions, one would set a tax rate that poses the same cost relative to each tonne of CO_2 emitted. However, achieving a rate that is neutral on a carbon basis will require a higher rate on an energy unit basis on the more carbon-intensive fuels.

This is illustrated in Figure 1 below. The horizontal axis shows the carbon intensity of three fuels in terms of the number of tonnes of CO_2 emitted per gigajoule of energy produced. Relative to its energy value, kerosene is a lower emission fuel than fuel oil. The vertical axis shows effective tax rates in terms of energy content, measured in EUR per GJ.

The sloped line represents a tax rate of EUR 30 per tonne of carbon, which is equivalent to a tax on kerosene at EUR 2.16 per GJ. Because fuel oil is relatively more carbon intensive than kerosene for each unit of energy, that same level of carbon price would require a tax on fuel oil equivalent to EUR 2.32 per GJ. For similar reasons, a uniform tax rate on a carbon basis would require differing tax rates on a physical unit (*e.g.*, per litre or per kilogram) basis.

Figure 1. **Taxation of different fuels at EUR 30 per tonne of CO_2**



Source: OECD calculations based on conversion factors from sources outlined in Annex A (see pp. 244-246).

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Effective carbon tax rates on electricity need to be interpreted carefully when there is a general tax on electricity consumption that applies regardless of the generation source. Essentially, the rate is the answer to the question: *if* the electricity tax were assumed to be a tax on the carbon content in the average unit of electricity, what would the effective rate of that tax (per tonne of CO_2) be? In this case, if carbon energy is a small proportion of the generation mix, the effective tax rate on carbon thus calculated will be very high. A tax on electricity consumption that does not distinguish between electricity from carbon sources and electricity from non-carbon sources cannot send an effective price signal about the use of carbon. Nonetheless, in this report, in order to maintain the same tax coverage for energy and carbon statistics, undifferentiated taxes on electricity consumption are included in the computation of effective tax rates on carbon.[5]

The maps also show tax rebates, credits and other tax expenditures that are reported by the country concerned. Tax expenditure reports typically set out the revenue foregone due to a particular measure. In the maps, the area of the light grey shaded rectangles is an estimation of this revenue loss. In addition, however, the top of this rectangle is the benchmark or "normal" level of tax from which the measure is a departure while the bottom of the rectangle is the net level of tax that applies as a result of the concession. In this respect, the maps are a useful complement to material that focuses on the value of tax expenditures, such as the OECD's *Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels* (OECD, 2013). By showing tax expenditures in context, the maps can facilitate discussion about appropriate tax benchmarks for different fuels, uses and users. Information about the international commitment to rationalize fossil fuel subsidies is set out in Box 4.

Box 4. **Tax expenditures for fossil fuels**

Regardless of the basis on which governments apply taxes on energy products, in practice they have often introduced exclusions or preferences to address concerns such as the potentially adverse impacts (real or perceived) of higher energy prices on particular groups of consumers or producers. It is increasingly recognised, however, that such preferences change relative prices in the economy in ways that can have negative environmental impacts.

In the OECD's June 2009 Declaration on Green Growth, 34 countries agreed to "encourage domestic policy reform, with the aim of avoiding or removing environmentally harmful policies that might thwart green growth, such as subsidies: to fossil fuel consumption or production that increase greenhouse gas emissions…" (OECD, 2009). Three months later, G20 leaders committed to "rationalise and phase out over the medium term inefficient fossil fuel subsidies that encourage wasteful consumption". They noted that inefficient fossil fuel subsidies "encourage wasteful consumption, distort markets, impede investment in clean energy sources and undermine efforts to deal with climate change" (G20, 2009).

To provide a knowledge-base on which to consider the scope and nature of fossil fuel support policies in member countries, the OECD has compiled an Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels (OECD, 2013). Unlike many developing and emerging countries, few OECD countries provide direct price subsidies for fossil fuels. However, a significant amount of support in these countries is provided through tax expenditures, including reductions in or exemptions from energy taxes. A tax expenditure is generally measured by the amount of tax reduction provided relative to the normal or "benchmark" tax treatment that would otherwise apply. Assuming some degree of neutrality in the benchmark system, tax expenditures measure the size of the relative preference provided within the national economy. Since the "normal" benchmark tax treatment, however, varies so much from country to country, tax expenditures are not readily comparable from one country to another.

A full assessment of a tax expenditure requires broader consideration of the tax system of which it is a part. The maps in this report illustrate the value of the relief given under reported tax expenditures relating to taxes on energy consumption. Importantly, however, they also show the broader context of these measures by showing the actual rate of tax as a result of the tax expenditure, the "normal" level of tax that would otherwise apply (the benchmark rate), and the rates of tax that apply to other products.

Given the economy-wide scale of the maps, they do not show certain small details of tax bases, rates and preferences. For examples, where tax bases are too small to show separately, they may be combined and shown with a weighted average tax rate.

Where multiple energy taxes or tax components apply to the same base, they have been aggregated and mapped together. This ensures that all countries are shown in the same manner and reflects the fact that behaviour is influenced by the overall level of energy taxation, rather than the individual components. However, the level of explicit carbon taxes as part of the aggregated components is indicated where practical within the graphs by a horizontal line within the darker grey shading.

For federal countries, the scale of the maps does not allow the separation of energy consumption by state or province (nor is internationally comparable data available at that scale). However, given the importance of energy taxes at the sub-national level, provincial tax rates are shown for an illustrative group of states or provinces.

In recognition that many countries are effectively pricing carbon emissions for some sectors through emission permit trading, the maps note the interaction of tax systems with the European Union Emission Trading System (EU ETS). An energy category is denoted "[ETS-A]" on the carbon map if it is fully or largely covered by the EU-ETS and "[ETS-P]" if it is only partially covered. The carbon maps also show the average market price for ETS credits for 2010-11 on the vertical axis.

Tax rates are expressed as of 1 April 2012 (unless otherwise indicated). Information on taxes has been taken from the OECD/EEA database on instruments used for environmental policy (*www.oecd.org/env/policies/database*), the European Commission (2012), and country-specific sources. Tax expenditure information is primarily from OECD (2013).

Further information on the methodology can be found in Annex A.

4. Energy use and taxation across OECD countries: Results from the analysis

The country maps presented in the second part of this report provide a number of insights into the taxation of energy use in OECD countries in general and illustrate a number of patterns. This section uses the data presented in the maps to consider patterns across the OECD, before focusing on each of the three broad categories of energy use: transport, heating and process use, and electricity. Finally, given its importance in addressing environmental concerns, the taxation of carbon emissions is considered in more detail.

The country maps make clear, first, that the energy situation across the OECD area is quite diverse – the composition of energy usage in terms of fuels and uses, and the resulting CO_2 emissions, varies substantially from one country to another. The most obvious insight from the maps, however, is that countries differ markedly in the way they tax energy. They differ in the range of products that are taxed, in tax base definitions and in tax rate levels and rebates. Even within individual countries, there are often substantial differences in the way in which different forms, uses and users of energy are taxed, whether they are compared in terms of energy content or CO_2 content. Sometimes the reasons for these differences are apparent, but in many cases, they are not. What is clear is that tax systems often send very different price signals in respect of different fuels and fuel uses.

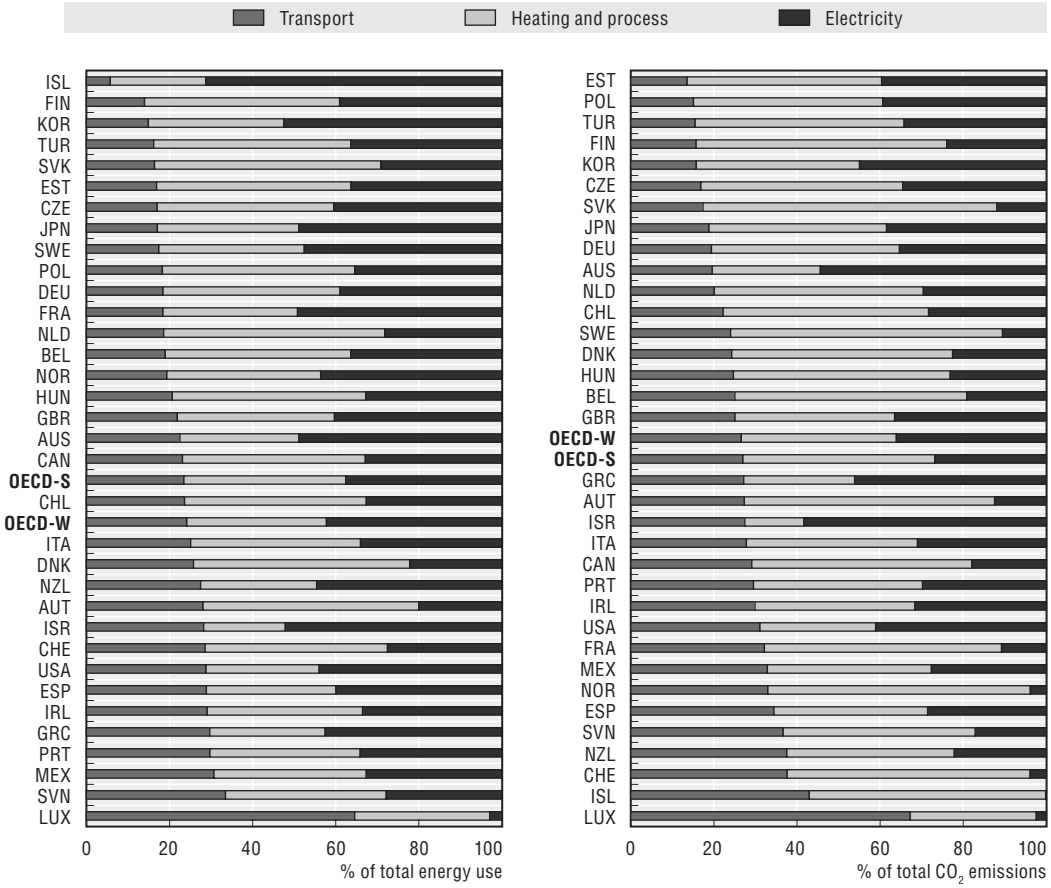
4.1. Taxation of energy in the OECD – general trends

Overall tax base: energy use in the OECD

OECD countries vary significantly in their sources of energy, their uses of energy, and consequently in the CO_2 emissions that result from energy use.

Figure 2 below shows the proportion of energy use (left panel) and CO_2 emissions (right panel) in each of the three main categories of energy use. The transport category varies in size from 6% to 65% of the total energy base, and 14% to 67% of total CO_2 emissions. On a simple average basis across OECD countries, transport accounts for 23% of total energy use and 27% of total CO_2 emissions. In Luxembourg, the unusually high (over 60%) share of energy used for transport purposes arises because of the high volume of motor fuel sales to non-residents.

Figure 2. **Composition of energy use (left) and CO_2 emissions from energy (right) in OECD countries by use**



Source: OECD calculations based on energy use data for 2009 from IEA (2011a).

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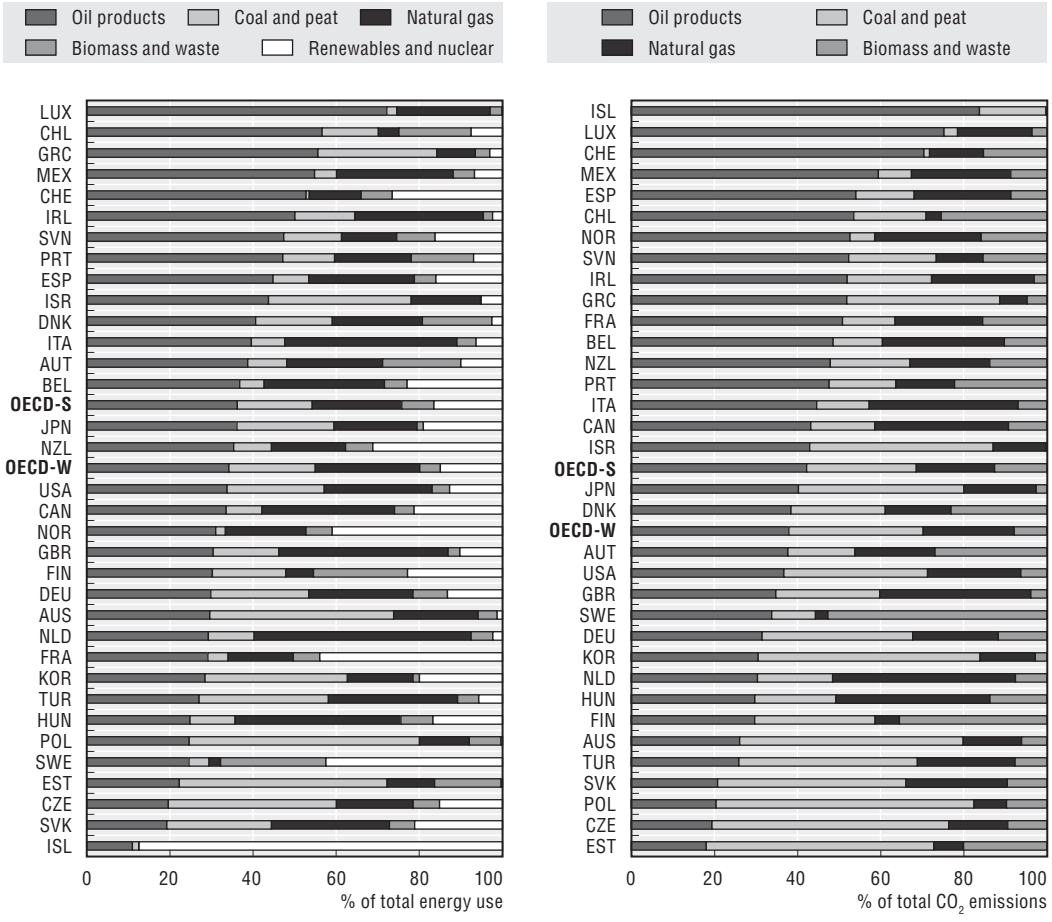
As illustrated, heating and process use varies from 20% to 54% of energy use, and 14% to 71% of CO_2 emissions; the simple averages for all OECD countries are 39% and 46%, respectively. The electricity category varies from 3% to 71% of energy use, and 0% to 58% of CO_2 emissions. The very large share of energy use in the electricity sector that is observed for Iceland (top of left panel) arises because of the importance of electricity-intensive

industries like aluminium smelting. However, since almost all of the electricity comes from renewable sources (hydro and geothermal), it has no appreciable carbon footprint (near bottom of right panel). On a simple average basis across the OECD, electricity makes up 38% of energy use and 27% of CO_2 emissions. The smaller relative size of the electricity category when measured in CO_2 terms is due to the higher proportion of renewables used to generate electricity relative to the small proportions of renewables used in the transport and heat and process categories.

The mix of fuel types also varies substantially across countries. Figure 3 breaks down energy use (left panel) and CO_2 emissions from energy use (right panel) into five major fuel groups. Oil products make up the greatest proportion of total energy usage in OECD countries – 34% (weighted average) and 36% (simple average). However, the proportion ranges from 11% in Iceland to 72% in Luxembourg – again reflecting the unusual characteristics of energy usage in these two countries. Even excluding these two outliers, there is still considerable variation with oil products making up between 19% and 57% of total energy use. Natural gas, coal and peat, and renewable and nuclear energy all account for similar (16%-22%) proportions of total energy use, on a simple average basis, while biomass and waste accounts for just 8% of energy use on this basis. Cross country variation, however, is very wide for each

Figure 3. **Composition of energy use (left) and CO_2 emissions from energy (right) in OECD countries by fuel**



Source: OECD calculations based on energy use data for 2009 from IEA (2011a).

StatLink http://dx.doi.org/10.1787/888932765579

energy type: natural gas ranges from 0% to 52% of total energy use; coal and peat, from 1% to 55%; renewables and nuclear energy, from 0% to 87%; and biomass and waste, from 0% to 25%. Iceland, unsurprisingly, is the outlier regarding renewables and nuclear energy (at 87%), with the next highest being France at 44%.

The story is very similar regarding CO_2 – there is substantial cross country variation, but with oil products still producing, on average, the greatest proportion of CO_2 emissions. There are two major differences though: renewables and nuclear energy now disappear from the graph – as they produce no CO_2 emissions – and coal tends to contribute a significantly greater share of emissions than natural gas. This is because coal produces greater CO_2 emissions per unit of energy (for example, around 0.095 tonnes per GJ for bituminous coal, depending on the source) than from natural gas (approximately 0.056 tonnes per GJ).

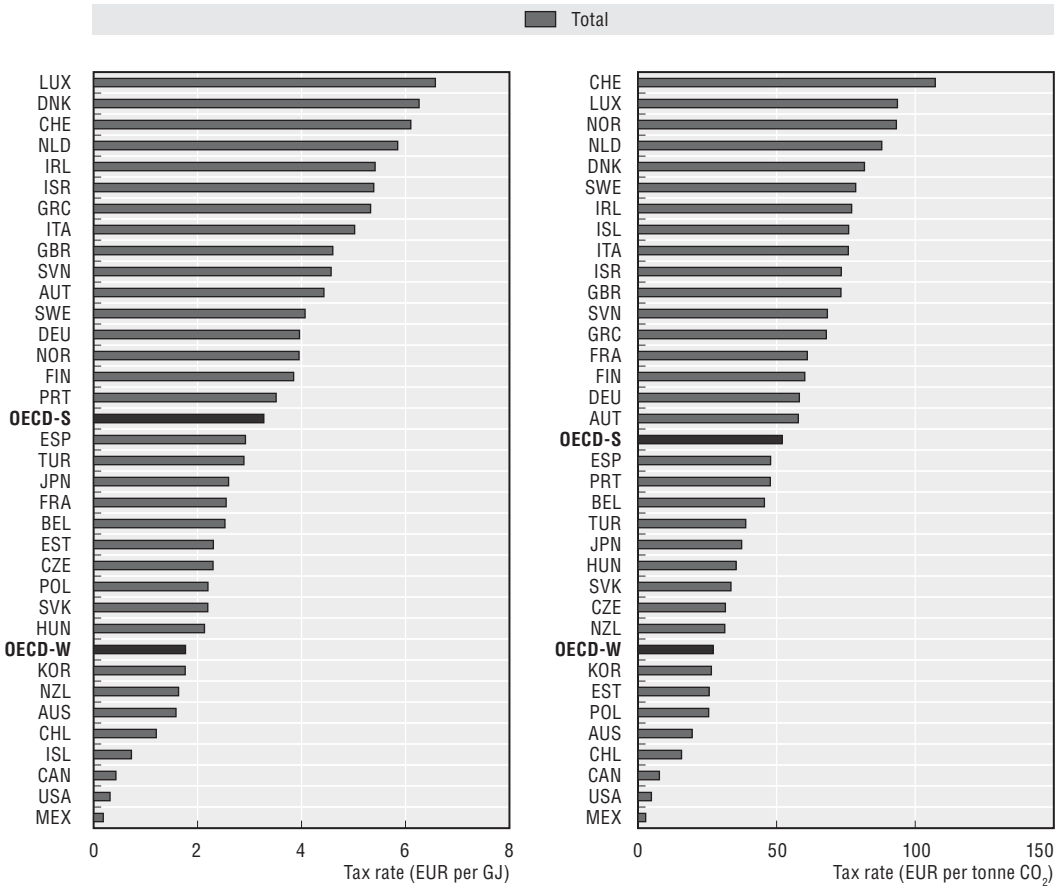
Overall tax rates: effective tax rates on energy in the OECD

At an economy-wide level, there are significant differences in the overall level of energy taxation across the OECD area. Figure 4 sets out for each country the overall average effective tax rate, on a weighted basis, on energy use (left panel) and on CO_2 emissions from energy use (right panel). In energy terms, the simple average rate (OECD-S) is EUR 3.28 per GJ while the weighted average rate (OECD-W) is 1.77 per GJ. The range of country averages, however, is very wide – from EUR 0.18 per GJ in Mexico to EUR 6.58 per GJ in Luxembourg. Luxembourg has the highest rate even though its tax rates on most fuels are not among the highest. This is because Luxembourg has an exceptionally high volume of motor fuel sales which, as in most countries, are taxed at considerably higher rates than other fuel uses. Note that the figures for Mexico do not include the variable component of the *Impuesto Especial sobre Producción y Servicios* on gasoline and diesel which can act as either a tax or a subsidy depending (predominantly) on international gasoline and diesel prices. Note also that for countries that impose energy taxes at both the federal and state/provincial level (notably Canada and the United States), these figures only account for taxes imposed at the federal level. This is the case for all the results presented in this part of the report.

Similarly, there is a wide range of effective tax rates on carbon, when measured on an economy-wide basis, as set out in the right panel of Figure 4. Consistent with the general approach of this report, these figures take into account all specific taxes on energy, whether or not they are explicitly intended to tax carbon. The simple average rate (OECD-S) is EUR 52.04 per tonne of CO_2, while the weighted average (OECD-W) is EUR 27.12 per tonne of CO_2. Again, there is a wide range around these averages: from EUR 2.80 per tonne in Mexico to EUR 107.28 per tonne in Switzerland (which incidentally has an explicit carbon tax).

The highest overall tax rates on carbon tend to be in European countries, which are generally found in the middle and upper parts of the graph. For members of the European Union, energy tax policy is significantly shaped by the 2003 EU Energy Taxation Directive, which sets minimum tax rates for a variety of energy commodities. Box 5 describes the EU Directive in more detail.

Figure 4. **Average effective tax rates on energy (left) and CO_2 from energy (right) in OECD countries**



Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a). Figures for CAN and USA include only federal taxes.

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Many of those countries with the highest effective tax rates on carbon per Figure 4 are countries with explicit carbon taxes (*e.g.* Denmark, Iceland, Ireland, Norway, Sweden and Switzerland).[6] Explicit carbon taxes generally exist alongside other taxes on energy products, which are sometimes based on the energy content of different fuels. From the maps for these countries in Part II, it can be seen that they tend to tax a broad range of energy products and to have more consistency in rates across different fuels and uses, particularly in the heat and process use category.

Many eastern European and Asian countries tend to have lower effective tax rates on carbon (*e.g.* Czech Republic, Estonia, Hungary, Japan, Korea, Poland, Slovak Republic, Turkey). Australia and the Americas (Canada, Chile, Mexico, United States) have the lowest effective tax rates. The maps for these latter countries (and New Zealand) illustrate that they typically tax fuels used in transport use (though generally at lower rates than the OECD average) and tend not to tax energy in non-transport uses (an exception being at the provincial level in Canada).

What is not evident from the economy-wide tax rates is that tax rates also vary significantly across fuels and fuel uses. Tables 1 and 2 show the simple average for OECD

Box 5. **European Union Energy Taxation Directive**

In October 2003, member states of the European Union (EU) adopted the Energy Taxation Directive 2003/96/EC, which sets out common rules for the taxation of energy products in member states. Twenty-one OECD member countries, as members of the European Union, are thus subject to the Directive: Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden and the United Kingdom.

The Directive is intended to reduce distortions of competition, both between member states created by divergent rates of tax on energy products, and between mineral oils and the other energy products. It is also intended to increase incentives to use energy more efficiently. The Directive sets common taxation rules for a range of fuels, including many oil products, coal and natural gas, and for electricity consumption. For each, it sets a minimum level of tax expressed in terms of the volume, weight, or energy content of the fuel. The directive also sets out transitional measures and permitted derogations (both general and country-specific) from the minimum levels, such as exemptions for particular sectors.

The current minimum tax rates under the Directive are set out in the table below.

Fuel		Minimum tax rate (EUR)	Unit	EUR per GJ equivalent[1]	EUR per tonne of CO_2 equivalent[1]
Gasoline	Leaded	421	1 000 litres	12.69	183.07
	Unleaded	359	1 000 litres	10.82	156.11
Gas oil	Propellant use	330	1 000 litres	9.19	123.99
	Heating and process use	21	1 000 litres	0.58	7.89
Kerosene	Propellant use	330	1 000 litres	9.19	129.41
	Process use	21	1 000 litres	0.59	8.24
Heavy fuel oil	Heating	15	1 000 kilograms	0.37	4.82
LPG – propellant use	Propellant use	125	1 000 kilograms	2.64	41.88
	Process use	41	1 000 kilograms	0.87	13.74
	Heating	0	1 000 kilograms	0	0
Natural gas	Propellant use	2.6	1 gigajoule	2.60	46.35
	Process use and non-business heating	0.3	1 gigajoule	0.30	5.35
	Business heating	0.15	1 gigajoule	0.15	2.67
Coal	Non-business heating	0.3	1 gigajoule	0.30	3.17
	Business heating	0.15	1 gigajoule	0.15	1.59
Electricity consumption	Business	0.5	1 megawatt hour	0.14	2.29
	Non-business	1	1 megawatt hour	0.28	4.57

1. Energy content and CO_2 equivalents have been calculated by the OECD Secretariat based on the conversion factors described in Annex A.

The European Commission has proposed a new Energy Taxation Directive which, if approved, would replace the current Directive from 2013 (European Commission, 2011a). The proposed rules aim to promote energy efficiency and consumption of more environmentally friendly products and to avoid distortions of competition in the Single Market. Under the revised directive, taxes on energy would have two components:

- a single minimum rate for CO_2 emissions (EUR 20 per tonne of CO_2) for all sectors that are not part of the EU ETS; and
- minimum rates based on the energy content of the fuel, which will be more uniform across types of fuel.

These components would be combined to produce the overall minimum tax rate at which fuel products would be taxed. Countries would be able to choose to exceed one or both minimum rates, although the same rate would then apply to all fuels used for the same purpose. Transitional periods would apply for certain fuels to allow government and industry to adapt, with full implementation intended from 2023. In addition, certain country-specific transition periods are proposed.

countries of the effective tax rates on energy (Table 1) and CO_2 emissions from energy (Table 2), broken down by major fuel types and fuel use categories. The simple average in a sense reflects the practice of the "typical" OECD country, with all countries considered equally regardless of the volume of their total energy use.

Table 1. **OECD simple average effective tax rates on energy by fuel type and use**

EUR per GJ

		Fuels					
		Oil products	Coal and peat	Natural gas	Biofuels and waste	Renewables (and nuclear)	All fuels
	% of base	34%	21%	25%	5%	15%	100%
Transport use	24%	11.8	0.0	0.6	5.0	0.0	**11.5**
Heating and process use	34%	1.7	0.5	0.7	0.0	0.0	**0.9**
Electricity	42%	0.9	0.7	1.2	0.7	1.1	**0.9**
Total use	100%	**7.9**	**0.8**	**0.8**	**0.8**	**1.0**	**3.3**

Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a).

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Table 2. **OECD simple average effective tax rates on CO_2 from energy use by fuel type and use**

EUR per tonne CO_2

		Fuels					
		Oil products	Coal and peat	Natural gas	Biofuels and waste	Renewables (and nuclear)	All fuels
	% of base	38%	32%	22%	8%	0%	100%
Transport use	27%	164	0	11	71	0	**161**
Heating and process use	37%	24	5	13	0	0	**12**
Electricity	36%	11	14	14	13	0	**13**
Total use	100%	**110**	**14**	**15**	**31**	**0**	**52**

Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a). The electricity figures exclude three outliers from the calculations – Iceland, Norway and Sweden.

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Focus first on the three macro categories of use in the column at the far left of each table and the corresponding "all fuels" tax rate in the far right column. What is most striking is that on average, transport use bears a very high level of taxation – more than EUR 11.5 per GJ in energy terms and EUR 161 per tonne of CO_2. The rates are well under a tenth of this level with respect to heating and process use and electricity.

The higher tax rates on transport fuel are likely explained by the broader range of policy goals that governments address in this category. While combustion of fossil fuels in all three categories contributes to emissions of CO_2, fuel use in road transport (the biggest subcategory within the transport category) contributes to other externalities such as congestion, traffic accidents and noise. Since these social costs generally vary by location and traffic conditions, time-specific road pricing would generally be a more direct and efficient way of addressing these externalities. In the absence of road pricing, road fuel consumption, which is correlated (though not evenly for different vehicles) with distance travelled, may be a rough proxy for these other external costs.[7] In addition, a number of

countries formally or informally earmark road fuel taxes to fund road infrastructure costs (construction and maintenance), as a kind of loose user charge. The comparatively heavy taxation of fuels for transport use has a strong impact on overall average rates.

There is also a wide variation in the average effective tax rate on the various fuels, seen most clearly from the bottom row of each of Tables 1 and 2, which provides the average tax rate for all uses for each major fuel group, in energy and carbon terms, respectively. Among fossil fuels, oil products are taxed the heaviest; by comparison natural gas and coal are taxed on the order of ten times less, with coal lower than natural gas. In part, this is driven by the high use of oil products in the heavily taxed transport category, but as discussed below, this is not the entire explanation.

In terms of carbon content (Table 2), biofuels and waste are taxed at a relatively higher rate than in energy terms (Table 1). While the effective tax rate on biofuels and waste is only one-eleventh of the tax rate on oil products in energy terms, it is just over a quarter in CO_2 terms. This difference is primarily due to the relatively low carbon intensity of biofuels, the combustion of which produces less CO_2 per GJ of energy than most other fuel types.

As noted, Tables 1 and 2 present the simple average of the effective tax rates in the 34 member countries – in a sense illustrating what the "typical" OECD country does. The effective tax levels on energy and carbon in the OECD area as a whole are even lower, however, if one considers weighted averages which take into account that some of the largest countries in the OECD (*e.g.* the United States, Japan, Canada) tend to have relatively low effective tax rates. This is illustrated in Figure 5, which presents a map of weighted average effective tax rates across the five main fuel categories for the entire OECD area in terms of energy content, and in Figure 6, which presents the same information in terms of carbon content. Given the global nature of the negative externalities created by carbon emissions, this emphasises the particular importance, from a global perspective, of the policy choices made by large energy users.

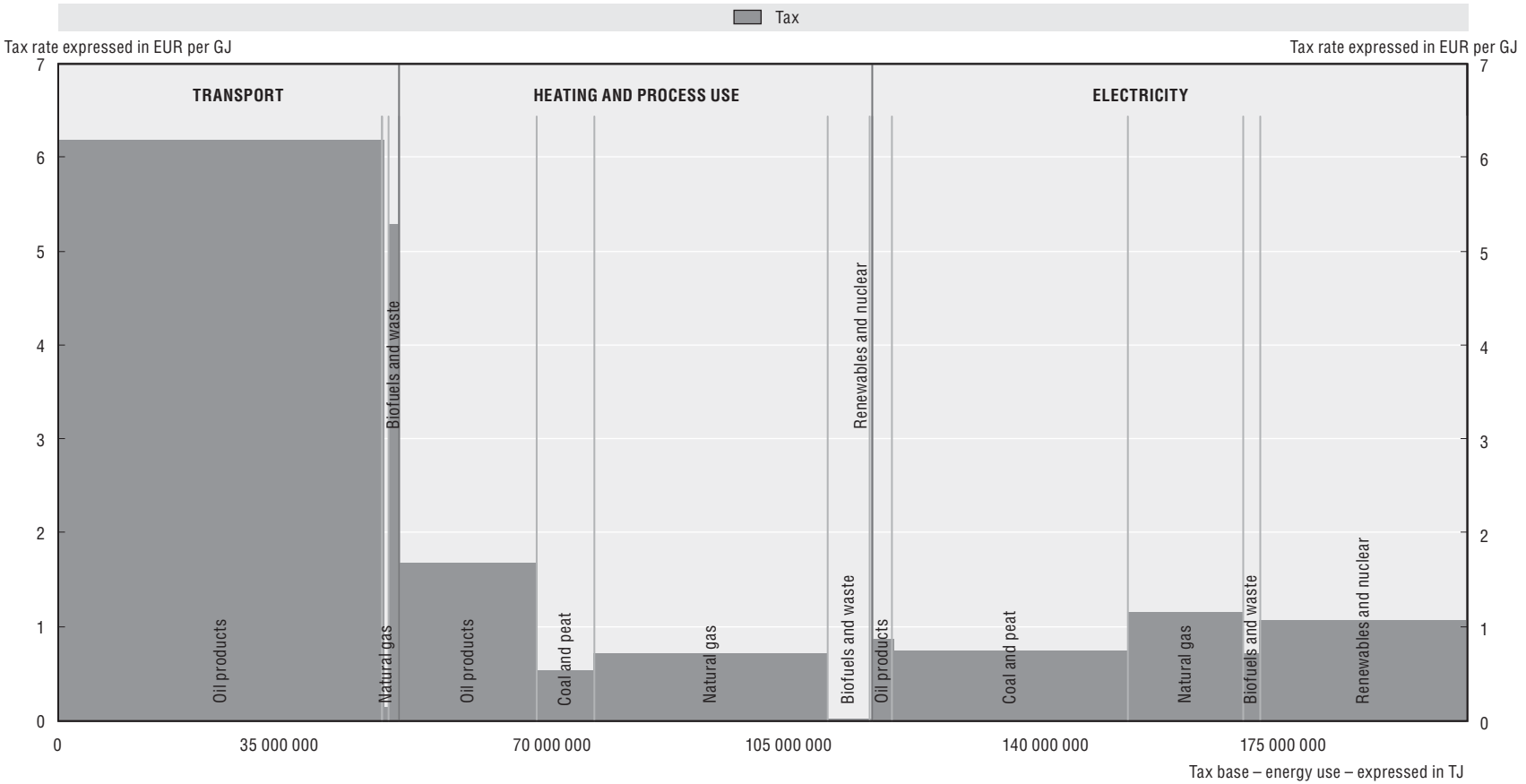
The contrast between the relatively high taxation in the transport category and the relatively low taxation in the heating and process and electricity categories is very evident from both maps. Equally evident in the maps is the variation in tax rates on different fuels within each of the three use categories. For example, the substantial quantity of coal used in electricity generation in the OECD area is taxed, on average, at a lower rate than most other fuel types used to generate electricity, both on an energy and CO_2 basis. Likewise, coal and natural gas used for heating and process purposes are often taxed at lower rates than oil products. Sections 4.2 to 4.4 of this report examine these differences in treatment of fuels sequentially within each of the three broad use categories: transport, heating and process use, and electricity.

4.2. Taxation of energy used in transport

The transport category includes both road transport and other modes such as rail, marine and air. In the average OECD country, transport accounts for 23% of total energy use, and 27% of the CO_2 emissions generated. However, as a result of the substantial tax rates highlighted above, it generates around 85%, on average, of total excise tax revenue from energy products in OECD countries.[8]

As seen above, the transport category is taxed more heavily than other categories. This is true on an OECD-wide basis and within each OECD country, as can be seen from the

Figure 5. **Taxation of energy in the OECD area on an energy content basis**



Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a).

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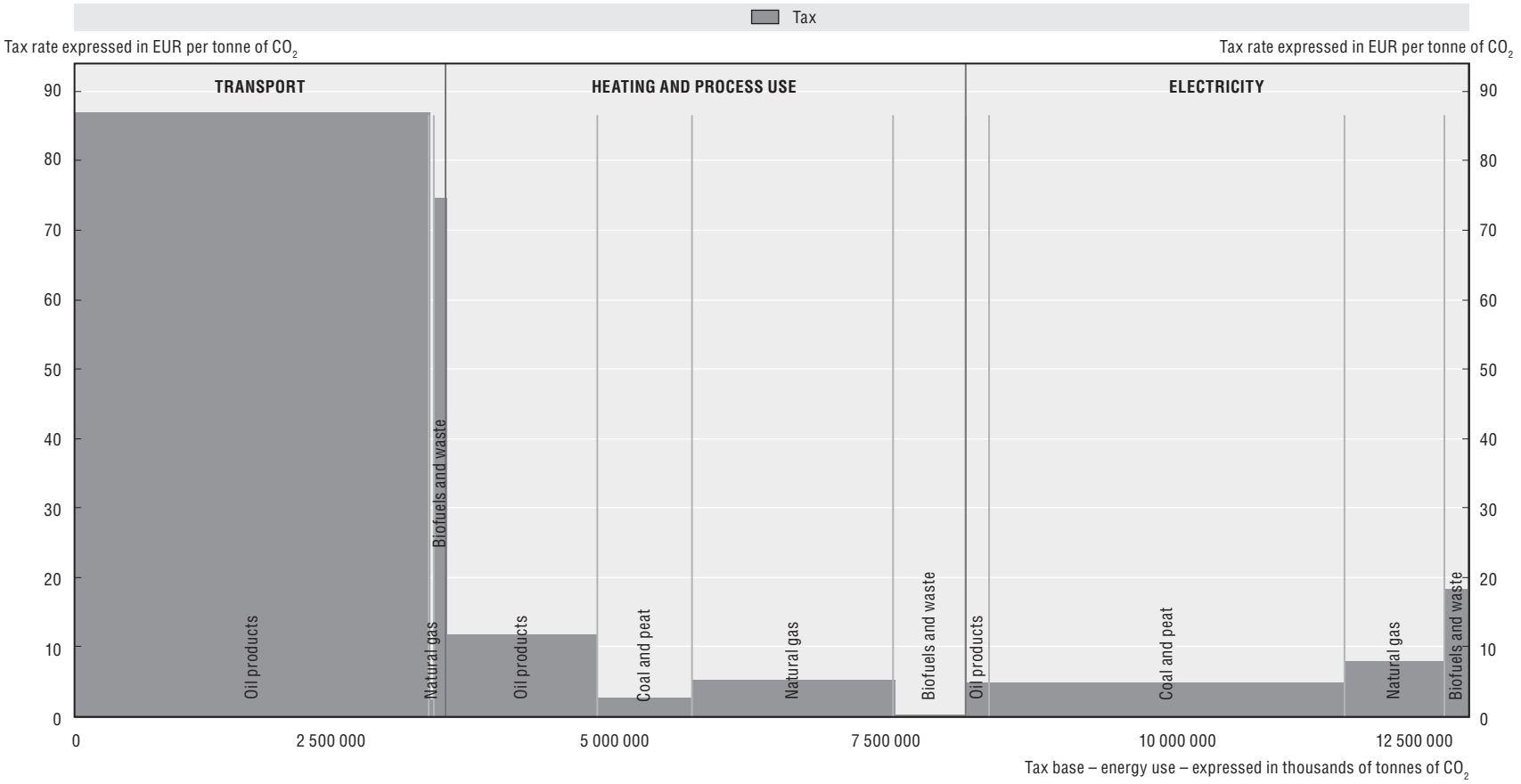
Figure 6. **Taxation of energy in the OECD area on a carbon content basis**



Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); emissions are based on data for 2009 from IEA (2011a).

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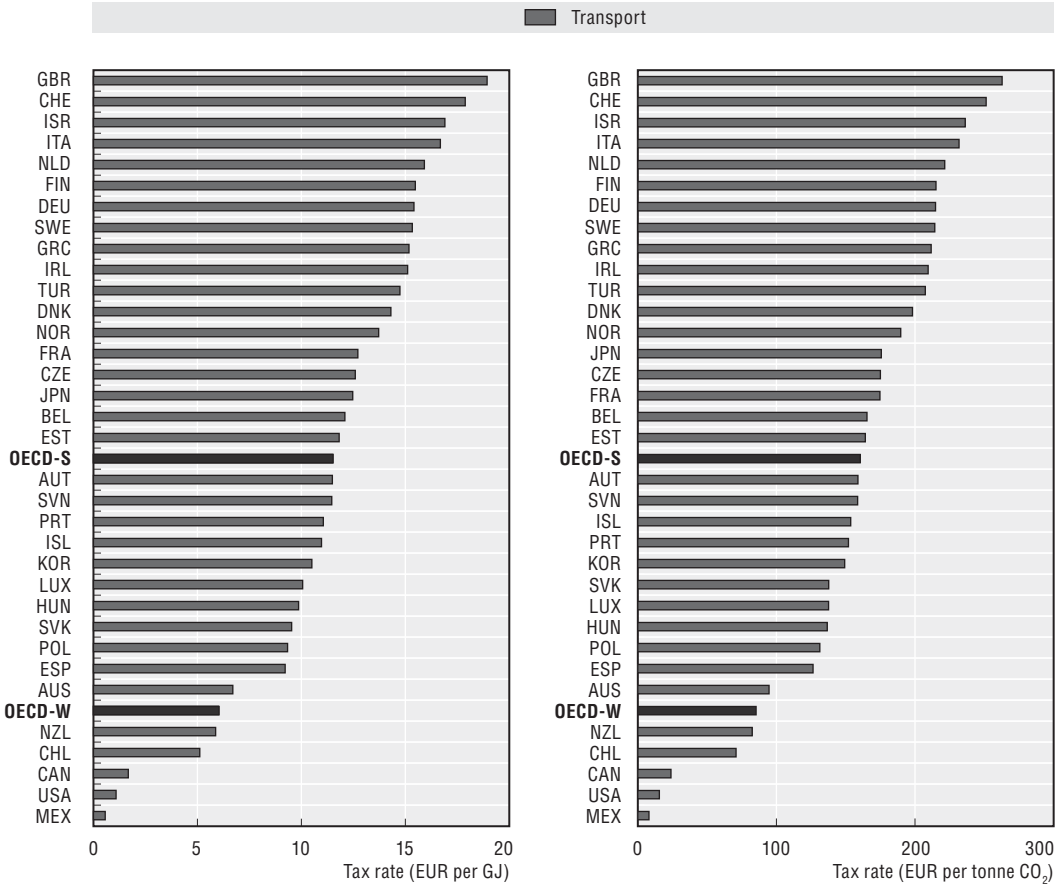
maps in Part II. The variation in the average effective tax rates that apply to transport fuels between countries is illustrated in Figure 7. Effective tax rates on energy (left panel) range from EUR 0.57 per GJ in Mexico to EUR 18.9 per GJ in the United Kingdom. Effective tax rates on carbon range from EUR 8 to EUR 263 per tonne of CO_2, in the same two countries respectively.

Despite these wide variations, Figure 7 shows that the majority of countries impose a substantial tax burden on fuels used in transport, whether measured in terms of energy or CO_2. In terms of energy content, the simple and weighted averages of the country effective tax rates are EUR 11.53 (OECD-S) and EUR 6.05 per GJ (OECD-W), respectively. In carbon terms the simple and weighted averages are EUR 160.53 and EUR 85.40 per tonne of CO_2.

Figure 7. **Effective tax rates on energy (left) and CO_2 (right) in OECD countries: Transport fuel use**



Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a). Figures for CAN and USA include only federal taxes.

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Effective tax rates on transport fuels also vary considerably within countries, both by fuel use and by fuel type. Tables 3 and 4 present OECD average rates on an energy and CO_2 basis, respectively. Information on the contribution of different fuels to the total size of the respective tax bases is also provided. Some fuels used in small amounts are not presented

in a separate column, though they are included in the calculation of the overall rate for all fuels. Individual country results are set out in Annex B.

Comparing the first and second rows in either table makes clear that road fuel is taxed at much higher rates than fuel used for other modes of transport, in terms of both energy and CO_2 content. This is perhaps explained by the use of taxes on road fuels to internalise social costs specific to road transport (congestion, accidents and noise) or to fund road infrastructure costs.

Table 3. **OECD simple average effective tax rates on energy in transport fuels, by fuel type and use**

EUR per GJ

		Fuels						
		Gasoline	Diesel	LPG	Aviation fuels	Biofuels	Natural gas	All fuels
	% of base	53%	34%	1%	6%	3%	2%	100%
Road use	90%	15.5	10.5	3.4	0.0	5.0	0.7	**12.2**
Non-road use	10%	1.0	4.4	0.3	1.7	0.0	0.3	**2.9**
Total transport use	100%	**15.5**	**10.2**	**3.6**	**1.7**	**5.0**	**0.6**	**11.5**

Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a).

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Table 4. **OECD simple average effective tax rates on CO_2 from transport fuels, by fuel type and use**

EUR per tonne CO_2

		Fuels						
		Gasoline	Diesel	LPG	Aviation fuels	Biofuels	Natural gas	All fuels
	% of base	52%	36%	1%	6%	3%	1%	100%
Road use	90%	224	142	54	0	71	12	**170**
Non-road use	10%	15	60	4	23	0	5	**40**
Total transport use	100%	**223**	**137**	**56**	**23**	**71**	**11**	**161**

Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a).

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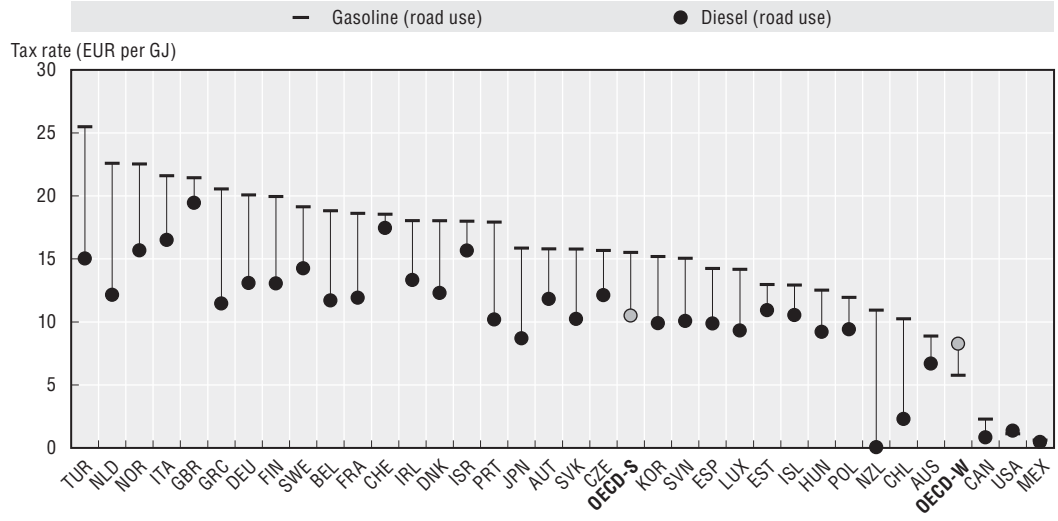
Even within each use category, however, the tables demonstrate a high variance among tax rates on the different fuels, in both energy and carbon terms. In road use, for example, gasoline and diesel face the highest tax rates. By contrast, natural gas, also a fossil fuel, on average is taxed at a very low rate in both energy and carbon terms (in many countries, it is not taxed at all), while LPG on average is taxed at somewhere near one-quarter of the rates on gasoline and diesel. On average, biofuels (mostly ethanol and biodiesel) are taxed at around one-third of the rates applying to gasoline and diesel. The underlying treatment, however, is quite diverse, likely reflecting differing views as to the net carbon impact of biofuels and the role of non-tax policies like mandates requiring a certain percentage of biofuels in the fuel stock. The result is that a few countries tax biofuels at "full" rates, some exempt them, and many tax them at concessionary rates.

The most striking difference from the tables, however, is large difference between the effective tax rates on road gasoline and diesel. Consumers know from experience at the pumps that in most OECD countries diesel is taxed at a lower rate per litre than gasoline. The two fuels, however, have different energy and emission characteristics. A litre of diesel has roughly 10% more combustion energy content than a litre of gasoline. A litre of diesel also produces roughly 18% more CO_2 emissions than a litre of gasoline.[9] (A litre of diesel is also typically associated with higher emissions of local air pollutants, though these are not taken into account in the maps.) As a result, equal treatment of gasoline and diesel on either an energy basis or a carbon basis would require a higher tax rate per litre on diesel than on gasoline. In fact, we observe the opposite: the simple average for all OECD countries of the effective tax rate on diesel is 32% lower than that on gasoline in energy terms and 37% lower in carbon terms.

The same pattern holds on a country by country basis. Figures 8 and 9 show that in all but one country (the United States), diesel is taxed less than gasoline on both a per unit of energy basis and on a per unit of CO_2 basis. In many cases the difference is very substantial.[10]

Figure 8. **Effective tax rates on energy: Gasoline vs. diesel (road use)**



Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a). Figures for CAN and USA include only federal taxes.

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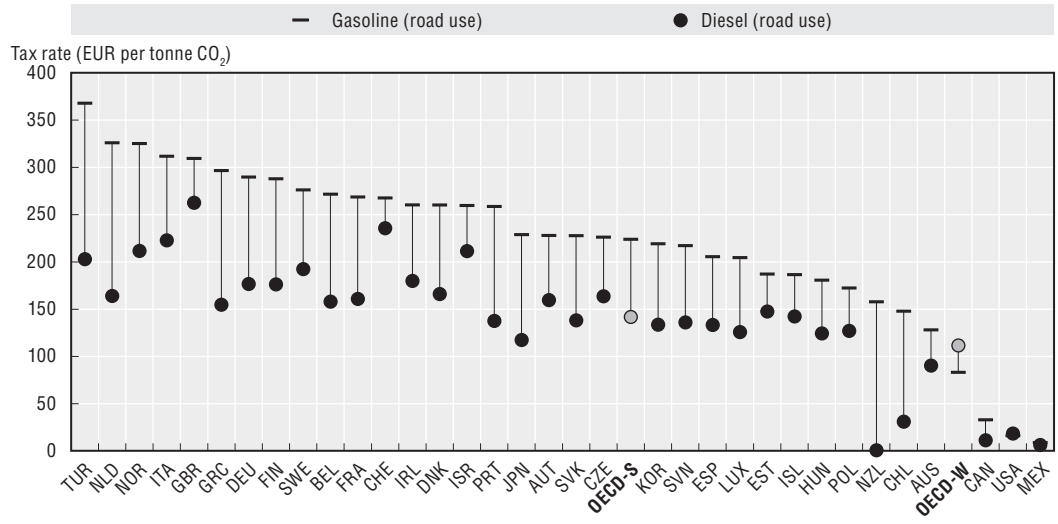
It is sometimes argued that diesel should be taxed at a lower rate per litre than gasoline on the basis that diesel-fuelled cars are more fuel efficient than comparable gasoline-fuelled cars – *i.e.* they can drive more kilometres per litre (both due to the greater energy content of diesel fuel per litre and the greater efficiency of diesel engines in converting fuel energy into motive energy). However, even in the absence of taxes, the increased fuel efficiency of diesel use will be taken into account by consumers in their consumption decisions, tending to increase the demand for diesel over gasoline. This advantage is internalised by the driver and need not be taken into account in fuel taxes. In contrast, the cost of the CO_2 emissions from burning the fuel are not internalised. These emissions (as well as those of certain local air pollutants[11]) – which represent social costs

Figure 9. **Effective tax rates on CO_2: Gasoline vs. diesel (road use)**



Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a). Figures for CAN and USA include only federal taxes.

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– are higher per litre of diesel than per litre of gasoline, regardless of how far the vehicle travels (an internalised private benefit). Internalising the cost of those emissions through a uniform price on carbon, therefore would imply a higher tax per litre on diesel than on gasoline.

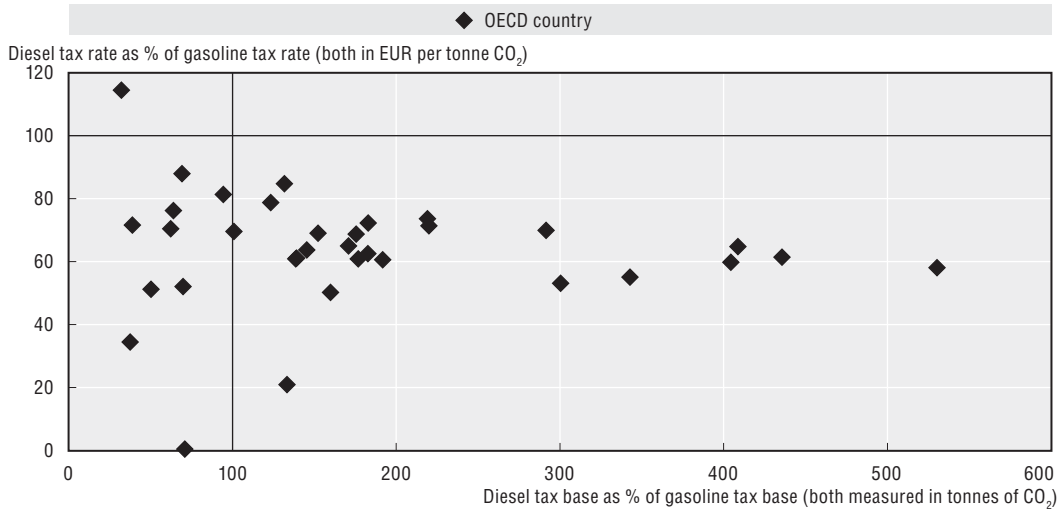
Similar considerations apply to the extent that fuel taxes are intended to internalise externalities related to vehicle use such as congestion and accidents. These costs are likely to be positively correlated with distance travelled. Therefore, since a litre of diesel fuel is generally associated with greater distance travelled, it will generally also be associated with greater congestion and accident costs. This again implies a tax rate per litre that is higher on diesel than on gasoline.

To some extent, the traditionally lower rates on diesel may reflect concerns about industrial competitiveness, given the traditional reliance of commercial and industrial vehicles on diesel fuel. Such competitiveness concerns likely could be addressed in more targeted ways without privileging diesel fuel. Furthermore, even if it was once the case, diesel fuel cannot be regarded as primarily a commercial fuel in many countries today. In recent years the share of diesel-powered passenger cars has increased substantially in many countries, likely at least in part in response to the tax advantage enjoyed by diesel.

There is indeed some correlation between effective tax rates on diesel and the diesel share in the fuel mix. Figure 10 shows on the horizontal axis the size of the diesel tax base in terms of carbon content relative to that of gasoline (for road use only). A number greater than 100% represents a diesel tax base larger than that of gasoline. Similarly, on the vertical axis, the graph shows the effective tax rate on carbon in diesel as a percentage of the effective tax rate on carbon in gasoline, with a number above 100% representing a higher tax rate on diesel than gasoline. With the exception of the United States (in the upper left hand corner), as noted above, all countries have a higher tax rate in carbon terms on gasoline than diesel. It is noteworthy that the large majority of countries are in the lower right quadrant, where there is both a lower effective tax rate on diesel and a higher share

of carbon emissions from diesel than gasoline, with the difference being the most marked in Belgium, France, Luxembourg and Spain, on the right side. While this graph does not show causation or track shares over time, the correlation is not surprising and is consistent with the tax preference for diesel influencing usage patterns.

Figure 10. **Diesel/gasoline (road use) – relative tax rates and bases in carbon terms**



Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a). Figures for CAN and USA include only federal taxes.

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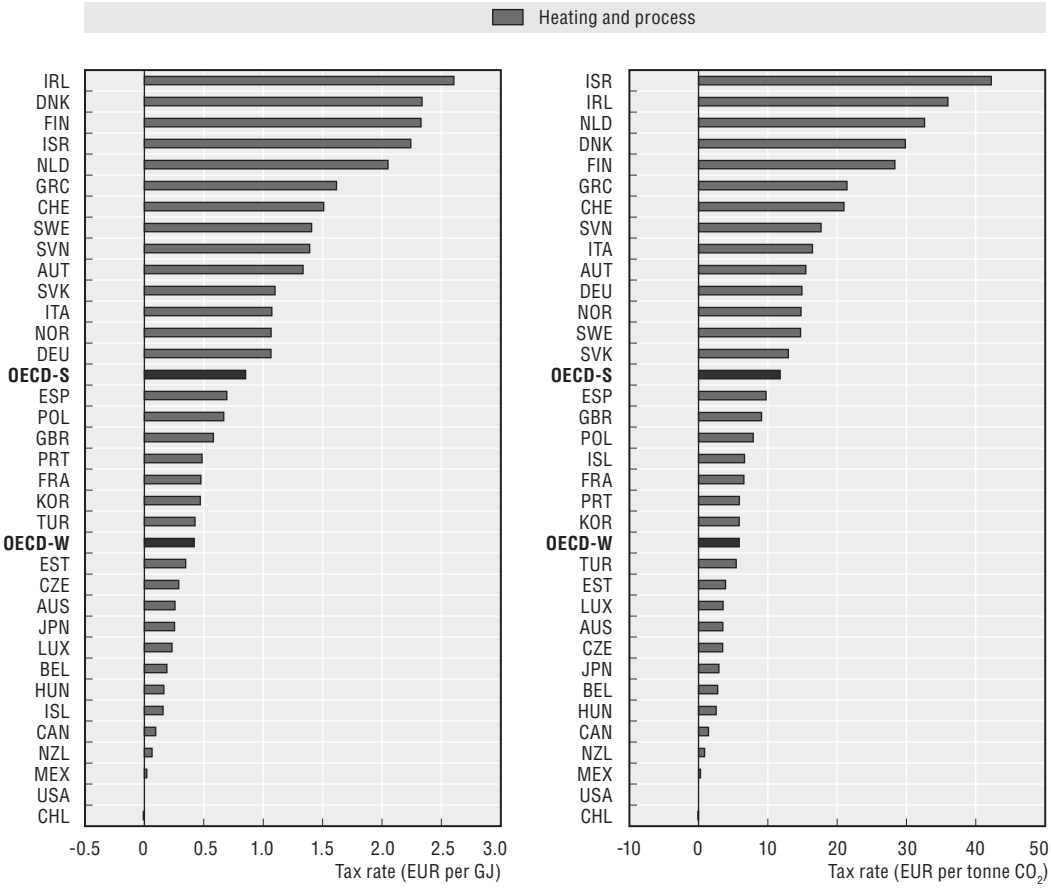
4.3. *Taxation of heating and process use of energy*

In the average OECD country, the heating and process category represents 39% of total energy use and 46% of the CO_2 emissions from energy use. As with the transport category, there is significant variation in effective tax rates on fuels both between and within countries. However, as highlighted earlier, effective tax rates are much lower than those applying to transport fuels.

Figure 11 illustrates the variation in the total level of taxation on heating and process fuel use across OECD countries in terms of both energy content (left panel) and CO_2 emissions (right panel). Effective tax rates range from EUR 2.61 per GJ in Ireland to being untaxed (at the federal level) in the United States, and to being slightly negative (effectively a subsidy of EUR 0.01 per GJ) in Chile as a result of a petroleum price stabilisation scheme. This scheme effectively imposes a tax when underlying fuel prices are low and a subsidy when they are high. In terms of carbon, effective tax rates range from EUR 42.25 per tonne of CO_2 in Israel, to zero again in the United States and a subsidy of EUR 0.10 per tonne of CO_2 in Chile. Overall, while rates are lower than in the transport category, the degree of variation in rates between countries is greater.

Within countries, effective tax rates also vary substantially by both fuel type and use. Tables 5 and 6 present the simple average for all OECD countries of the effective tax rates on heating and process fuel use broken down by fuel type and fuel use, on an energy and CO_2 basis, respectively. Fuel use is divided into residential and commercial use on one hand, and industrial use and energy transformation (*e.g.,* oil refineries) on the other. Information on the shares of different fuels in the respective tax bases is also provided.

Figure 11. **Effective tax rates on energy (left) and CO_2 (right) in OECD countries: Heating and process fuel use**



Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a). Figures for CAN and USA include only federal taxes.

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Some fuels used in small amounts are not presented in separate column though they are included in the overall rate for all fuels. Individual country results are again provided in Annex B.

Table 5. **OECD simple average effective tax rates on energy by fuel type and use: Heating and process fuel use**

EUR per GJ

		Fuels						
		Coal	Peat	Natural gas	Diesel	Fuel oil	Other oil products	All fuels
	% of base	12%	0%	49%	12%	3%	14%	100%
Residential and commercial use	41%	0.3	0.1	1.1	3.1	1.9	1.8	**1.2**
Industrial and energy transformation use	59%	0.6	0.1	0.6	3.3	1.3	0.5	**0.8**
Total heating and process use	100%	**0.6**	**0.2**	**0.7**	**3.4**	**1.3**	**0.7**	**0.9**

Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a).

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Table 6. **OECD simple average effective tax rates on CO_2 by fuel type and use: Heating and process fuel use**

EUR per tonne CO_2

		Fuels						
		Coal	Peat	Natural gas	Diesel	Fuel oil	Other oil products	All fuels
	% of base	18%	0%	39%	12%	3%	14%	100%
Residential and commercial use	38%	3	1	20	42	24	27	**17**
Industrial and energy transformation use	62%	5	1	10	45	17	7	**10**
Total heating and process use	100%	**5**	**2**	**13**	**46**	**17**	**11**	**12**

Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a).

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In terms of fuels, on average diesel faces the highest effective rate on carbon (Table 5), followed by fuel oil (res fuel) and natural gas, with lower rates applying to coal, peat and other oil products. Coal and sometimes natural gas are not taxed at in a number of countries. Interestingly, diesel faces a relatively similar effective tax rate to that imposed on diesel used for non-road transport. This suggests that countries may tend to make a general distinction between road use diesel and all other uses of diesel. No significant amounts of biofuels, waste or renewables are used for heating and process purposes in OECD countries.

Turning to Table 6, diesel also faces the highest effective tax rate in terms of CO_2 emissions, followed by other oil products, natural gas and fuel oil. Coal and peat face even lower effective tax rates in CO_2 terms than in energy terms as they generate more CO_2 emissions per TJ of energy than the other fuel types. The rationale for these differences is not clear.

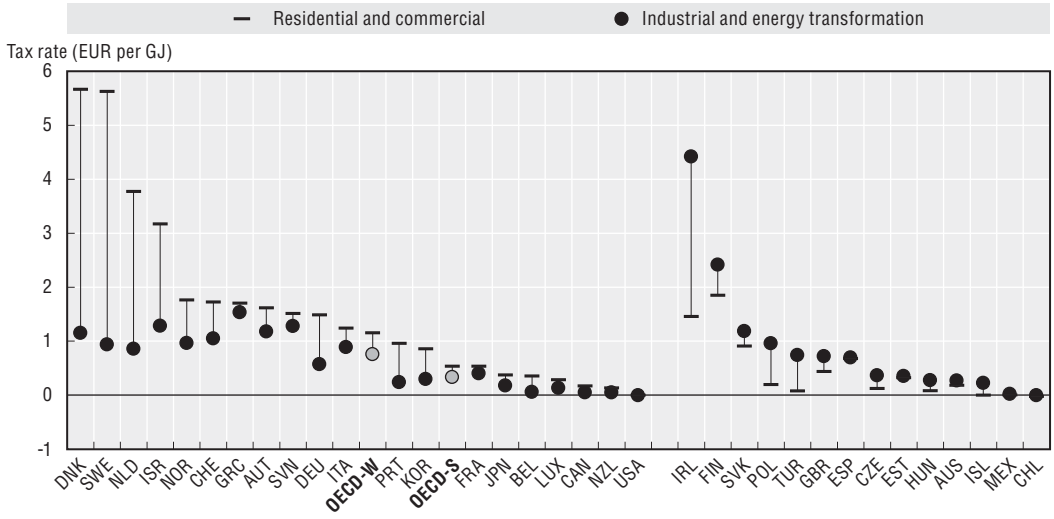
In terms of fuel uses, examination of the first two lines in both tables indicates that fuel used for residential and commercial purposes (mostly space heating) is taxed significantly more in both energy and carbon terms than fuel used in industrial and energy transformation use (mostly for industrial processes). The pattern is also seen for many of the more significant individual fuels: natural gas, fuel oil and other oil products. Diesel is taxed similarly irrespective of its use. On the other hand, coal and peat on average are taxed more highly, in both energy and CO_2 terms, when used in industry and energy transformation than in residential and commercial use (though the use of coal in the latter sector is quite small).

Figures 12 and 13 move down to the national level by presenting the differences in effective tax rates between the two main user groups for all fuels used in heating and process for each OECD country.

In energy terms (Figure 12), 18 countries impose a clearly higher tax on residential and commercial fuel use than on industrial and energy transformation use. In Sweden, Denmark, Italy and Israel the difference is substantial. In contrast, 10 countries impose a clearly higher effective tax rate on industrial use and energy transformation, with one country – Ireland – imposing substantially higher effective rates. Meanwhile, in six countries there is minimal difference between the two fuel use groups.

A similar picture is presented in CO_2 terms (Figure 13). Residential and commercial use is taxed more highly in 16 countries, while industrial use and energy transformation is

Figure 12. **Effective tax rates on energy: Residential and commercial vs. industry and energy transformation use**



Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a). Figures for CAN and USA include only federal taxes.

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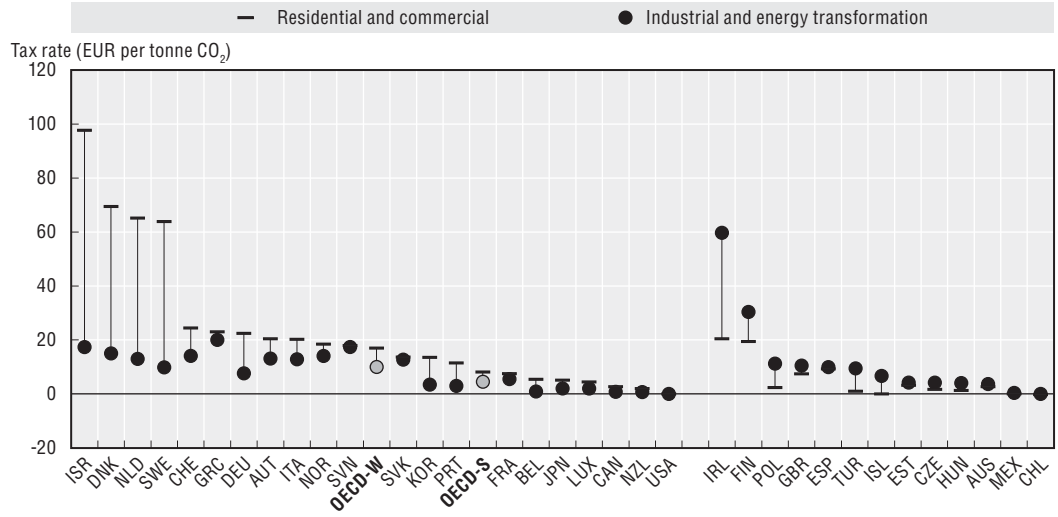
taxed more highly in 11 countries. In the remaining seven countries there is minimal difference between these rates. Among OECD countries, the interquartile range in effective rates for residential and commercial use is from EUR 0.17 per GJ to EUR 1.62 per GJ in energy terms and from EUR 2.36 to EUR 20.43 per tonne of CO_2 in carbon terms. For industrial and energy transformation use, the interquartile range is from EUR 0.23 per GJ and EUR 1.05 per GJ in energy terms and from EUR 2.97 to EUR 13.10 per tonne of CO_2 in carbon terms. The taxation of energy in industry and energy transformation use is thus slightly more variable among countries than the taxation of energy in residential and commercial use

The generally low tax rates in the heating and process category, together with the large variation in rates between different uses, may partly be explained by distributional and competitiveness concerns. For example, countries that impose lower effective tax rates on industrial use may be seeking to address competiveness concerns, particularly in relation to energy-intensive heavy industries that are subject to strong international competition, such as iron and steel, petrochemicals and mineral smelting. On the other hand, in EU countries, the lower rates may to some extent reflect the fact that many large industrial emitters are subject to the EU emission trading system, which sends price signals similar to a carbon tax.

In contrast, countries that impose lower rates on residential fuel use may place greater weight on concerns regarding the ability of low-income families to afford heating fuels, or because of greater need for heating (for example in Sweden, where consumers in the northern part of the country pay a reduced rate on electricity). Meanwhile, countries imposing very low or zero taxes on heating and process fuels in general (*i.e.* the countries on the far right of each part of Figures 12 and 13) may do so due to strong concerns regarding both issues.

Figure 13. **Effective tax rates on CO_2: Residential and commercial vs. industry and energy transformation use**



Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a). Figures for CAN and USA include only federal taxes.

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While concerns about industrial competitiveness and impacts on low-income households are valid policy concerns, OECD work has underlined that providing relief from environmentally related taxes such as taxes on fuel blunts the price signal (*e.g.* in terms of the cost of carbon emissions) that could otherwise be sent to such sectors. This results in loss of an opportunity to help shift production and consumer decisions toward a lower-carbon path. It is generally preferable to assist such sectors in a way not linked to energy costs, so as to ensure an incentive to change behaviour (OECD, 2006).

4.4. *Taxation of energy used to produce electricity*

In the average OECD country, fuels used to generate electricity make up 38% of total energy use and 27% of the CO_2 emissions resulting from energy use. Excise taxes can be levied on the fuels used to generate electricity and/or on the consumption of electricity. A number of countries tax both, while many tax only one, or neither (see Table 7). Taxing electricity consumption is more common than taxing the underlying fuels.

Table 7. **Taxation of electricity in OECD countries (number of countries)**

		Consumption	
		Not taxed	Taxed
Production fuels	Not taxed	5	17
	Taxed	2	7
	Rebated	1	2

Source: OECD calculations.

As discussed in Section 3.2, the methodology "looks through" taxes on electricity consumption to calculate the implicit tax rates on the primary energy used to generate electricity. Where countries tax the primary energy used to generate electricity directly, the tax rate for each energy source is calculated. Where a country taxes both fuels used to produce electricity and electricity consumption, both levels of taxation are taken into account in calculating the effective tax rate on each primary energy source.

While taxing electricity consumption is viewed for the purposes of this report as an indirect tax on the fuels used for electricity generation, an electricity tax that does not distinguish between sources of generation sends no price signal favouring high-efficiency or low-carbon sources of generation.

As with the other energy use categories, the maps show that effective tax rates on the fuels used to generate electricity vary considerably across fuel types. Tables 8 and 9 set out the simple average for OECD countries of the effective tax rates in energy and CO_2 terms for different fuels used in electricity generation. These take into account both taxes on fuel used to generate electricity (inputs), and taxes on electricity (the output). Due to the more complicated construction of the effective tax rates on electricity, they must be interpreted carefully.

Since the methodology looks through taxes on electricity consumption to the underlying fuels, a tax on electricity consumption will result in a lower effective tax rate on generation sources that are less efficient in transforming fuel into electricity (since the tax on electricity used is attributed to a greater amount of underlying fuel). This can be seen in Table 8, where natural gas, the most efficient form of fossil fuel generation, faces the highest effective tax rate among fossil fuels in energy terms.[12] A tax on electricity may encourage conservation of electricity generally. However, unlike differential taxation of the fuels used to generate electricity, taxation of electricity consumption itself provides no incentive to favour higher-efficiency generation sources since it effectively ignores energy lost as a result of inefficiencies in the generation process.

Table 8. **OECD simple average effective tax rates on energy by fuel type: Fuels used to generate electricity**

EUR per GJ

		Fuels									
		Coal	Peat	Biofuels	Waste	Natural gas	Oil	Renewables	Hydro	Nuclear	All fuels
	% of base	40%	0%	2%	1%	19%	3%	2%	5%	27%	100%
Electricity	100%	**0.7**	**0.1**	**0.8**	**0.6**	**1.2**	**0.9**	**1.5**	**1.5**	**0.3**	**0.9**

Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a).

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On the CO_2 side, Table 9 sets out the implicit tax rates on carbon that are calculated by taking into account explicit taxes on carbon fuels and treating taxes on electricity consumption as if they were an indirect tax on the average carbon content of that country's electricity. Where a significant share of electricity is generated from non-carbon sources (*e.g.* renewables and nuclear), the calculated tax burden on the smaller carbon generation

Table 9. **OECD simple average effective tax rates on CO_2 by fuel type: Fuels used to generate electricity**

EUR per tonne CO_2

		Fuels						
		Coal	Peat	Biofuels	Waste	Natural gas	Oil	All fuels
	% of base	71%	0%	3%	2%	20%	5%	100%
Electricity	100%	**14**	**2**	**13**	**12**	**14**	**11**	**13**

Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a). The electricity figures exclude three outliers from the calculations: Iceland, Norway and Sweden.

StatLink http://dx.doi.org/10.1787/888932767555

sources will be quite large. From a policy perspective, this helps illustrate that an undifferentiated tax on electricity regardless of generation source creates no incentive to favour less carbon-intensive sources.

4.5. *Tax rates on carbon – thumbnail profiles*

The full richness of the energy tax picture in each OECD country is set out in the detailed maps in Part II of this report. It can be useful, however, to compress this detailed information into a more compact picture. Using the information underlying the detailed maps, Figure 14 on the next two pages sets out a thumbnail profile of the implicit carbon price signal sent by energy taxes[13] in each of the 34 OECD countries. These sketches take the information on effective tax rates from the maps, and arrange it from the lowest to the highest tax rate.[14] The proportion of the tax base (in tonnes of CO_2) is set out on the horizontal axis, with the corresponding effective tax rate on carbon on the vertical axis. For example, at the 80% mark, the line shows the rate that the 80th percentile of the base is taxed at, and by implication, the rate below which 80% of the carbon emissions in that country are taxed.

Like the summary statistics above, these sketches highlight the wide variance in effective tax rates on carbon both within and across OECD economies. In general, the highest levels on the right side of these profiles represent the tax rates on transportation fuels.

As was emphasised in Box 2, empirical evidence shows that the imposition of energy taxes does affect energy consumption behaviour. Consistent with this, it is interesting to note that a simple scatter plot of OECD countries in Figure 15 shows that countries with a higher average effective tax rates on CO_2 tend to have lower carbon emissions per unit of GDP (*i.e.* have less carbon intensive economies). In this chart, countries with explicit carbon taxes are denoted by a + and others by a dot point. While this correlation does not imply causation, it suggests that there may be a linkage.

Figure 14. **Effective tax rates on carbon in OECD countries: Thumbnail profiles**

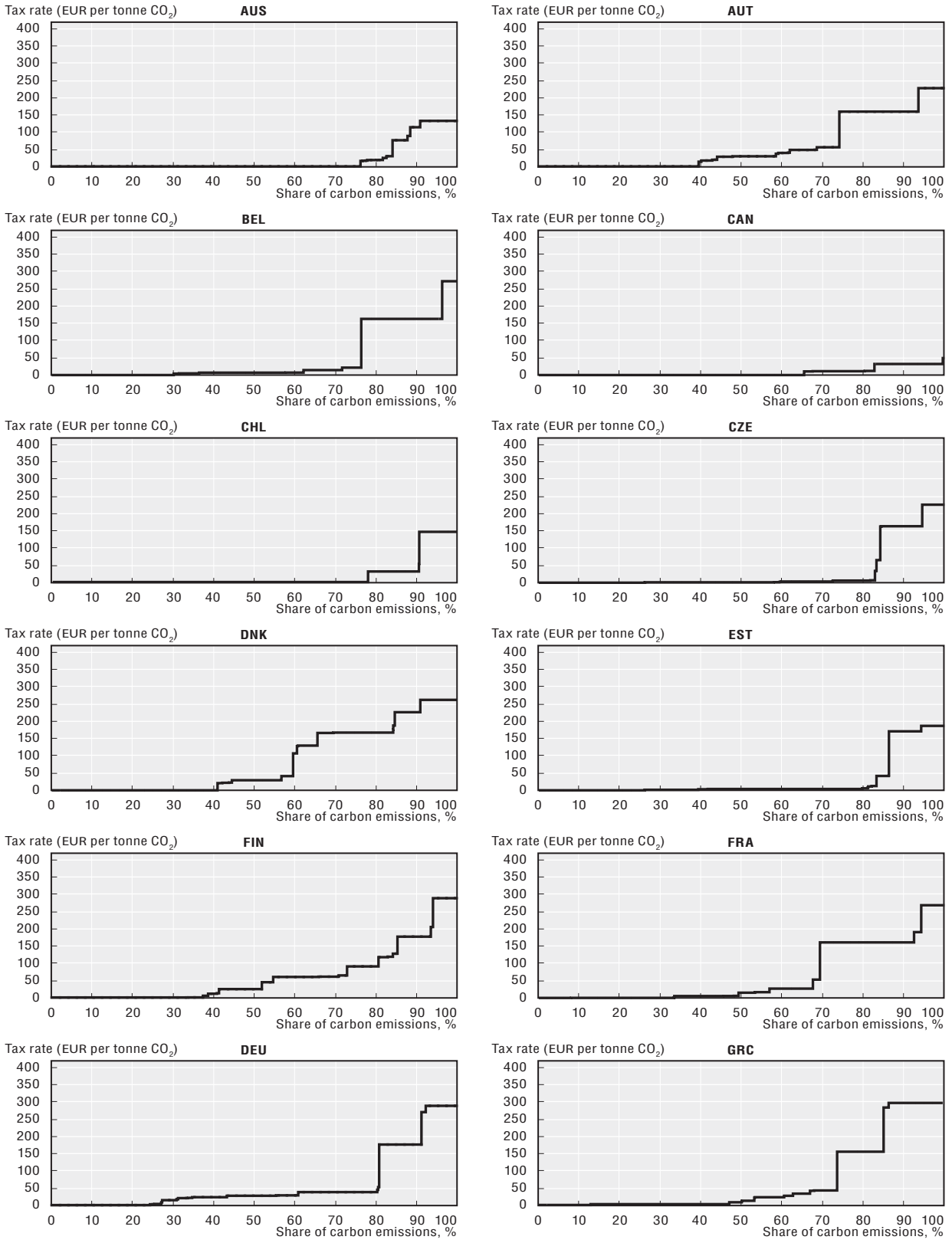


Figure 14. **Effective tax rates on carbon in OECD countries: Thumbnail profiles** *(cont.)*

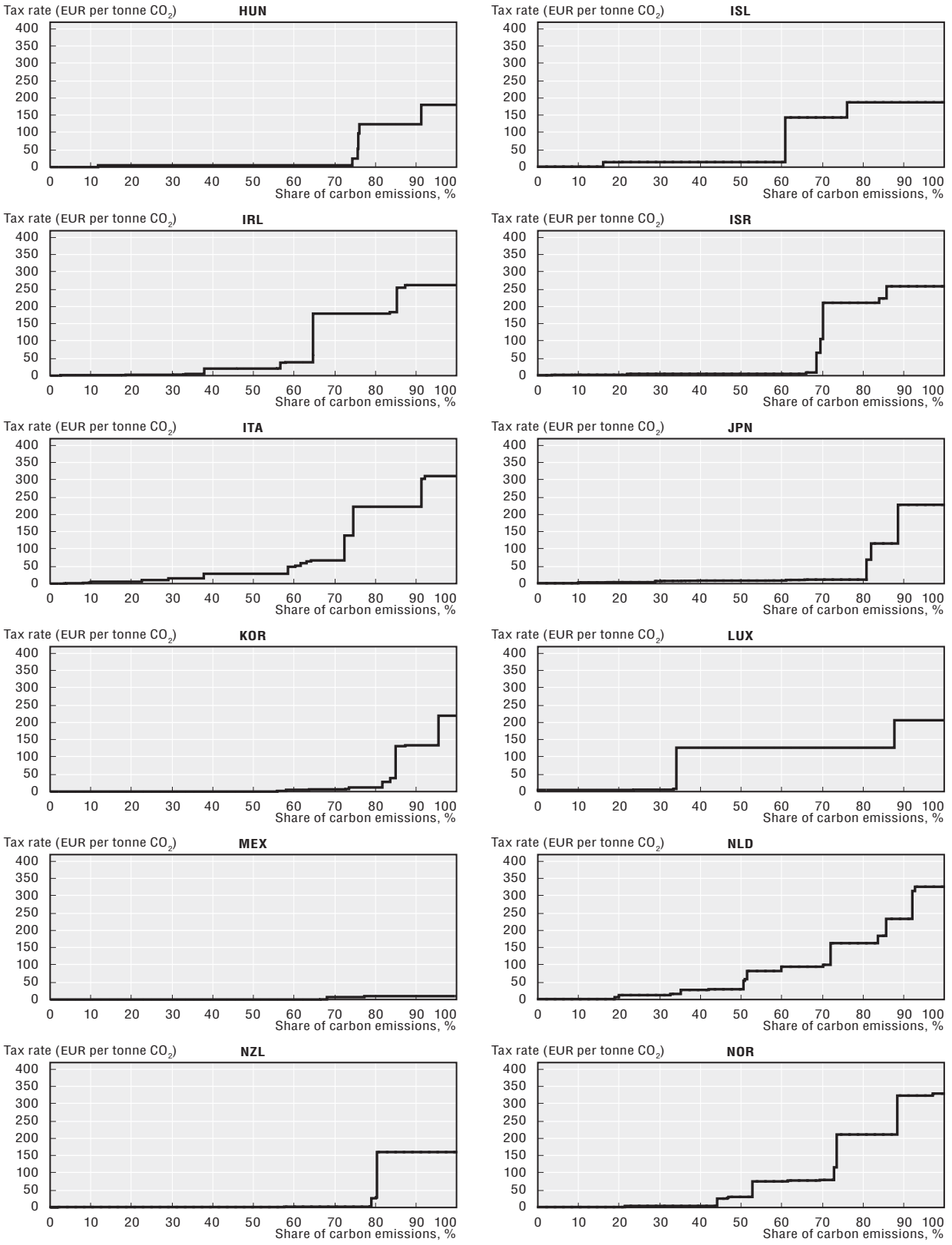
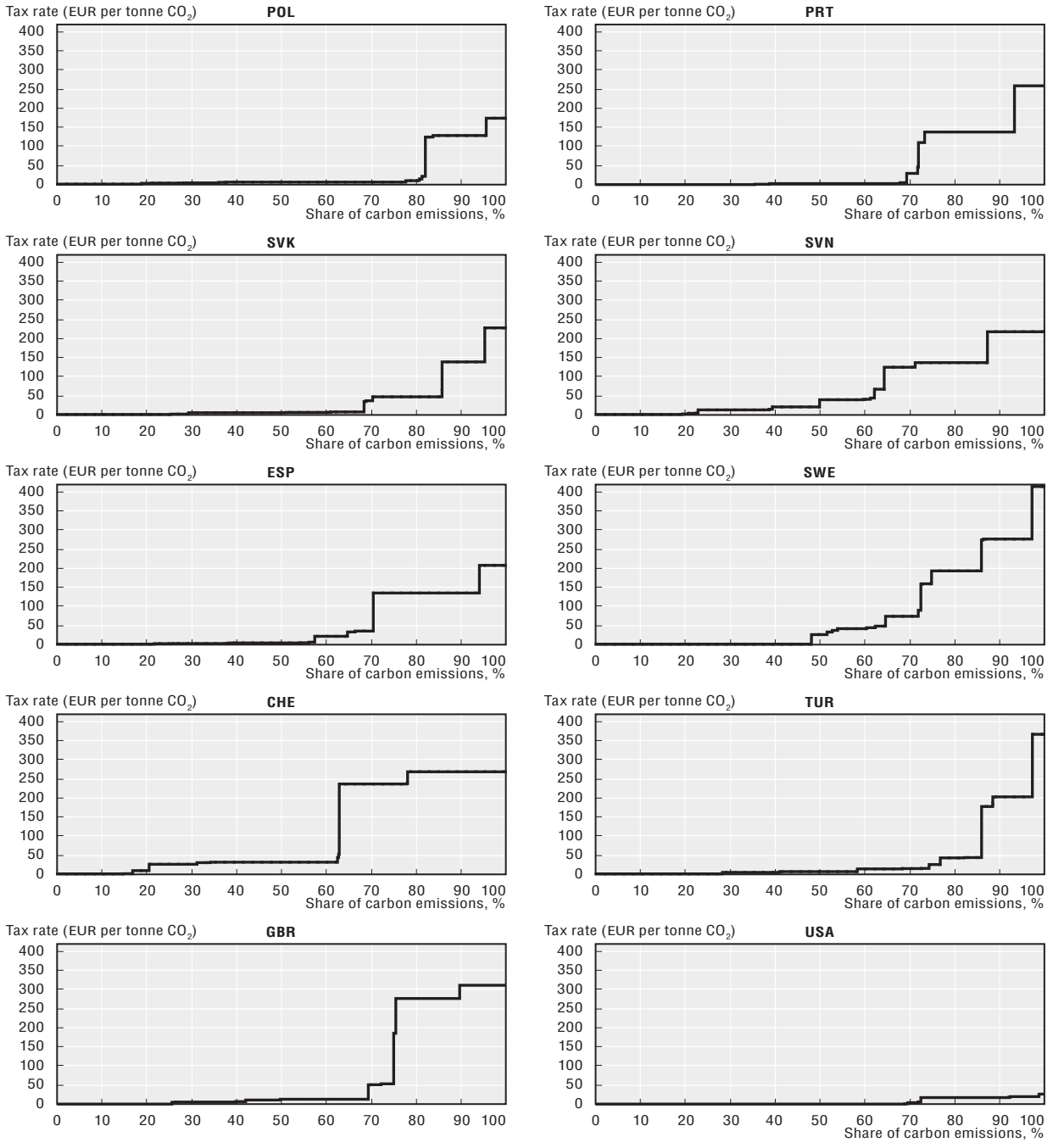


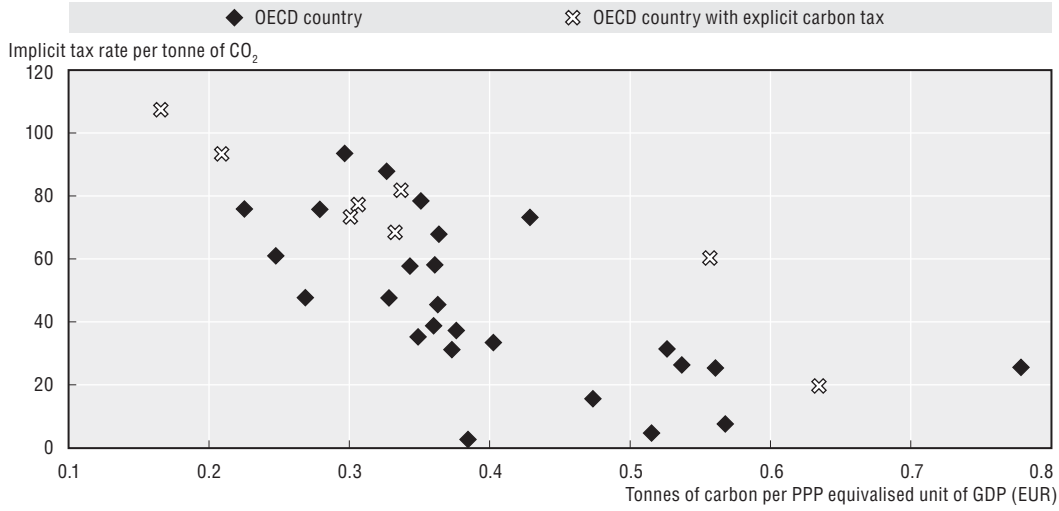
Figure 14. **Effective tax rates on carbon in OECD countries: Thumbnail profiles** *(cont.)*



Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a). Figures for CAN and USA include only federal taxes.

StatLink http://dx.doi.org/10.1787/888932765788

Figure 15. **Average effective tax rates on CO_2 and carbon efficiency in OECD countries**



Source: OECD calculations. Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA (2011a). Figures for CAN and USA include only federal taxes.

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5. Conclusion

Whether or not intended, energy taxes have an important impact on energy use patterns and the environment. Indeed, many current tax systems impose a substantial price on carbon. The profiles of energy taxation set out in this report, however, underline that across countries and within countries there are widely varying effective tax rates on CO_2 emissions – both across fuel types and fuel uses. While in some cases there may be good justifications for variations in effective tax rates on carbon (*e.g.*, where motor fuels are taxed as a proxy for other social costs of vehicle use), in many other cases the reasons are not at all obvious. Furthermore, some rates may not be reflective of the external costs associated with different forms of energy and energy use. This may suggest that many countries have not given great weight in their tax policy design to environmental damage from fuel use, such as that caused by carbon emissions. Many differentials may simply have arisen out of the piecemeal design and introduction of taxes on different energy products over a period of time.

The report notes various situations that suggest a need for reappraisal of tax settings:

- The effective tax rate on diesel for road use in terms of both energy and carbon content is typically lower than the comparable rate on gasoline.
- In both the transport and the heating and process categories, oil products (predominantly gasoline and diesel) tend to be taxed significantly more heavily and more frequently than other energy products, such as natural gas and coal.
- Among heating and process fuels, there is often a very low (or zero) tax rate on coal, despite its significant negative environmental impacts, particularly its greater contribution than other fuels to greenhouse gas emissions and other air pollutants per unit of energy.
- Fuel used in agriculture, fishing and forestry is often exempt from tax, providing no signal with respect to external costs, thereby encouraging over-use.

- In the electricity category, coal, which is widely used, is often taxed at a lower rate than natural gas and biofuels and waste; and taxes on the consumption of electricity provide no signals in terms of the differing environmental impact of the various primary energy sources from which electricity may be generated.

These uneven price signals with respect to different energy products, and low rates and exemptions on some of them, suggest that some of the lowest-cost opportunities to reduce carbon emissions are being foregone. In many countries, a reappraisal may be warranted to explicitly determine whether current energy tax settings are appropriately adapted to their environmental, social and economic goals. The profiles of energy taxation in this report provide policy makers and analysts with a data-rich tool to aid in the review and reappraisal of energy tax systems.

Notes

1. On one hand, earmarking of tax revenue may help increase the public acceptability of environmentally related taxes. As a general principle of fiscal management, however, earmarking of tax revenue is not usually recommended since the revenues that result from a tax are unlikely to match the appropriate spending level for any particular area of public spending on an ongoing basis.
2. The Directive 2003/96/EC sets minimum rates of taxation applicable to energy products when used as motor or heating fuels and to electricity. For more information, see Box 5. For the proposed modification, see European Commission (2011a).
3. The CO_2 emission figures have been derived from fuel use volumes using standard physical conversion factors from the sources set out in Annex A (see pp. 244-246). This is possible since CO_2 emissions are generally fixed for given quantities of particular fuel types (subject to variations in fuel quality) regardless of the particular combustion technology used.
4. The impact of reduced VAT rates and specific *ad valorum* taxes on energy products could be taken into account by considering the average price for the relevant product over a reference period like a year. It was not possible, however, for the purposes of this study to obtain data on all the relevant energy products in all the relevant countries of the OECD.
5. An alternative approach would be to include such taxes only in the computation of effective tax rates expressed in energy terms, but this would result in unequal coverage between the two sets of maps.
6. Other OECD countries with explicit carbon taxes are: Australia (as of July 2012); Canada (British Columbia and Quebec); Finland; Norway; Slovenia; and the United Kingdom.
7. For example, Newberry (2005) and Parry and Small (2005) estimate an optimal level for motor fuel taxes in the UK and the US taking into account a range of externalities. Reviews concerning automobile externalities are also presented in Parry *et al.* (2007) and Ce-Delft (2008).
8. This revenue estimate has been generated from the underlying base and rate data presented in the country maps. Both weighted and unweighted OECD averages are almost identical.
9. Calculated on the basis of conversion factors from the sources in Annex A (see pp. 244-246).
10. The large differential in New Zealand may be explained by the fact that a road user charge, levied per kilometre driven by diesel vehicles, exists in place of a specific excise tax on diesel. Unlike a fuel tax, however, the road user charge does not give any incentive to reduce fuel use per kilometre driven.
11. See: Hausberger *et al.* (2009).
12. Since renewable energy does not have an inherent heat energy value separate from its use to generate electricity, the value of the energy used in generation is considered to be equal to that of the electricity generated – *i.e.* these technologies are essentially considered to be 100% efficient. For this reason, the effective tax rate is highest on renewables.
13. These thumbnail profiles only include explicit taxes and therefore do not reflect the implicit price signal sent by emission trading systems.
14. A similar presentation of effective tax rates on carbon is presented in Vivid Economics (2012).

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PART II

Country profiles

The analysis for each OECD country is presented in this part of the report.

For each country, two maps of energy use and taxation are provided, one comparing energy sources on the basis of energy content, the other on the basis of carbon content. The country sections discuss the structure and policy rationale for energy taxation in each country and use the maps to relate these tax structures to energy use. Important assumptions and caveats to the analysis are noted at the end of each section.

Australia

Figures 1.1 and 1.2 map the use and taxation of energy in Australia on the basis of energy content and carbon content, respectively.

Structure of energy taxation

The structure of energy taxation in Australia changed from 1 July 2012. From this date, a carbon price and an equivalent carbon price were introduced, alongside the pre-existing taxation of petroleum products. Figures 1.1 and 1.2, and the discussion below, are based on the rules applying as of 1 July 2012.

In the transportation category, Australia applies fuel taxes on a per-litre basis to several oil products used for transportation, including gasoline, diesel, liquefied petroleum gas (LPG), and fuel oil. Rates for diesel and gasoline are set at AUD 0.3814 per litre and are partially rebated through a fuel tax credit that applies to emergency vehicles and to vehicles that weigh over 4.5 tonnes. LPG is taxed at a lower rate of AUD 0.05 per litre. The equivalent carbon price that was introduced on 1 July 2012 increased tax rates on domestic aviation fuels to AUD 0.09536 per litre for aviation kerosene and AUD 0.8616 for aviation gasoline and removed the fuel tax credit that previously applied to LPG and LNG used in transport.

For heating and process use, gasoline, diesel and other liquid petroleum products are taxed at AUD 0.3814 per litre. Fuel tax credits also apply to these products when used for heating or process purposes. Through this mechanism, certain activities (in the agriculture, fishing and forestry sectors) are exempt, while other uses of fuels in industry or for domestic heating pay a reduced rate. The introduction of the equivalent carbon price reduced the fuel tax credit rate that applied to fuels used by industry and for heating use, effectively increasing the tax rates that apply. Other fuels such as coal and natural gas are untaxed.

In addition to the equivalent carbon price, the carbon price introduced on 1 July 2012 applies to many firms in the heating and process category. This carbon price applies to firms that emit more than 25 000 tonnes of carbon dioxide per year. The carbon price is initially set at AUD 23 per tonne of carbon emitted and will rise at 2.5 per cent per annum in real terms. On 1 July 2015, the carbon price will transition to a fully flexible price under an emission trading scheme, with the price determined by the market.

The consumption of electricity is not taxed. The use of oil in electricity is subject to the equivalent carbon price, and most of the producers of electricity are required to pay the carbon price.

Energy use and taxation in Australia

On the maps for Australia, the equivalent carbon price is shown by the dark grey line across the bars showing the tax rates. Fuels and users that are partially subject to the carbon price are indicated by [CP-P] after the name of the subcategory; firms and users that are entirely or substantially subject to the carbon price are shown with [CP-A] after the name of the subcategory. The level of the carbon price is shown, converted into euros, on the right hand axis.

Most fuels used for transport in Australia are taxed at the same rate on a per litre basis. This amounts to a higher tax on gasoline than on diesel on both an energy and a carbon content basis. Together, gasoline and diesel comprised 81% of both energy used and carbon emissions from fuels used for transport in 2009. Reduced tax rates apply to both fuels when used by heavy vehicles, and to LPG which comprises just under 4% of both energy use and emissions in this sector. Domestic aviation is taxed at a lower rate and represented approximately 8% of energy use and carbon emissions from transportation. The introduction of the equivalent carbon price has increased the rates of tax that apply to fuels used for aviation purposes. Carbon emissions from rail and marine fuels accounted for 5% of energy use and emissions in the transport sector. A small amount of electricity is also used in transport, and is untaxed.

Within the heating and process use category, only oil products are taxed under the fuel tax and fuel tax credit regime. The introduction of the equivalent carbon price has increased the tax rates applying in this category by decreasing the fuel tax credits applied to oil used for industrial purposes. Oil accounts for 25% of energy use and carbon emissions from this category of use; of this, just over 10% derives from fuels used by the agricultural, fishing and forestry sectors which are exempt from taxation. Other fuels used for heating and process use include natural gas (35% of all energy used in the heat and process category and 26% of emissions from this category), other gases, and waste. These fuels are subject to the carbon price if used by a firm that emits over 25 000 tonnes of CO_2 per year in the electricity and industrial sectors. The use of non-oil fuels are not subject to the carbon price, and oil use by households, small businesses, and the agricultural sector are not be taxed.

The majority of CO_2 emissions from fuel combustion in Australia result from the production of electricity; particularly from coal used to generate electricity. Coal used to generate electricity accounted for 80% of energy used to generate electricity and 87% of carbon emissions from electricity production. They were also the single most significant source of carbon emissions from energy use in Australia, accounting for 47% of all emissions. While fuels used to produce electricity were previously untaxed, they are now subject to the carbon price at a rate of AUD 23 per tonne of carbon emissions, as shown in the maps.

Reported tax expenditures and rebates

Australia reports a number of tax expenditures which can be identified in the maps.

- *Fuel tax credits:* The tax expenditures associated with the fuel tax credits are shown on the maps in light grey in the categories "Diesel and gasoline (ag., fish.)", "Gasoline (road: heavy vehicles)", "Diesel (road: heavy vehicles)", "Diesel (ind., comm., res.)", and "All other oil products (ind., comm.)". The tax expenditures calculated for these are based on the benchmarks shown at the top of the light grey area (on a weighted basis where a category includes more than one type of fuel). Most tax credits were reduced as part of the 2012 carbon pricing policy reform.
- *Domestic aviation:* Australia estimates a tax expenditure based on the reduced tax rate for fuel used for domestic aviation of AUD 0.0356 per litre (relative to AUD 0.38143 for other oil products). The maps show the lower rate of fuel on aviation relative to other oil products (although differing calorific values between fuels means that an AUD 0.38143 per litre tax rate will differ slightly on a per gigajoule basis).

- *Exemption from excise for alternative fuels:* As shown in the maps, Australia exempts LPG from fuel taxation and calculates a tax expenditure for this exemption. A benchmark of AUD 0.25 per litre is used to calculate tax expenditures for LPG, as it has a lower calorific content than some other oil products, for which AUD 0.38 is used for a benchmark.

Key assumptions and caveats

Key assumptions and caveats are as follows:

- Only federal level taxes and tax credits were considered. State-level rebates (such as the Queensland Subsidy Scheme, and the Western Australian dividend scheme) were not included here. The former is no longer operational, and the latter is of a small scale.
- Minor exemptions and rebates are also not included: for example, the home energy assistance scheme and the reticulated natural gas rebate.
- Operational elements of the tax system, and in particular of the fuel-tax credit system (such as GST registration and the need to claim the credit), are not taken into account.
- The proportions of gasoline and diesel used by heavy road vehicles (vehicles heavier than 4.5 tonnes) were assumed to be 7% and 60%, respectively. These assumptions were based on Australian Bureau of Statistics information (2007).

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Australian Bureau of Statistics (2007), "Survey of Motor Vehicle Use, Australia". Available at: *www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/9310017FE20A9F88CA2578F4001E4EB2?opendocument*.

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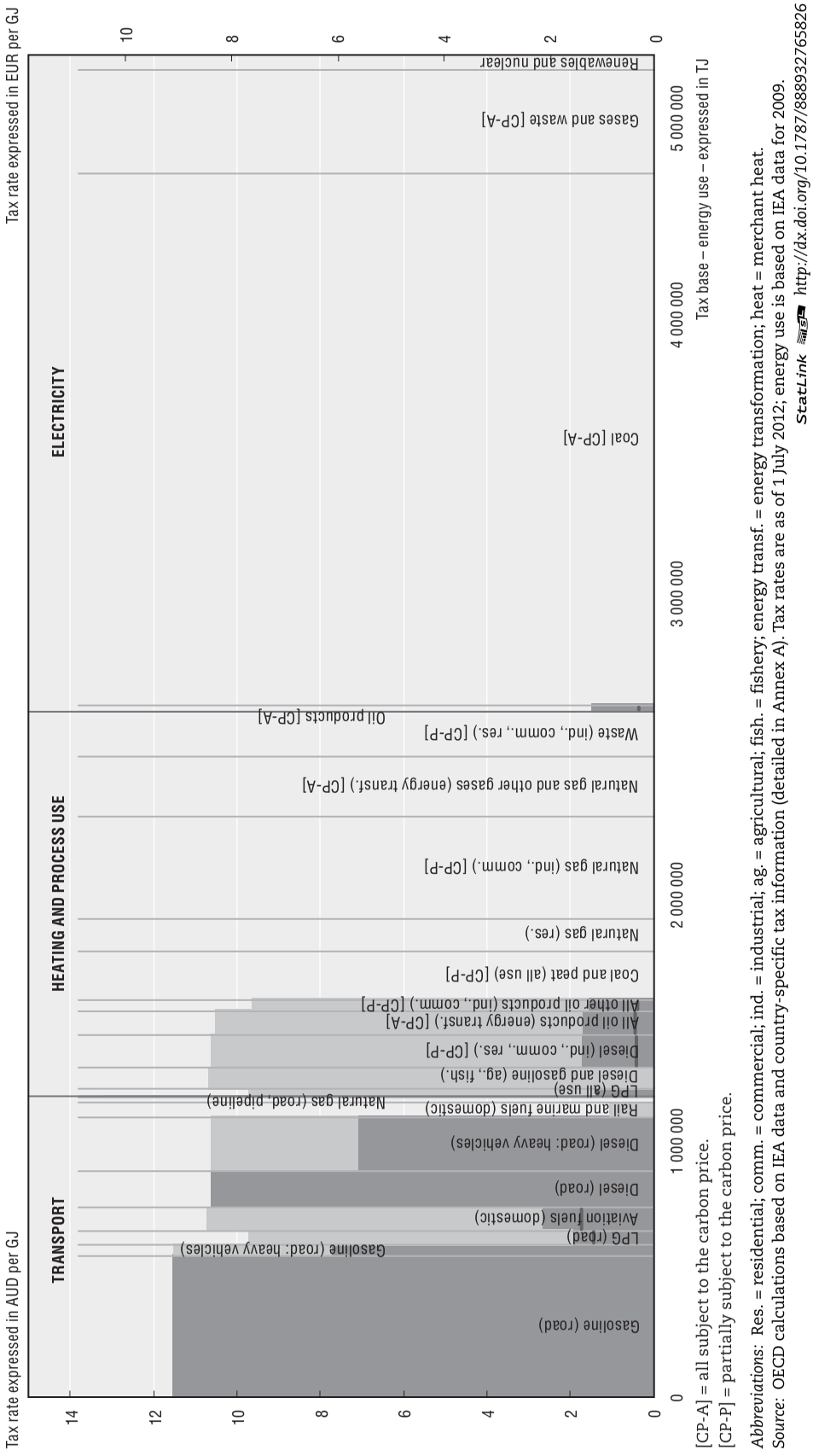
Australian Taxation Office (2012b), "Fuel Tax Credits Rates and Eligible Fuels". Available at: *www.ato.gov.au/businesses/content.asp?doc=/content/00174722.htm&pc=001/003/044/009/010&mnu=&mfp=&st=&cy=1*.

Figure 1.1. **Taxation of energy in Australia on an energy content basis**



[CP-A] = all subject to the carbon price.
[CP-P] = partially subject to the carbon price.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 July 2012; energy use is based on IEA data for 2009.

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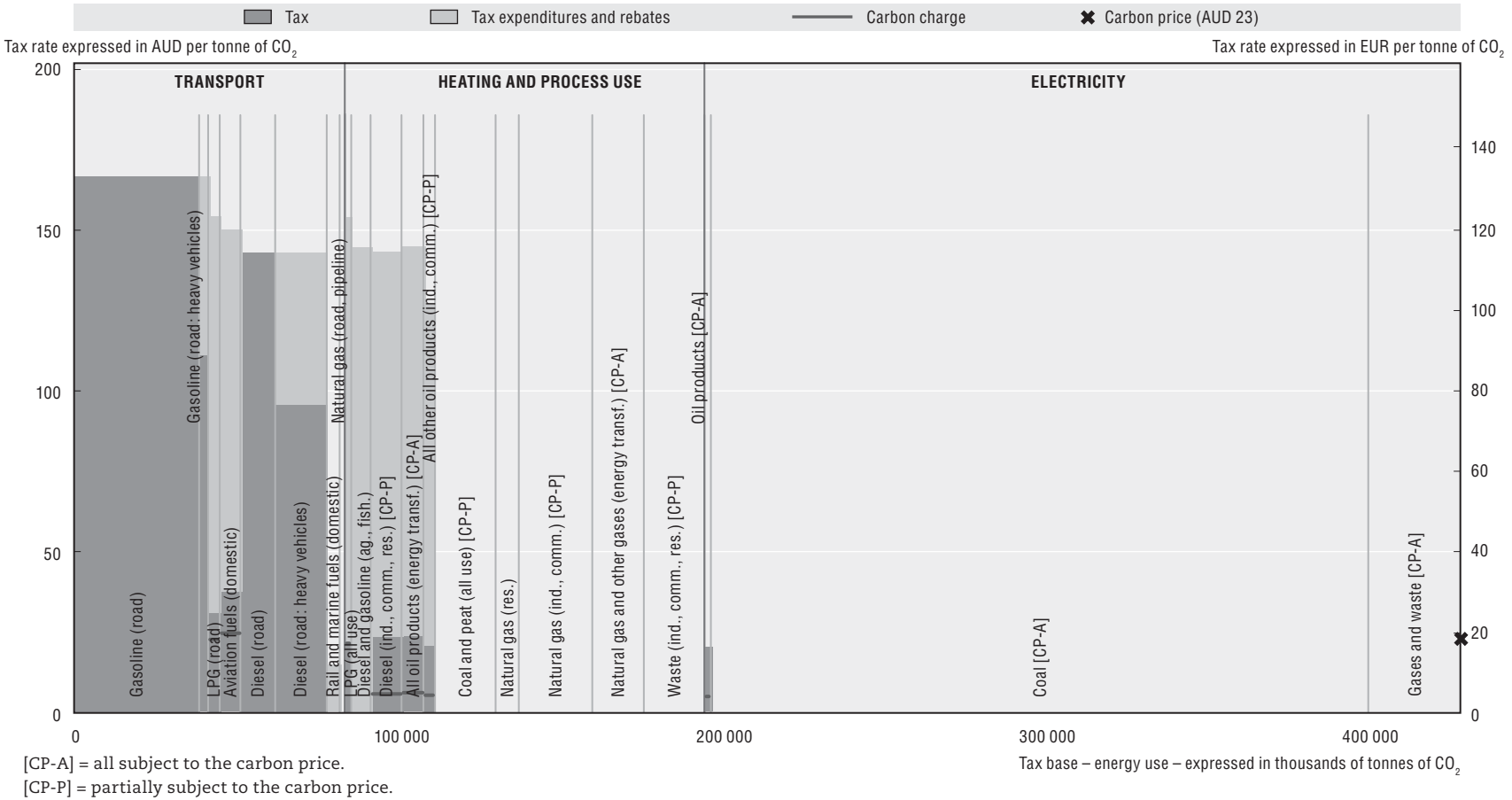
Figure 1.2. **Taxation of energy in Australia on a carbon emission basis**



[CP-A] = all subject to the carbon price.
[CP-P] = partially subject to the carbon price.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 July 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932765845

Austria

Figures 2.1 and 2.2 map the use and taxation of energy in Austria on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In Austria, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). Tax rates are generally set above the minimum rates specified in the Directive. Natural gas used as a propellant, and diesel used in rail transport, are subject to reduced rates. Fuels used for domestic aviation and shipping purposes are exempt from excise tax, as are biofuels.

Diesel is taxed in the same way whether used as a transport or process fuel. Diesel used by the agricultural sector benefits from a partial refund, whereas diesel used as a heating fuel is taxed at a reduced rate. The same approach is applied to LPG, for which transport and process use are treated the same way, whereas heating use is taxed at a lower rate. In contrast, natural gas is taxed at the same rate whether it is used for transport or for heating and process purposes. All fuels used for energy transformation are exempt from excise tax.

Electricity is taxed at the same rate for all consumers, and fuels used to generate electricity are not taxed.

Energy use and taxation in Austria

As can be seen from the maps, diesel accounted for the majority of energy use in the transport category in 2009 – making up 65% of energy use and 66% of the resulting CO_2 emissions in this category. Gasoline accounts for a further 24% of energy use and 23% of CO_2 emissions from transport. Diesel is taxed at a lower rate than gasoline both in terms of energy and CO_2 emissions. Small amounts of LPG and natural gas are taxed at significantly lower rates than gasoline and diesel, as are aviation, navigation and rail fuels. As noted above, biofuels – which make up around 6% of both energy use and CO_2 emissions in transport – are exempt from tax.

Heating and process use is dominated by natural gas, and biomass and waste. Natural gas accounts for 37% of energy use and 33% of CO_2 emissions, while biomass and waste account for 27% of energy use and 35% of CO_2 emissions in this category. Diesel makes up an additional 15% of energy use and 13% of CO_2 emissions. Diesel is taxed at the highest effective tax rate (in terms of both energy and CO_2), with the rate higher for industrial use than for residential, commercial and agricultural use. LPG is taxed at the next highest effective rate, with natural gas, coal and fuel oil taxed at comparatively lower rates. The exemptions from excise tax on fuels used in energy transformation and to produce merchant heat, together with untaxed biomass and waste, result in 51% of energy use and 63% of emissions from the heating and process category being untaxed.

Electricity is generated predominantly using renewables and natural gas – which provide 47% and 26%, respectively, of the energy used to generate electricity. While the use of renewables does not generate any CO_2 emissions, natural gas is responsible for 65% of the CO_2 emissions from electricity generation. The substantial use of renewables, results in the electricity sector being proportionately smaller in CO_2 terms than in energy terms. The

highest effective tax rate, in terms of energy, falls on renewables. This is because renewables are more efficient at generating electricity (in terms of the amount of energy lost) than the other energy sources used, hence the amount of energy usage on which the tax on electricity consumption is effectively imposed is smaller than would otherwise be the case. Coal, and biomass and waste have the lowest effective tax rates (both in terms of energy and CO_2) as they are the least efficient energy sources used to generate electricity in Austria.

Reported tax expenditures and rebates

Austrian national laws provide several refunds and reduced rates for energy products, as summarised in the OECD Inventory.

The tax expenditures associated with two reduced rates applied to diesel consumption are shown in the maps for Austria:

- *Rail, aviation and marine fuels*: the reduced rate applied to diesel for rail transport is shown in this category. The benchmark applied is the tax rate levied on diesel used as a transport and process fuel. Although fuel use in railways is aggregated with fuel use in navigation and aviation, the benchmark is applied only to the portion of the tax base related to diesel.
- *Diesel used in agriculture*: The tax expenditure corresponding to the refund applied to agricultural use of diesel has been computed using the tax rate levied on industrial use of diesel as the benchmark.

Note that both these tax expenditures will be removed from 1 January 2013.

Key assumptions and caveats

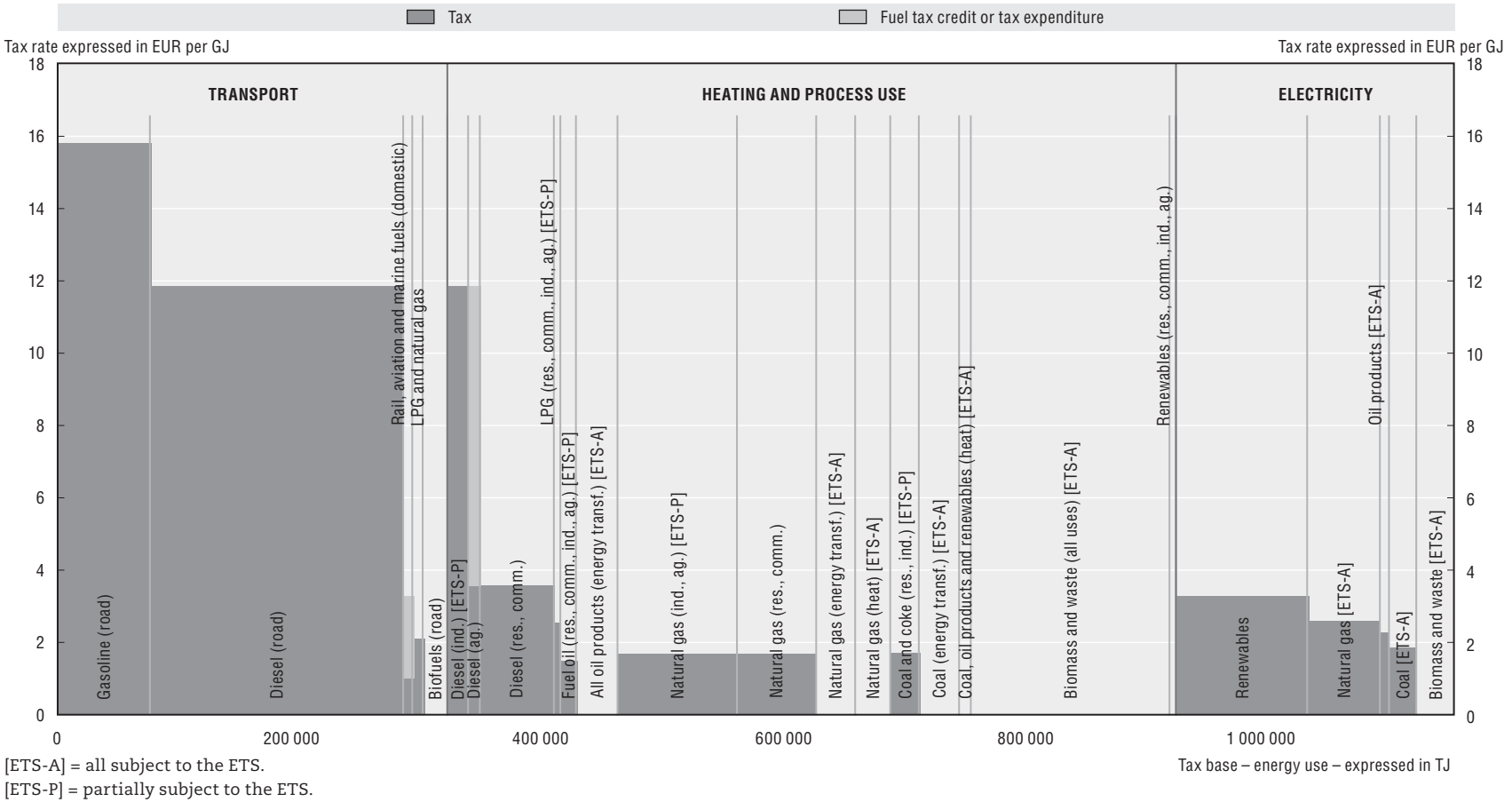
Key assumptions:

- The refund for diesel used by rail and agriculture has been computed as the difference between the standard tax rate and the reduced rate for marked gas oil, using information from the European Commission (2012).
- The lower tax rates for blended gasoline and diesel (0.554 EUR per litre and 0.397 EUR per litre, respectively) are not represented in the map, since only pure biofuels are shown.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials.

Figure 2.1. **Taxation of energy in Austria on an energy content basis**

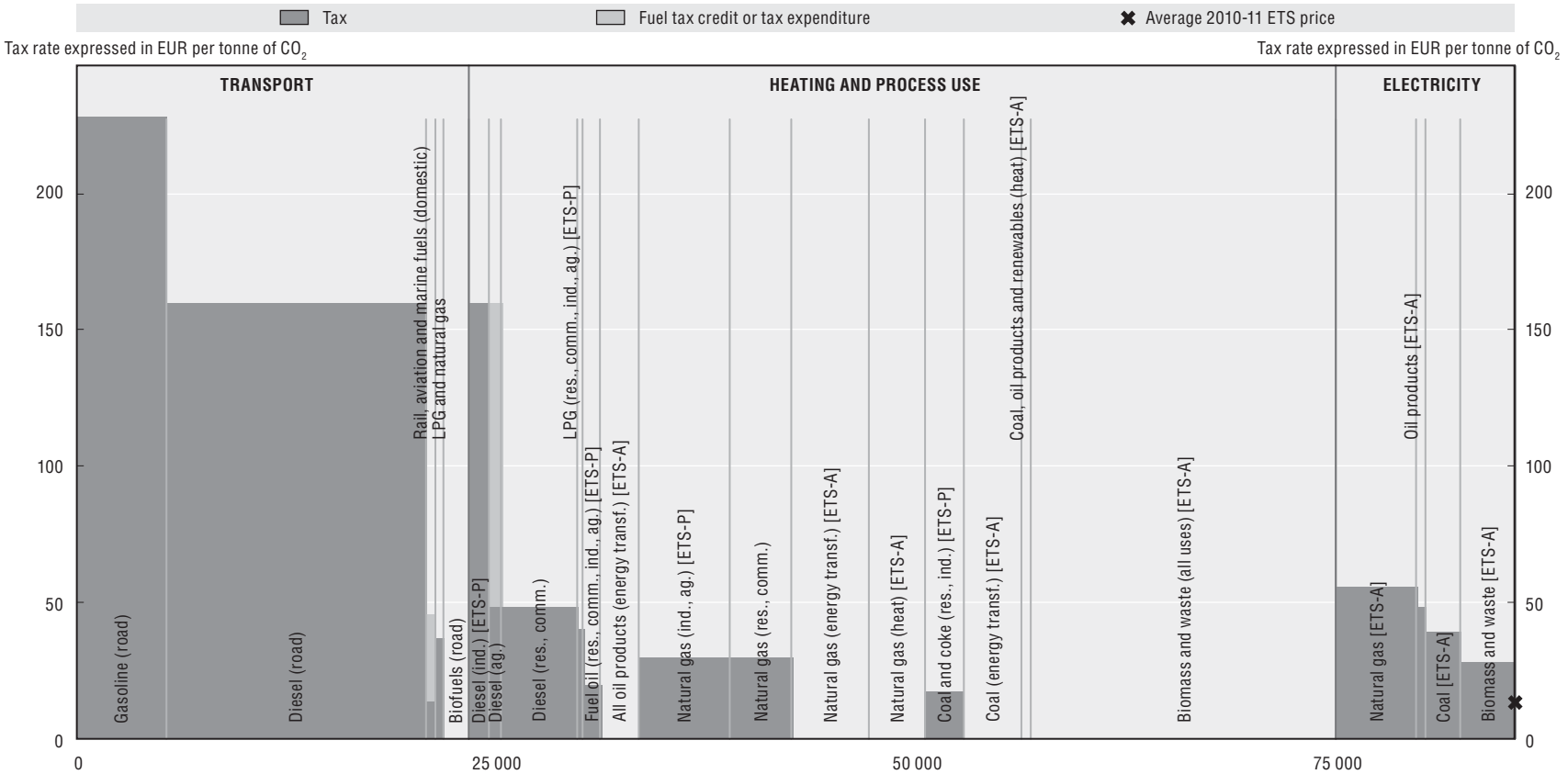


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink *http://dx.doi.org/10.1787/888932765864*

Figure 2.2. **Taxation of energy in Austria on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

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Belgium

Figures 3.2 and 3.3 map the use and taxation of energy in Belgium on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In Belgium energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). The tax rates are above the minimum rates set by the Directive for gasoline and diesel used as transport fuels. In contrast, LPG used as a transport fuel is untaxed. Exemptions from excise duties are provided for fuel used in domestic aviation, rail transport, and navigation.

Diesel used for heating and process purposes is taxed at the minimum rate specified by the Directive, whereas natural gas is taxed slightly below the minimum rate. Fuels used in agriculture, and coal used for residential heating are exempt. Reduced rates are applied to fuels used in industries with an environmental agreement. Energy-intensive industries with an environmental agreement are entitled to an exemption from the excise tax levied on fuels they use. Participation in the European Emission Trading System (ETS) is considered to be an environmental agreement. As a result, most energy intensive industries are exempt from tax. Fuels used by oil refineries and other energy transformation industries are taxed, except when they are used as raw materials. Refineries are energy-intensive industries and for this reason the exemptions and reduced rates described above often apply to them as well.

Electricity is taxed at differing rates according to the voltage used – with higher voltage users facing a lower tax rate than lower voltage users. An additional rate is also applied only to business use. Energy-intensive industries with an environmental agreement are entitled to an exemption from the excise tax on electricity consumption. Excise duties are also levied on coal and fuel oil used to generate electricity. Fuels used for the combined production of heat and power are exempted. Waste and forms of renewable energy are not taxed when used to produce heat or electricity.

Energy use and taxation in Belgium

As can be seen from the maps of energy use and taxation that follow, diesel constituted the majority of energy used in transport (78%) and the resulting CO_2 emissions (79%) in 2009. Gasoline accounts for a further 16% of energy used in transport and 15% of transport emissions. Diesel used in transport is taxed at a lower rate than motor gasoline, on both an energy and carbon content basis. Diesel consumed by trucks, taxis and public buses is taxed at a lower rate. The remaining fuel use in the transport category is exempt.

Heating and process use is dominated by natural gas, which accounts for 45% of energy used in the category, and 40% of the resulting CO_2 emissions. Around one-third of this (in terms of both energy and CO_2) is tax exempt, as it is consumed by energy intensive industries or merchant heat producers. Diesel accounts for around 20% of both energy used and CO_2 emissions in the heating and process use category. Diesel is taxed at a higher rate than natural gas (both in energy and CO_2 terms), although agricultural use is exempt. Kerosene is taxed at a similar rate but is far less significant than diesel, representing less than 1% of both energy use and CO_2 emissions in this category. Coal, fuel oil and LPG are taxed at similar

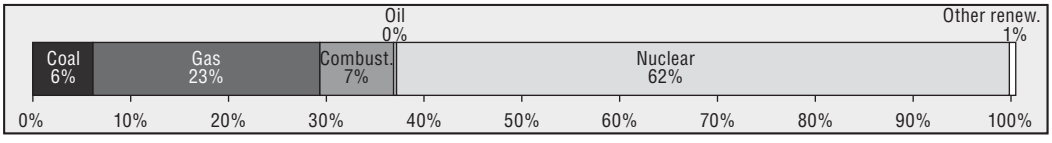
rates to natural gas. However, the majority of coal is used either for residential heating or in energy transformation and is therefore exempt. Agricultural use of fuels represents 3% of both heating and process energy use and CO_2 emissions, and is exempt.

Electricity consumption is taxed in Belgium, and coal and fuel oil used to generate electricity are also taxed. Electricity is produced mainly from nuclear energy and natural gas (see Figure 3.1). Electricity for commercial use faces the highest effective tax rate, as it is assumed to be subject to both the basic excise tax rate as well as the additional business rate. Residential use is subject to the lowest effective rate as it is assumed to only be subject to the basic rate. The effective tax rate on industrial use lies in between the rates for residential and commercial use. This is because only the business rate is assumed to apply to industrial use, and this is greater than the basic rate applied to residential use. Meanwhile, electricity used in agriculture, fishing and transport are exempt from any excise tax on electricity consumption.

Two measures provide support to the consumption of fossil fuels but because of their structure they could not be included in the map. The *Fonds social chauffage* ("Fonds Mazout") program applies to diesel, kerosene and propane gas consumed by the residential sector for heating purposes. The *Fonds* is financed through contributions that are included in the official (maximum) price of the related fuels.

Social tariffs are also in place for specific natural gas and electricity consumers, which are financed through a surcharge. This surcharge is a component of the federal contribution tax, which affects the official price of electricity and gas and is earmarked to finance various policies related to energy.

Figure 3.1. **Fuels used to generate electricity in Belgium (TJs)**



Source: OECD calculations using 2009 IEA Energy Balance data (IEA, 2011a).

StatLink http://dx.doi.org/10.1787/888932765902

Reported tax expenditures and rebates

Belgium reports a number of tax expenditures in the document *Inventaire 2010 des exonérations, abattements et réductions qui influencent les recettes de l'État* which is annexed to the *Budget des voies et moyens pour l'année budgétaire 2012*.

Several tax expenditures are included in the map for Belgium:

- *Diesel used by trucks, taxis and public buses*: These consumers benefit from a reduced rate which is shown in the map using the standard rate for diesel as the benchmark.
- *Diesel and kerosene used as heating and process fuel*: This represents the highest tax expenditure included in the *Inventaire*. The tax expenditure in the map uses three benchmark rates: the rates applied to two different types of diesel and to kerosene.
- *Fuels used in agriculture*: All agricultural uses of fuel are exempt from tax. In Belgium, fuels used by the agricultural sector include natural gas, diesel, fuel oil and kerosene.
- *LPG used as heating and process fuel*: LPG used as heating and process fuel is taxed at a lower rate than the rate levied on the use for certain commercial and industrial purposes

(use in stationary motors, plant and machinery used in construction, civil engineering and public works and vehicles intended for use off the public roadway or which have not been granted authorisation for use mainly on the public roadway).

- *Natural gas used by energy intensive industries:* Based on data on natural gas consumption from the 2009 IEA Energy Balances (IEA, 2011a) for the iron and steel, non-ferrous metals, non-metals, paper, pulp and printing, chemical and petrochemical sectors, 60% of industrial consumption of natural gas has been considered energy-intensive use and entitled to an exemption. The benchmark used to compute the tax expenditure is the standard rate applied to other uses of natural gas as a heating and process fuel.

Key assumptions and caveats

Key assumptions include:

- "Diesel (road, professional)" is diesel used by taxis, buses and trucks and was assumed to represent 15% of total diesel consumption for transport purposes.
- Consumption of biofuels is combined with natural gas, and LPG, and they are shown as untaxed. In reality, biofuels in Belgium may be taxed. For example rapeseed oil is untaxed only if specific conditions are met.
- The tax rates applying to blended gasoline and diesel are lower than the ones shown in the map, respectively equal to 0.570 and 0.406 EUR per litre.
- In Belgium two tax rates are levied on diesel according to its sulphur content. Diesel with a sulphur content of less than 10 mg per kilogram is generally used as a propellant, while diesel with a higher sulphur content is generally used as a heating fuel. For this reason, the tax rate shown in the transport category is equal to the excise duty levied on diesel oil with a sulphur content smaller than 10 mg per kilogram, whereas the tax rate in the heating and process fuel category is equal to the excise duty levied on diesel oil with a sulphur content greater than 10 mg per kilogram.
- Electricity for residential and commercial use are assumed to be supplied at less than 1 kV, and are therefore subject to a basic tax rate of EUR 1.9088 per MWh. Commercial use is also subject to a business rate of EUR 3.8597 per MWh. Electricty used in industry or energy transformation is assumed to be supplied at greater than 1 kV, and is therefore only subject to the business rate of EUR 3.8597 per MWh.

A few existing exemptions could not be represented in the maps. In particular:

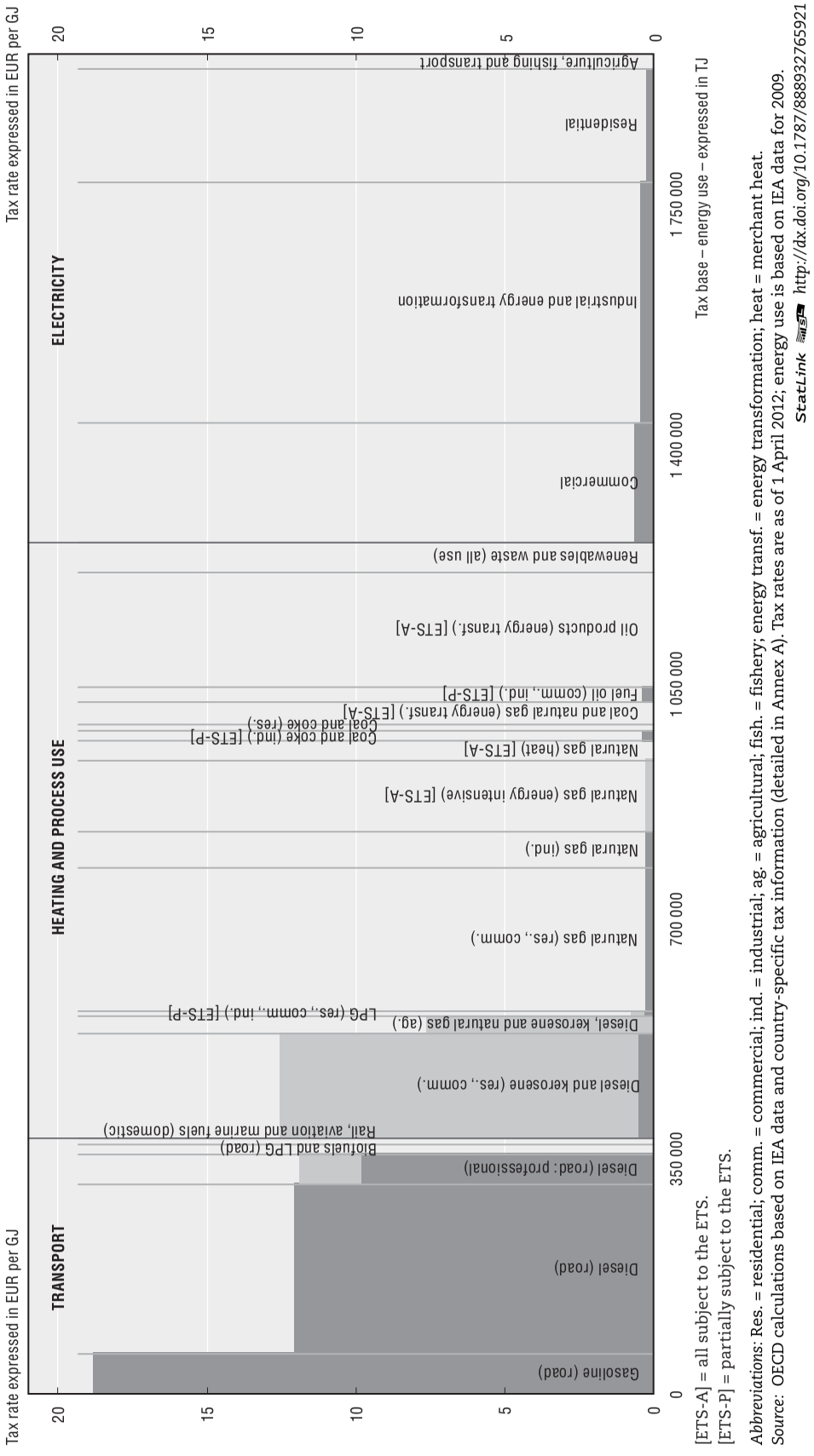
- The exemption in force for the consumption of diesel, fuel oil, kerosene and LPG by energy intensive industries could not be represented in the map due to the very small tax base of these categories.
- The exemption from the excise duty on electricity used by energy intensive industries is not shown in the map since information to disaggregate the tax base was unavailable.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Belgian Service Public Fédéral Finances (2011), "Mémento Fiscal No. 23". Available at: *http://docufin.fgov.be/intersalgfr/thema/publicaties/memento/pdf/MF2011_V10_complet.pdf*.

Figure 3.2. **Taxation of energy in Belgium on an energy content basis**



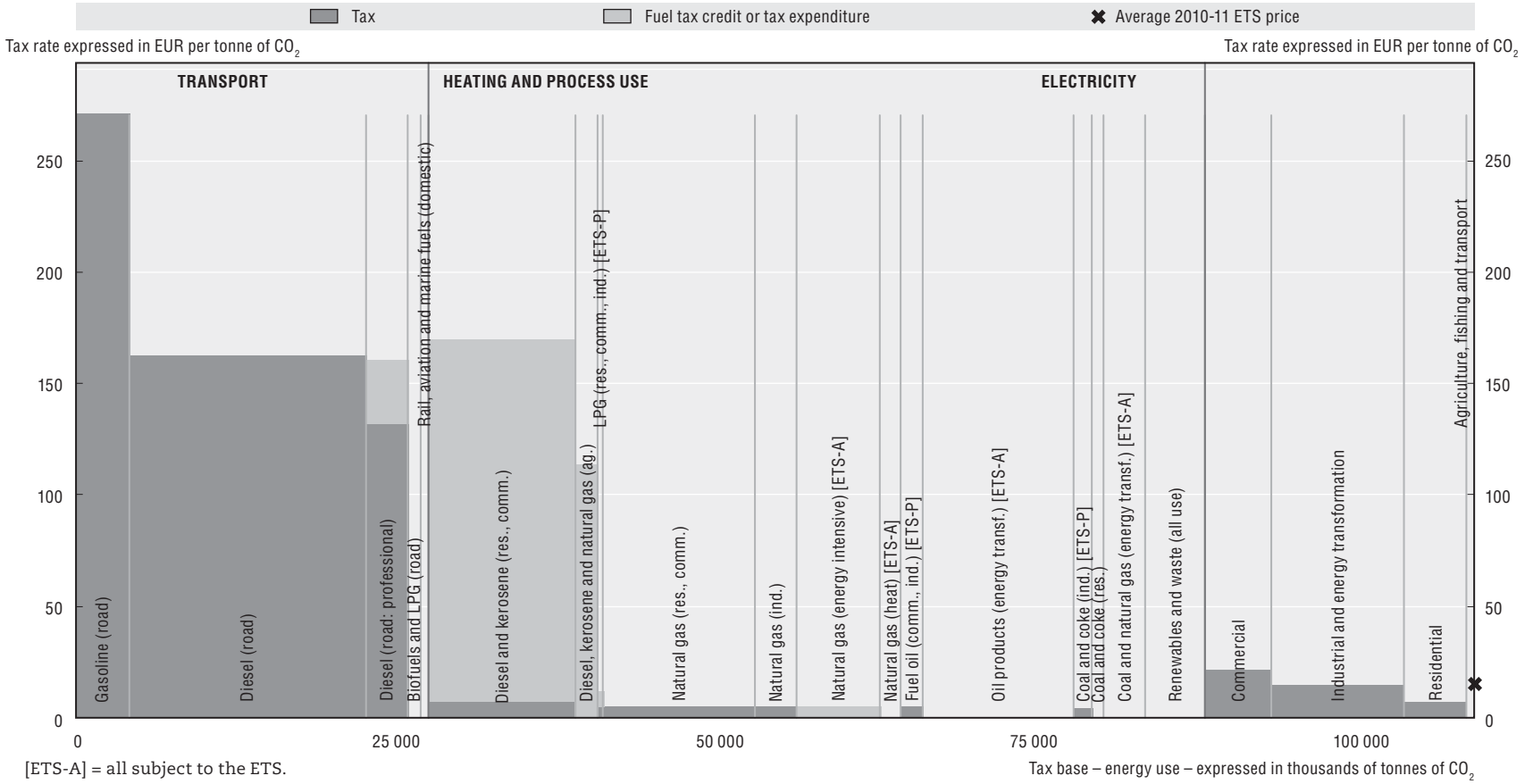
[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932765921

Figure 3.3. **Taxation of energy in Belgium on a carbon emission basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932765940

Canada

Figures 4.1 and 4.2 map the use and taxation of energy in Canada on the basis of energy content and carbon content, respectively. In addition to showing the tax base and tax rates as the federal level, to illustrate the important role of provincial taxation, combined and federal and provincial tax rates are shown for the four most populous provinces (Alberta, British Columbia, Ontario and Quebec).

Structure of energy taxation

At the federal level, an excise tax at CAD 0.10 per litre applies to unleaded gasoline,[1] ethanol, and unleaded aviation gasoline, whereas a tax rate of CAD 0.04 is levied on diesel, biodiesel and aviation fuel other than aviation gasoline.

The consumption of electricity, and of fuels used to produce electricity, is not taxed federally except where the electricity is used primarily in the operation of a vehicle.

Federal taxes represent only a portion of total energy taxes in Canada, since provinces and territories also impose their own product-specific taxes on the consumption of certain energy products. Excise taxes on energy therefore vary across the country in scope, level and characteristics. In most instances, provincial product-specific tax rates on energy products are higher than the federal excise tax rate.

Two provincial governments (British Columbia and Quebec) have explicit carbon levies. The British Columbia carbon tax base includes emissions from everyone who combusts fossil fuel in the province. This includes all businesses – manufactures, processors, retails stores, and others. The tax base does not include "process emissions" that do not result from the combustion of fossil fuel. Quebec does not impose a specific tax on carbon emissions. Rather, a regulatory charge is imposed on hydrocarbons. The revenue from this is dedicated to a Green Fund.

The table below gives a summary of tax rates for selected energy products at the federal level and at the provincial level for the selected provinces as of 1 April 2012 (but note the caveats in the final section below). British Columbia and Quebec tax a wide range of products, reflecting the broad scope of their carbon taxes. Unlike this table, note that in the maps below, the effective provincial tax rates shown reflect the sum of the federal rate and the provincial rate in the particular province.

Table 4.1. **Federal and provincial tax rates for selected energy products**

CAD per unit

	Federal	AB	BC	ON
Gasoline (CAD/L)	0.10	0.090	0.20	0.15
Ethanol (CAD/L)	0.10	0.090	0.20	0.15
Aviation fuel (CAD/L)	0.04	0.015	0.08	0.03
Diesel fuel (CAD/L)	0.04	0.090	0.21	0.14
Biodiesel (CAD/L)	0.04	0.090	0.21	0.00
Natural gas (CAD/GJ)	0.00	0.000	1.24	0.00
Propane (CAD/L)	0.00	0.065	0.04	0.04
Low Heat Coal (CAD/tonne)	0.00	0.000	44.43	0.00
High Heat Coal (CAD/tonne)	0.00	0.000	51.93	0.00
Coke (CAD/tonne)	0.00	0.000	62.18	0.00

In some cases, further local surcharges are added to the provincial rates. In British Columbia, for instance, surcharges apply in certain regions of the province with the aim of financing regional public transportation authorities. As an example, considering the provincial excise tax, the carbon tax and the additional South Coast surcharge, the total provincial tax rates on gasoline and diesel exceed CAD 0.30 in the South Coast area. The additional local surcharges, however, are not shown in the map due to complexity.

Energy use and taxation in Canada

From the maps for Canada, it can be seen that gasoline accounts for over 50% of the energy used in transport and the resulting CO_2 emissions, and it provides the vast majority of energy tax revenue at the federal level.[2] Diesel usage, the second largest base in the transport category, is taxed at a lower rate than gasoline on both an energy and a CO_2 emissions basis.

Biofuels (ethanol and biodiesel) are taxed at the federal level at the highest rate in terms of both energy content and CO_2 emissions. This is because although ethanol has the same nominal tax rate per litre as gasoline, and biodiesel has the same nominal tax rate per litre as diesel, both biofuels have a lower energy content per litre and lower CO_2 emissions per litre relative to the equivalent fossil fuel.[3] Some provinces tax biofuels at a lower rate than gasoline and diesel.

At the federal level, aviation fuel, the principal fuel used by commercial air carriers, is subject to a federal excise tax of CAD 0.04 per litre, the same rate as diesel fuel (the principal fuel used in marine and rail transportation). Aviation gasoline, however, is subject to the same rate as gasoline, at CAD 0.10 per litre.

In the heating and industrial process use category, diesel used in motors in industries like agriculture, farming, fishing and mining is taxed federally at the same level as in transportation use. This accounts for about 11% of energy use and 12% of CO_2 emissions from heat and process use. No other energy products in this category are taxed at the federal level. More than 60% of energy use and CO_2 emissions in this category are attributable to natural gas. The carbon taxes introduced by British Columbia and Quebec cover several energy products used for heating and industrial processes.[4]

Electricity and fuels used to produce electricity are not taxed at the federal level. Due to the high proportion of electricity generated using renewable (mostly hydro) and nuclear energy, electricity generation represents about 33% of total energy use but is responsible for less than 20% of total CO_2 emissions. Coal and coke used to produce electricity, which account for more than 75% of CO_2 emissions in this category, are taxed at the provincial level under the carbon taxes in British Columbia and Quebec.

Reported tax expenditures and rebates

At the federal level, a rebate of CAD 0.015 of the excise tax on gasoline is provided for Canadian amateur athletic associations and persons certified as suffering from a permanent impairment to locomotion. Estimates for these concessions are not published, but they are likely too small to be included on the maps.

The provinces provide a number of tax exemptions or refunds. For example, marked (*e.g.*, coloured) fuel used for specific uses (generally off-road usage) is exempt or taxed at a lower level in several of the provinces considered.[5]

Key assumptions and caveats

The rates of provincial tax graphed in the rail and marine category reflect only rail rates.

Consistent with the result of the publication, the graphs reflect tax rates as of 1 April 2012. Note, however, that the rates under the British Columbia carbon tax have been increased as of 1 July 2012. Also, starting from April 2013, with the re-introduction of the Provincial Sales Tax, British Columbia will also re-introduce a Clean Energy Levy of 0.4% of the purchase price of electricity (other than for residential or commercial use), natural gas, fuel oil and propane sold on a grid system, while propane for motor use will be subject to the motor fuel tax at 2.7 cents per litre.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

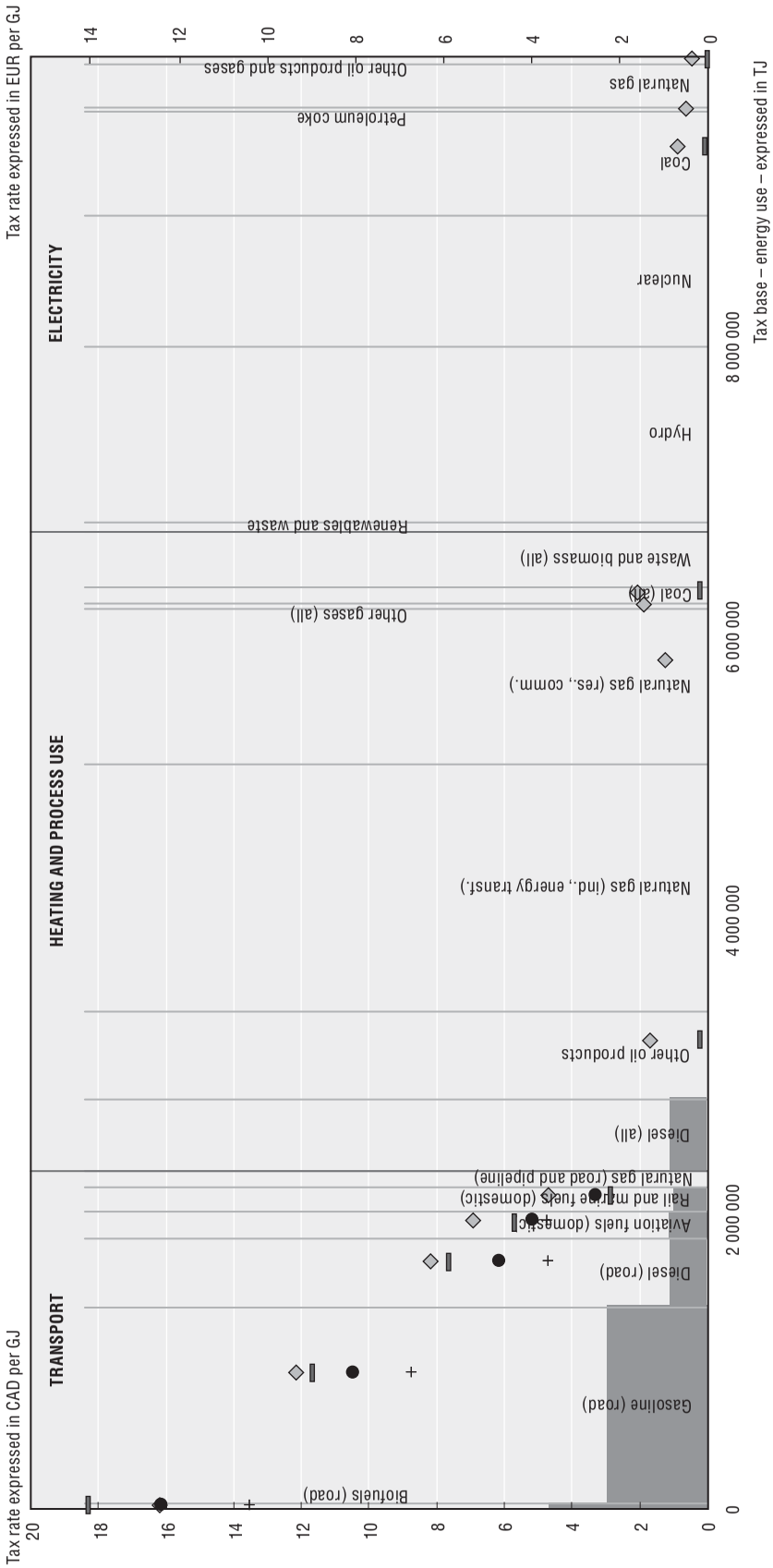
Canada Revenue Agency (2012), "Current Rates of Excise Taxes", Available at: *www.cra-arc.gc.ca/E/pub/et/currate/currate-e.html*.

Natural Resources Canada (2012), *Fuel Focus – 2011 Annual review*. Available at: *www.nrcan.gc.ca/energy/1374*.

Notes

1. A tax rate of CAD 0.11 is applied on leaded gasoline and aviation gasoline.
2. The percentages of energy use and CO_2 emissions cited in this section have been calculated by the OECD using 2009 IEA Energy Balance data (IEA, 2011a). See Section 3.1 of the report and Annex A for further information.
3. In the maps, the bar "biofuels (road)" reflects a weighted average of the tax rate on ethanol (about 97% of the total volume) and the tax rate on biodiesel (about 3% of the total volume).
4. While peat, tires and shredded tires are subject to the carbon tax in British Columbia, this tax is not reflected in the graphs since these sources are not segregated in the 2009 IEA Energy Balances (IEA, 2011a).
5. In terms of exemptions more generally, British Columbia, as an example, provides certain motor fuel tax exemptions for coloured fuel, marine fuel, methanol, natural gas, hydrogen (if used in a hydrogen fuel cell) and propane. Exemptions from the carbon tax are provided for various purposes including fuel used in industrial process but not combusted. In addition, exemptions are also provided for "process emissions", which entails any emissions created from processes other than the combustion of fuel (*e.g.* emissions created from breaking up lime stone for cement production).

Figure 4.1. **Taxation of energy in Canada on an energy content basis**

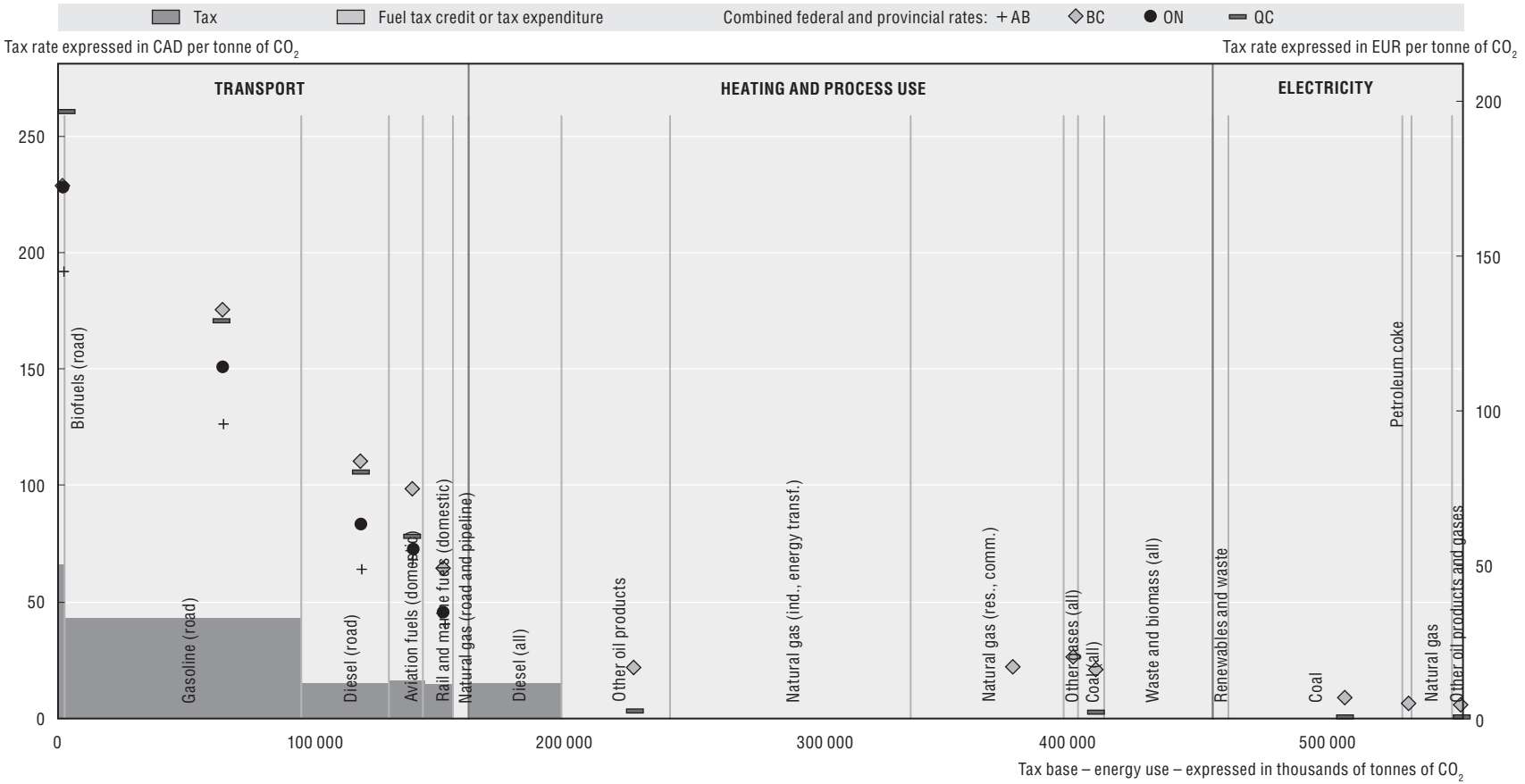


Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009. Shaded blocks show federal taxes. For illustrative purposes, the combined level of federal and provincial taxes for selected provinces is indicated.

StatLink http://dx.doi.org/10.1787/888932765959

Figure 4.2. **Taxation of energy in Canada on a carbon emission basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009. Shaded blocks show federal taxes. For illustrative purposes, the combined level of federal and provincial taxes for selected provinces is indicated.

StatLink http://dx.doi.org/10.1787/888932765978

Chile

Figures 5.1 and 5.2 map the use and taxation of energy in Chile on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In Chile, the Specific Excise Tax (*Impuesto Específico para Combustibles*, IEC) is levied on transport fuels. The tax rates are expressed in *Unidad Tributaria Mensual* (UTM), an official unit of account whose value is adjusted monthly to reflect general price inflation, based on the consumer price index. As at 1 April 2012, UTM 1 was equal to CHP 39 570.

The general mechanism is the IEC which has a fixed and a variable component; the sum of the two components can never be negative. The table below shows the IEC fixed tax component expressed in UTM and in USD (in which the variable component is reported) for different fuels:

Table 5.1. **IEC tax rates expressed in UTM and in USD**

Gasoline	6 UTM per m^3	450 USD per m^3
Diesel	1.5 UTM per m^3	113 USD per m^3
Liquefied Petroleum Gas (LPG)	1.4 UTM per m^3	105 USD per m^3
Compressed Natural Gas (CNG)	1.93 UTM per 1000 m^3	145 USD per 1000 m^3

The Consumer Protection System of IEC Taxpayers (*Sistema de Protección al Contribuyente del Impuesto Específico a los Combustibles*, SIPCO), created in February 2011, is the variable component of the IEC. The objective of SIPCO is to protect domestic consumers of transport fuels from strong fluctuations in international oil prices.

In Chile, the prices of the energy products covered by SIPCO – and also by the FEPP mechanism to be described below – are freely set by the refiner and throughout the distribution chain. The aim of both mechanisms is to reduce the impact of oil price volatility on consumers and to smooth prices to allow consumers to internalise external shocks in fuel prices, since Chile relies heavily on oil imports. Both mechanisms apply a variable tax component, according to a threshold level of international oil prices, that serves to smooth fluctuations in consumer oil prices. If the imported oil price (set on the international market) exceeds the threshold, the variable component results in a tax credit: if the imported oil price is below the threshold, the variable component results in a tax. The intention is that SIPCO be neutral in the long-run.

The price intervention mechanism associated with SIPCO relies on an import parity price (IPP) and an intermediate reference price (IRP), adjusted on a weekly basis and expressed in USD per m^3. The IPP is computed by the National Energy Commission (*Comisión Nacional de Energia*, CNE) based on the c.i.f. (cost, insurance and freight) price of fuel and adding a mark-up reflecting other costs until the placement of the product in the seaport of Quintero. The IRP is computed referring to an historical average of oil prices, oil price projections and the difference between the price of crude oil and the price of refined oil products (crack spread). These two prices are the basis for calculating the variable component to be added to the fixed component in order to obtain the final amount of the

Specific Excise Tax. If the import parity price of the week exceeds a price band ceiling based on the intermediate reference price, consumers benefit from a tax credit (the variable component assumes a negative value). On the contrary, if the IPP of the week is below the price band ceiling an additional tax is introduced. Finally, if the IPP fluctuates inside the price band ceiling the variable component is equal to zero and the IEC is only the fixed (or basic) component.

The second mechanism, the Petroleum Price Stabilisation Fund (*Fondo de Estabilización de Precios del Petróleo*, FEPP), was created in 1991 after the Gulf crisis, and was aimed at stabilising domestic prices of a wide range of fuels. It initially covered six petroleum products: gasoline, domestic kerosene, diesel, LPG, naphtha and fuel oil. In 2005 all these fuels, except for fuel oil and LPG, were transferred to the new Fuel Price Stabilisation Fund (FEPC). FEPC ceased to be operational in 2010 and all the fuels were covered again by the FEPP until the creation of SIPCO. Currently, the FEPP covers only domestic kerosene.

The functioning of the FEPP is similar to SIPCO, except in two respects. First, there is no fixed component levied on domestic kerosene. Second, the intermediate reference price is computed in a different way, reflecting the historical evolution and future expectations for the import parity price. The National Energy Commission obtains the value for the price band ceiling referring to a historical average of the IPP values, and to short-term and long-term forecasts for the IPP.

Energy use and taxation in Chile

Fuels used in transport covered by the Specific Excise Tax are the only energy products taxed in Chile. Altogether, they represented 22% of energy consumption and 20% of total CO_2 emissions in 2009. Domestic kerosene, the only fuel covered by FEPP, accounts for only 2% of energy consumption and CO_2 emissions. The majority of energy consumption comes from heating and process fuels and fuels used to produce electricity, and is not taxed. In terms of CO_2 emissions, heating and process fuels accounted for 44% of the total emissions in 2010, and fuels used to produce electricity for 32%.

Considering the fixed component in SIPCO, gasoline is taxed more heavily than diesel, both on a volume and CO_2 content basis; however diesel used for transport produces 44% of total transport emissions, and gasoline 28%. LPG and natural gas are also covered by the IEC, but they constitute a minor share of total emissions from transport fuels and have been aggregated in the graph. Aviation fuel is not subject to the IEC and accounts for 11% of CO_2 emissions from the transport sector. The Specific Excise Tax is not levied on the majority of fuel consumption in navigation (17% of transport emissions).

In the maps, the variable components for both SIPCO and FEPP have been calculated as the average for the one-year period up to 1 April 2012, based on weekly data from the CNE. In this period, the variable component for both LPG and natural gas was always equal to zero. In contrast, the variable component for gasoline provided a tax credit in one-quarter of the examined period (April-May 2011, and late February-March 2012). The maximum credit during this time was USD 118 per m^3. Over the full year the average credit was USD 18 per m^3. For diesel, a tax credit was provided only during April and May 2011. The maximum credit was USD 62 per m^3, with the full year average equal to 5 USD per m^3. Regarding the FEPP, a tax credit was paid in 39 of the 52 weeks covered. The maximum credit was USD 84 per m^3, and the full year average was USD 32 per m^3.

Reported tax expenditures

No tax expenditures are reported in respect of the Specific Excise Tax in Chile.

The graph shows in light grey the fixed component of the Consumer Protection System of IEC taxpayers – in other words the basic component of the Specific Excise Tax, shown in the table above. This amount is referred to as the "maximum tax". The average tax credit provided in the year to 1 April 2012 is then subtracted from the maximum tax and the net amount is shown in dark grey. Since the credit amount varies, the net amount graphed effectively reflects the average amount of tax paid during the period. These amounts could vary significantly from year to year in response to changes in oil prices.

The graph also shows a negative amount for domestic kerosene, reflecting the credit provided by the Petroleum Price Stabilisation Fund. Again, the credit rate shown in the graph reflects the average credit paid in the year to 1 April 2012.

Key assumptions and caveats

Key assumptions:

- Fuel consumed by aviation has been considered to be untaxed.
- The consumption of fuel oil as transport fuel is outside the scope of both SIPCO and FEPP.
- Diesel used in shipping and rail has been disaggregated from diesel used for road transport, since the former is not subject to the Specific Excise Tax Diesel and is not included in SIPCO.
- Only kerosene consumed by the residential sector has been considered to be covered by the Petroleum Price Stabilisation Fund. This assumption is equivalent to excluding 35% of kerosene consumption from the price stabilisation mechanism.

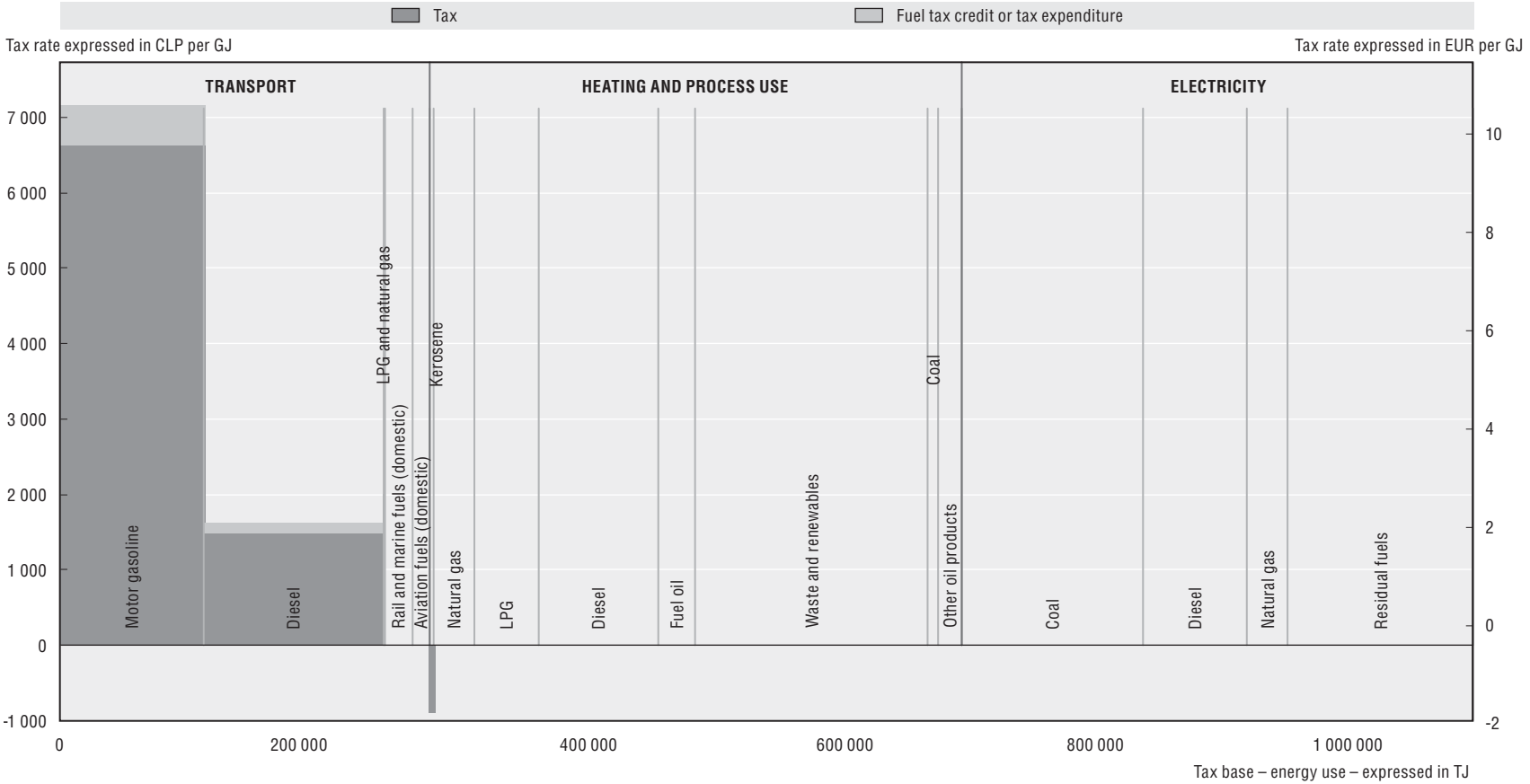
Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Chilean Comisión Nacional de Energia (2011), "Informes SIPCO". Available at: *www.cne.cl/cnewww/opencms/07_Tarificacion/02_Hidrocarburos/otros_niveles/preciosparidad/SIPCO.html*.

Chilean Comisión Nacional de Energia (2011), "Informes FEEP". Available at: *www.cne.cl/cnewww/opencms/07_Tarificacion/02_Hidrocarburos/otros_niveles/preciosparidad/FEPP.html*.

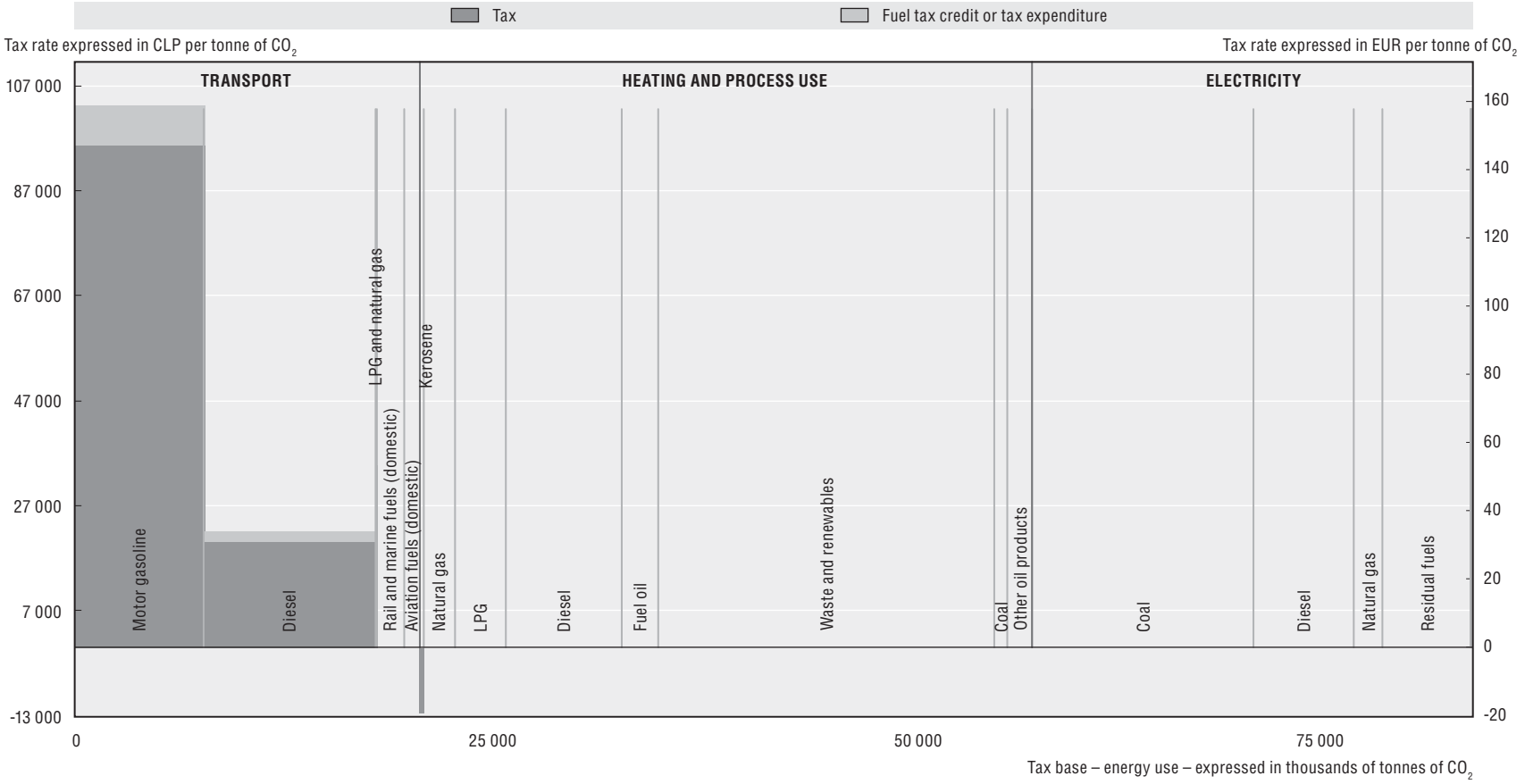
Figure 5.1. **Taxation of energy in Chile on an energy content basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932765997

Figure 5.2. **Taxation of energy in Chile on a carbon emission basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766016

Czech Republic

Figures 6.1 and 6.2 map the use and taxation of energy in the Czech Republic on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In the Czech Republic, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail) Tax rates are generally levied above the minimum level prescribed by the Directive. The following energy products are exempted from energy excise taxes: gasoline and diesel not used for transport or heating purposes; gasoline and diesel used for commercial aviation and shipping; natural gas used for residential heating and in combined heat and power plants (CHPs); LPG used for heating; coal and other solid fuels used for residential heating and in CHPs; pure biofuels and biofuels contained in high percentage biofuel blends. Additionally, 60% of the excise tax paid on diesel used in agriculture is refunded, as well as 94% of the excise tax paid on diesel used for commercial heating purposes.

The consumption of electricity generated from renewables (including nuclear), biomass and/or waste is untaxed. Other electricity is taxed at a single rate for all users. Fuels used for the purpose of electricity generation are exempt from tax.

Energy use and taxation in the Czech Republic

As can be seen from the maps of energy use and taxation that follow, gasoline and diesel dominate the transport category. Together they constituted 95% of both energy used and CO_2 emissions produced in transportation in 2009. The remainder of the transport category is made up of small quantities of LPG and natural gas, as well as aviation, marine and rail fuels (the majority of which is also diesel). Gasoline is taxed at the highest effective rate, with diesel (for road use) also taxed at a relatively high level. Note that the use of very small amounts of coal (which is taxed at a far lower effective rate than diesel) for rail transport slightly lowers the (average) effective rate on rail fuels below that of diesel used for road transport. LPG and natural gas are taxed at comparatively low rates, while, as noted above, aviation and marine fuels are untaxed.

The heating and process use category is taxed much more lightly than the transport sector and is dominated by natural gas and coal. These account for 41% and 33%, respectively, of the heating and process energy use, and 28% and 40% of the CO_2 emissions in this category. Biofuels and waste also contribute significantly to this category, while there are only small amounts of diesel and other oil products such as LPG, fuel oil and refinery gas. These other oil products are taxed at the highest effective tax rates, with natural gas (not used for residential heating) and coal (not used to produce merchant heat) taxed at slightly lower rates. The significant untaxed amounts of natural gas and coal, together with untaxed biofuels, waste, diesel (not used for heating), and other gases, results in 48% of energy use, and 53% of CO_2 emissions in this category being untaxed

Electricity generation is dominated by biofuels and waste, which make up 59% of energy used to generate electricity and 95% of the resulting CO_2 emissions. Renewables (predominantly nuclear, but also hydro, wind and solar) make up another 37% of energy used to generate electricity. As a result of the substantial use of renewables, the electricity

category is proportionately smaller in CO_2 terms than in energy terms. The highest effective tax rates (in terms of both energy and CO_2) fall on natural gas and other gases. This is because these gases are slightly more efficient (in terms of the amount of energy lost in the conversion of gas to electricity) at generating electricity than the other energy sources used, hence the amount of energy usage (and CO_2 emitted) on which the tax on electricity consumption is effectively imposed is smaller than would otherwise be the case. Note that, in energy terms, despite the use of highly efficient hydro, wind and solar electricity generation sources, the use of nuclear generation (which is less efficient) reduces the overall level of efficiency of the "Renewables" subcategory below that of natural gas and other gases.

Reported tax expenditures and rebates

The Czech Republic reports a number of tax expenditures:

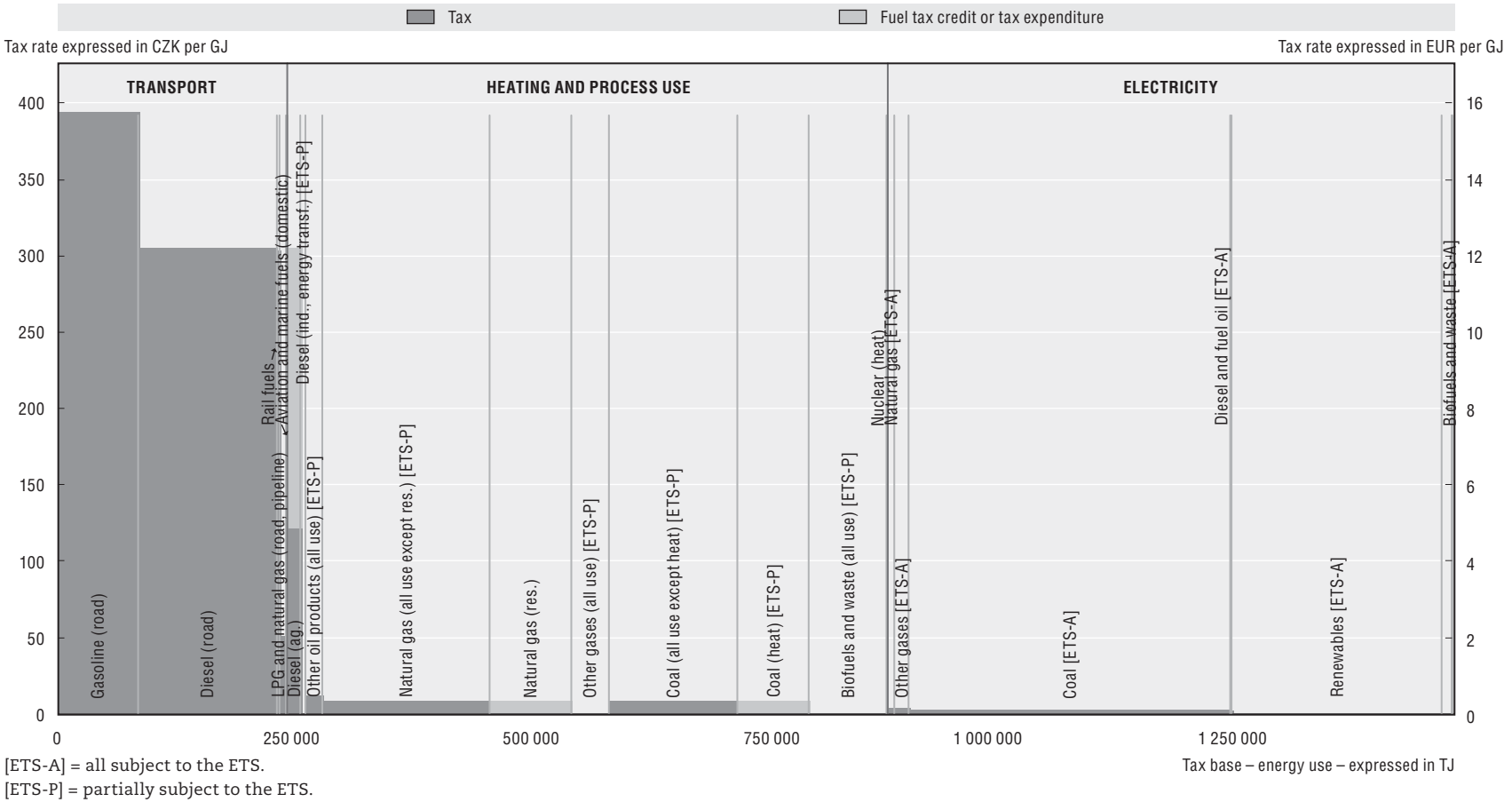
- *Natural gas:* The Czech Republic exempts natural gas used for residential heating or in CHPs from excise taxation. The excise rate on natural gas used for commercial and industrial purposes is used as the benchmark in the maps.
- *Coal:* The Czech Republic exempts coal and other solid fuels used for residential heating or in CHPs from excise taxation. The standard excise rate for coal is used as the benchmark in the maps.
- *Diesel:* The Czech Republic provides a 60% refund of excise tax paid on diesel used in agriculture. The Czech Republic also provides a 94% refund of excise tax paid on diesel used for commercial heating purposes. The standard excise rate for diesel is used as the benchmark in the maps. As diesel used for commercial heating is grouped with "other oil products" due to the small quantity used, this tax expenditure is not identifiable in the maps.

In 2013, the partial refund of excise duty on diesel used in agriculture will be decreased from 60% to 40%, and in 2014 the refund will be abolished. In 2014, the exemption from excise tax on natural gas used for heating in households will be abolished. At the same time a "carbon tax" will be introduced. The carbon tax will apply to natural gas and other gases, solid fuels, and light and heavy fuel oils. Businesses subject to the European Union Emission Trading Scheme (EU ETS) will be exempt from the carbon tax. Introduction of the carbon tax will better equate the taxation of businesses that are subject to the EU ETS and those that are not.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials.

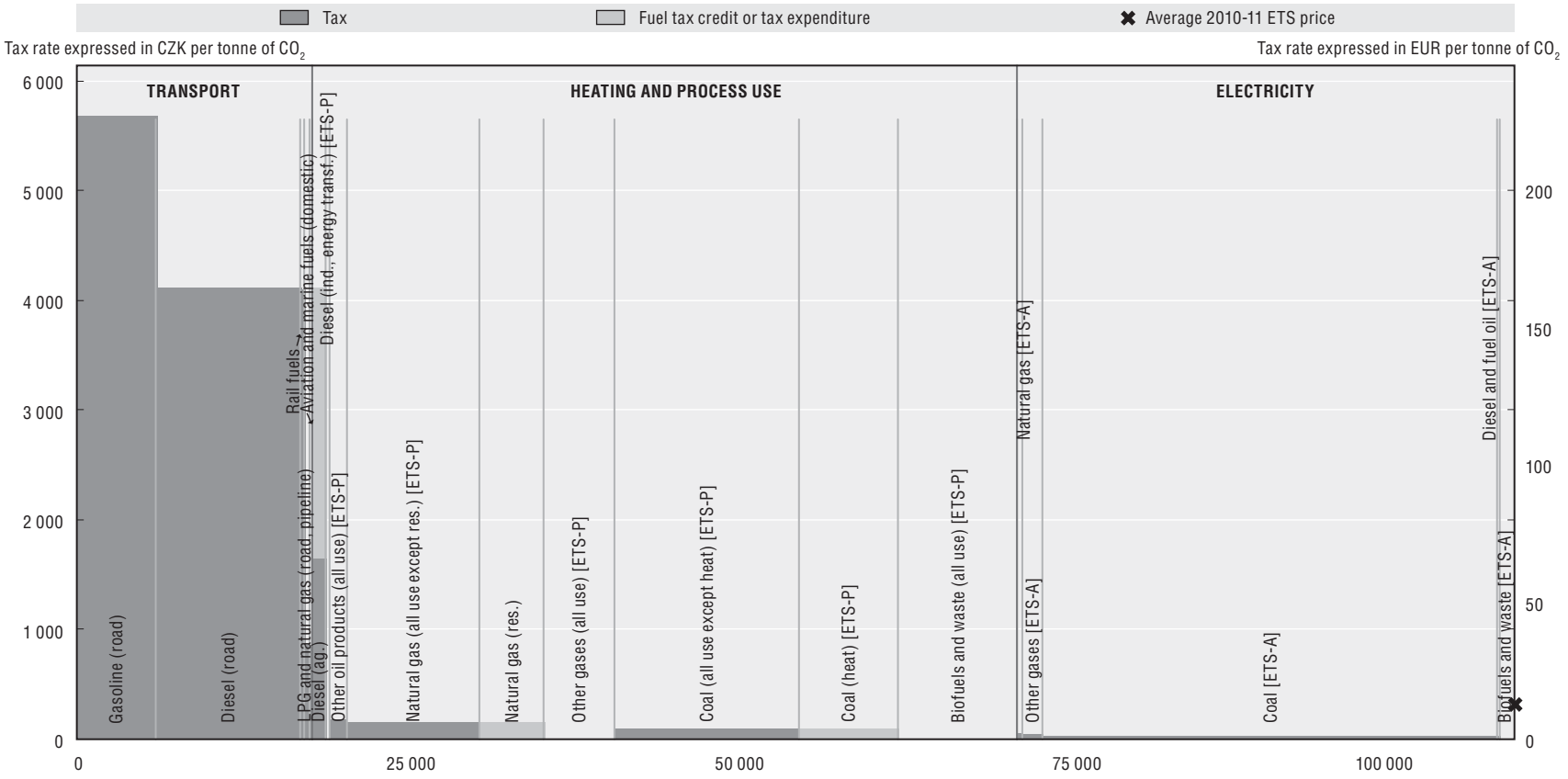
Figure 6.1. **Taxation of energy in the Czech Republic on an energy content basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766035

Figure 6.2. **Taxation of energy in the Czech Republic on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766054

Denmark

Figures 7.2 and 7.3 map the use and taxation of energy in Denmark on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In Denmark, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). Denmark introduced a carbon tax on fossil fuels in 1992. The general structure of energy taxation was changed as of the beginning of 2010, with the aim of improving the interaction between the European Emission Trading Scheme (ETS) and the Danish tax system. The aim of this reform was to ensure a similar carbon-related burden between ETS and non-ETS sectors and to avoid overlap between the Danish carbon tax and the EU ETS.

The current structure of energy taxation includes three elements: energy taxes, carbon dioxide taxes and a tax on sulphur dioxide and nitrogen oxide emissions.

The energy tax is levied on fossil fuels and electricity. The tax rates applied vary according to the energy content of each product and are indexed for inflation. All products are taxed at the same tax rate with respect to their energy content in gigajoules. However, pure biomass is not taxed in order to promote the use of renewable energy.

Similarly, carbon taxes apply to all energy products used by businesses. It applies at a rate that is based on the emissions associated with the use of each fuel. Biofuels are not taxed, as they are regarded as emission neutral on a lifecycle basis. The carbon tax element is not levied on fuels used by sectors subject to the EU ETS. As a general rule, fuels used for generation of power are therefore not taxed. However, a CO_2 component is still levied on electricity consumption through the energy saving tax.

The component related to sulphur dioxide and nitrogen oxide are calculated by reference to either the level of emissions of each (if measured), or the sulphur and nitrogen content of the fuels used (if emissions are not measured). These taxes are not shown on the maps.

Energy use and taxation in Denmark

From the maps, it can be seen that diesel accounts for 58% of energy used in transport and for over 60% of the carbon emissions from transport use and it provides about 30% of energy tax revenue. Gasoline usage is the second largest base in the transport category, whether measured in terms of energy use or carbon emissions, and is taxed at a higher rate than diesel on both an energy and an emissions basis. LPG and fuel oil use for transport accounted for only 1% of the energy use and emissions from transport fuels, while fuels used for domestic aviation accounted for another 1% of emissions and energy use. The transport category represents around 25% of all energy use and emissions from fuel use in Denmark.

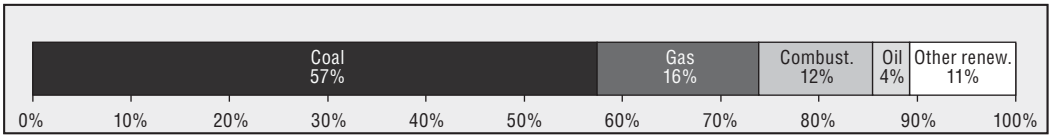
As for heating and processes, waste and biomass are not taxed under either the energy tax or carbon tax components, and account for over 35% of emissions from heating and process use of fuels (24% of energy use in this category). Diesel, natural gas and other oil products are taxed at lower rate with respect to their use as transport fuels, and represent

36% of the emissions base. Tax rates applied to heating fuels are generally lower than those applied to the use of the same fuel for industrial or processing purposes; and lower rates again apply to the use of fuels by the agricultural sector.

Electricity represents around 22% of energy used in Denmark and emissions from energy use. In the maps, electricity has been divided by user, with the amount of fuel used to generate electricity for each user shown. Electricity used by industry and agriculture (57% of fuels used to generate electricity is taxed at a much lower rate than commercial and residential use of electricity.

Coal represents 57% of fuels used to generate electricity in Denmark. The proportion of renewables is quite small, and largely comprised of wind with a small amount of hydroelectricity. The fuels used to generate electricity are set out in Figure 7.1 below.

Figure 7.1. **Fuels used to generate electricity in Denmark (TJs)**



Source: OECD calculations using 2009 IEA Energy Balance data (IEA, 2011a).

StatLink http://dx.doi.org/10.1787/888932766073

Reported tax expenditures and rebates

Denmark does not report tax expenditures in this area.

In order to take into account the free quotas[1] given to firms covered by the ETS, a credit for the CO_2 tax is granted to energy-intensive firms that are not subject to the ETS (small plants electricity producers or energy intensive production processes). This is not shown on the maps due to unavailability of data that would allow the identification of these sectors from those not covered by the ETS. Instead, the maps note where a sector is fully [ETS-A] or partially [ETS-P] subject to the ETS.

Sources

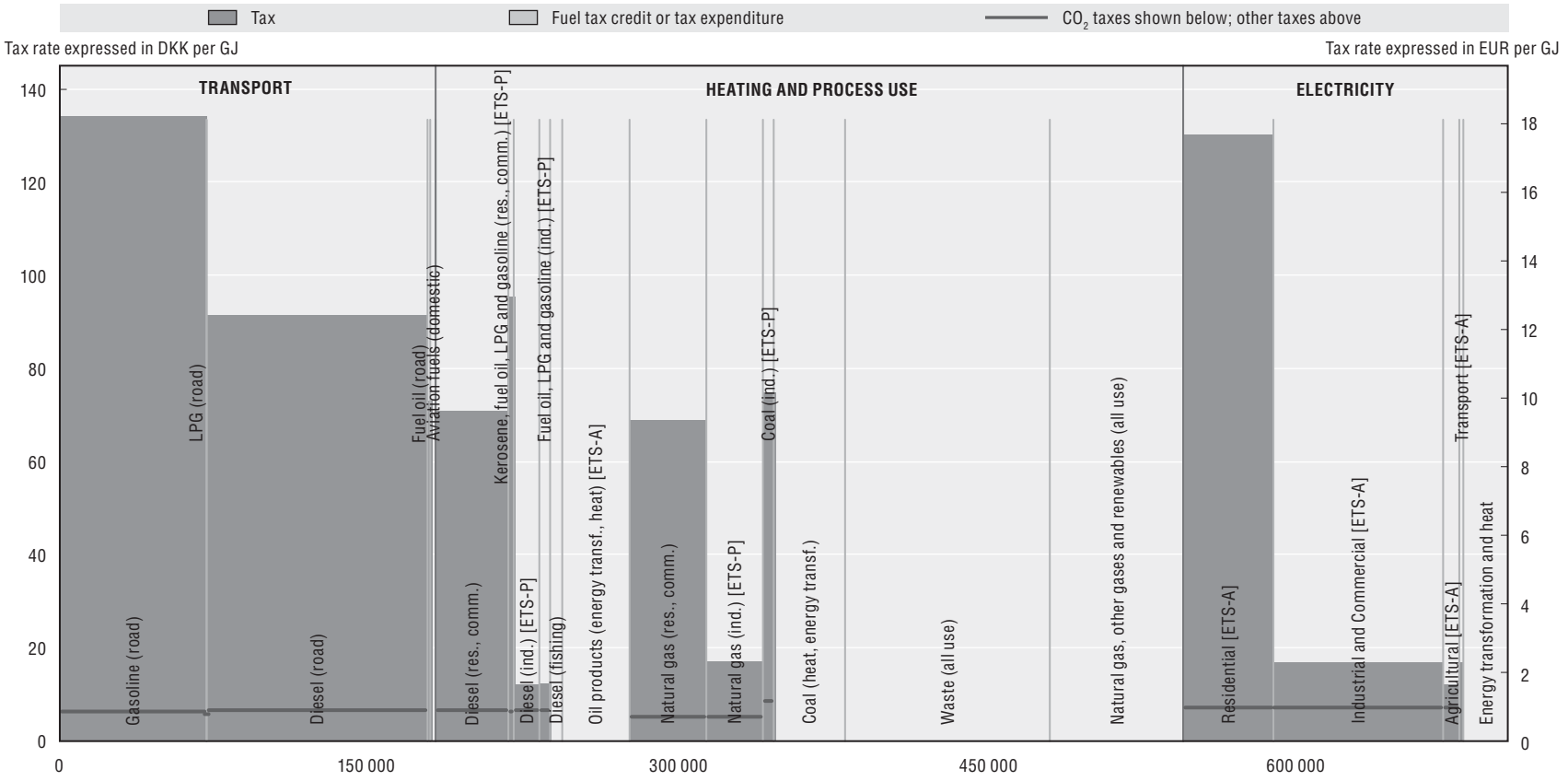
Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Danish Skatteministeriet (2012), "CO_2-afgiftsloven". Available at: *www.skm.dk/tal_statistik/satser_og_beloeb/216.html*.

Note

1. The free quota distribution is considered as a lump sum transfer to firms operating in the ETS. The tax credit for CO_2 tax is considered fair because it leads to the same overall burden for firms operating inside and outside the ETS.

Figure 7.2. **Taxation of energy in Denmark on an energy content basis**

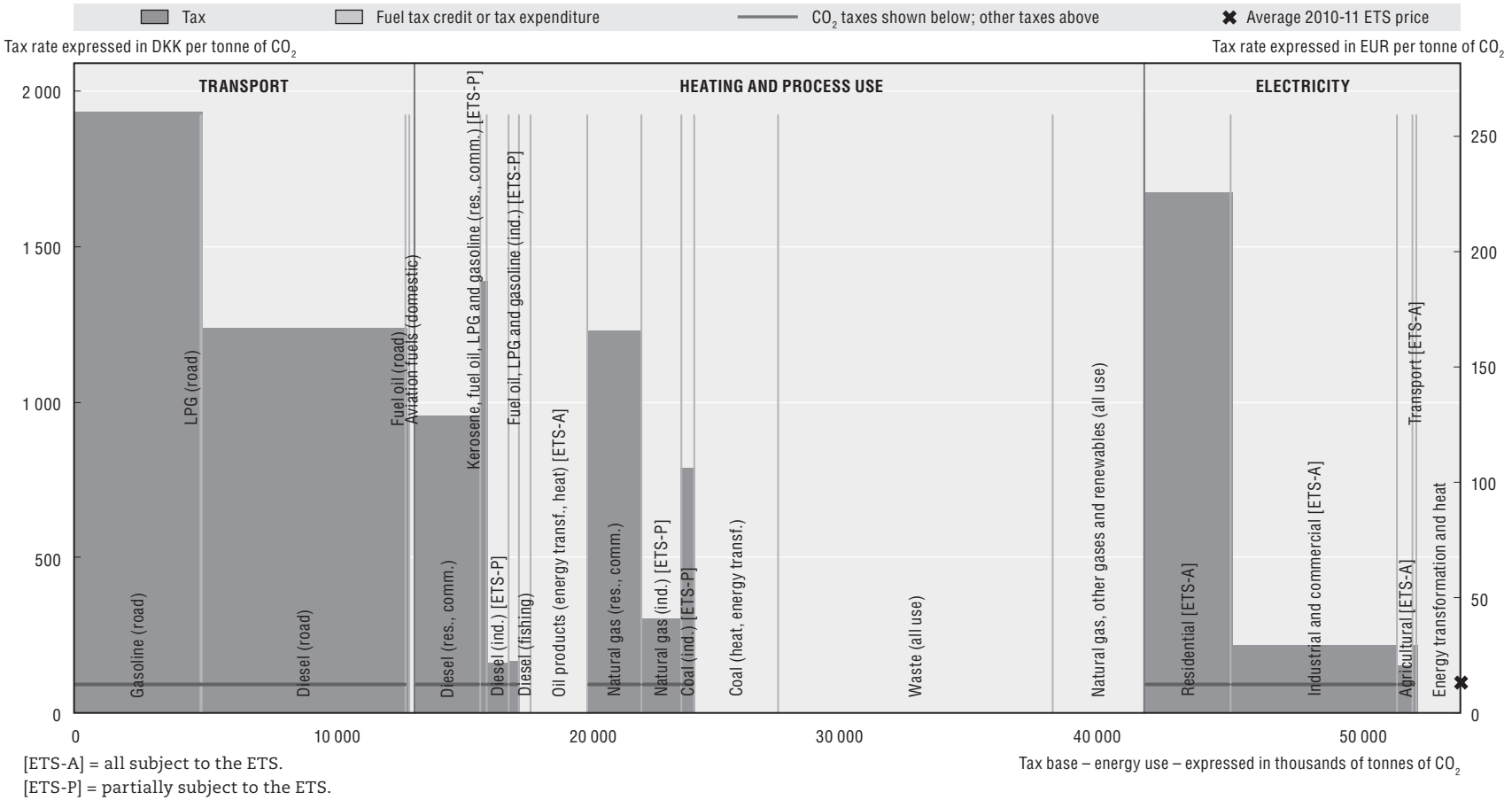


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766092

Figure 7.3. **Taxation of energy in Denmark on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766111

Estonia

Figures 8.1 and 8.2 map the use and taxation of energy in Estonia on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In Estonia, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). Tax rates are generally levied slightly above the minimum level prescribed by the Directive. Natural gas is only taxed when used for heating. Biofuels and biomass are untaxed, as are coal and LPG used for heating.

Electricity is taxed at a single rate for all users. Fuels used for the purpose of electricity generation are exempt from tax.

Energy use and taxation in Estonia

As can be seen from the maps of energy use and taxation that follow, gasoline and diesel together constitute almost all (99.85%) of both energy used and CO_2 emissions produced in transportation. Aviation fuel is the only other transport fuel used. Gasoline is taxed at a higher effective rate than diesel (in terms of both energy and CO_2 content), while the tax rate on aviation fuel is in between the two.

The heating and process use category is dominated by biomass, oil shale and, to a lesser extent, natural gas. These account for 33%, 25% and 24%, respectively, of the heating and process energy use, and 41%, 28% and 15% of the CO_2 emissions in this category. Diesel and the propellant use of LPG are taxed at the highest effective rates (both in terms of energy and CO_2), with other energy products taxed at comparatively low effective rates. As noted above, natural gas not used for heating and biomass are both untaxed. Primarily as a result of this, 56% of energy use, and 55% of the CO_2 emissions, in this category are untaxed.

Electricity generation is dominated by oil shale, which makes up 92% of energy used to generate electricity and 97% of the resulting CO_2 emissions. The electricity category is proportionately larger in CO_2 terms than in energy terms due to the carbon emissions from oil shale, and despite the small countering presence of some renewables (hydro and wind). Interestingly, the highest effective tax rate, in terms of energy, falls on these renewables. However, this result is driven by the fact that the renewable energy sources are far more efficient at generating electricity than fossil fuels are, hence the energy base on which the tax on electricity consumption is effectively imposed is smaller than would otherwise be the case. Similarly, this results in the effective tax rate being higher on natural gas and other gases than on oil shale, coal, and diesel and fuel oil.

Reported tax expenditures and rebates

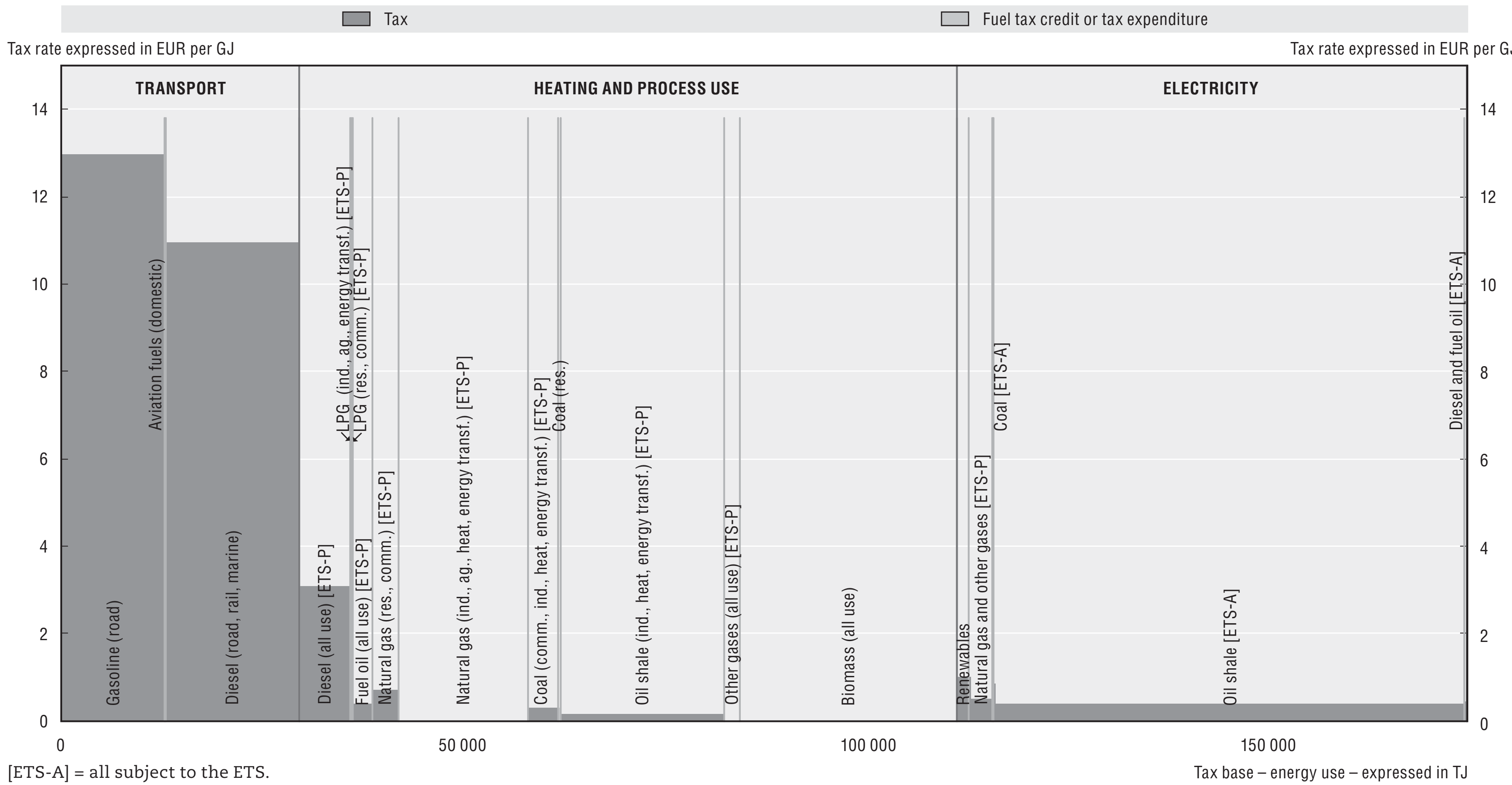
Estonia reports tax expenditures in relation to exemptions from excise tax on coal and LPG used for heating purposes. Estonia does not provide any fuel tax rebates, nor does it report any of its other fuel tax rate discrepancies as constituting tax expenditures.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Government of Estonia, "Alcohol, Tobacco, Fuel and Electricity Excise Duty Act". Available at: *www.legaltext.ee/text/en/X70018K8.htm*.

Figure 8.1. **Taxation of energy in Estonia on an energy content basis**

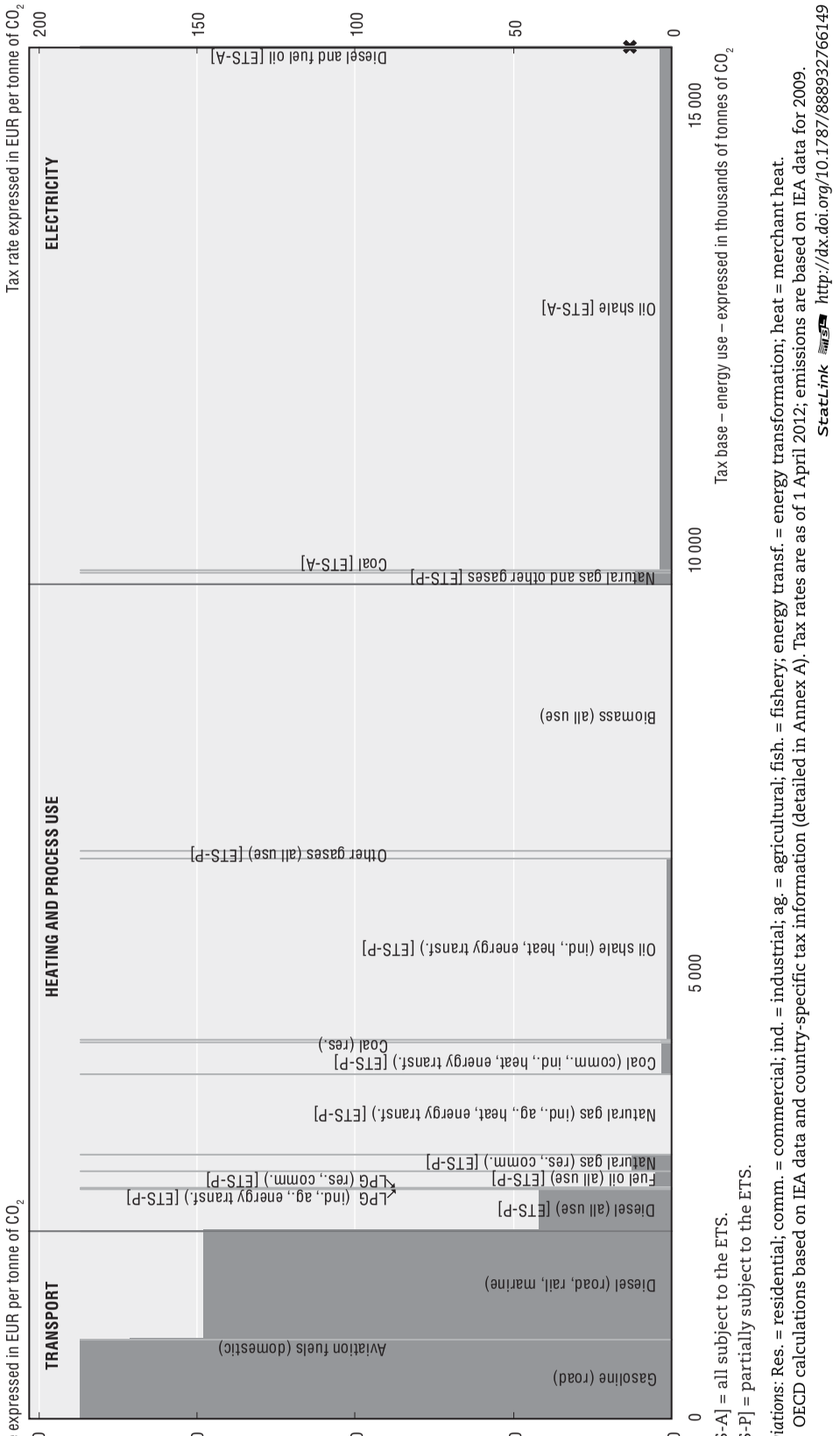


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766130

Figure 8.2. **Taxation of energy in Estonia on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766149

Finland

Figures 9.2 and 9.3 map energy taxes in Finland on an energy content and a carbon content basis respectively.

Structure of energy taxation

In Finland energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). Finland had also introduced a carbon tax on fossil fuels in 1990, prior to the first Mineral Oil Directive. The general structure of energy taxation experienced important changes as of the beginning of 2011.[1]

The current structure of energy taxation encompasses three tax levies. The overall tax rates are driven primarily by the energy content component and the carbon emissions component (which considers carbon dioxide emissions and local emissions). An additional surcharge, the strategic stockpile fee, is included in the final total.

The energy content component is levied on both fossil fuels and biofuels, according to their volumetric energy content. Higher rates apply to fuels used in the transport sector. Lower rates apply for agriculture usage in the case of light and heavy fuel oils, and electricity.

The CO_2 component is based on the CO_2 emissions of the fuel in question, and for this reason biofuels are subject to a rate of CO_2 tax which is reduced from 50% to 100% if they meet the sustainability criteria.[2] Carbon dioxide taxes for fossil fuels used in combined electricity and heat production are also lowered by 50%. The strategic stockpile fees range from 0.28 euro cent per kilo of heavy fuel oil to the 0.68 euro cents per litre of most liquid fuels.

In cases where the excise duties paid by a company during the accounting period for electricity, coal, natural gas, and other products that exceed 0.5 per cent of the company's value added during the accounting period, the company is entitled to apply, on the exceeding amount, for a refund of 85 per cent of the amount of the excise duties paid for the products or the excise duties contained in their acquisition price. Only the part exceeding 50 000 euros of the thus calculated tax refund is repaid. However, the maximum refund can only be as high as the excise duties paid.

LPG and fuel for commercial aviation and shipping are untaxed. Peat is taxed at a lower rate. This rate will increase progressively in 2013 and 2015 but will remain lower than the benchmark rate.Natural gas is subject to a tax expenditure which is due to expire in 2015.

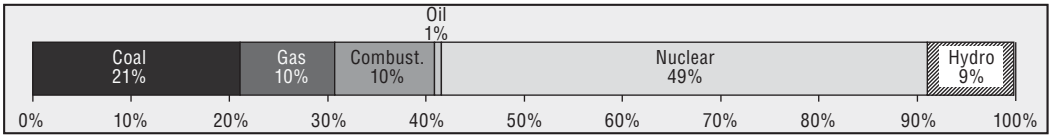
Energy use and taxation in Finland

In the transport category, diesel accounts for more than 50% of both carbon emissions and energy content. The tax rate on diesel and the biofuels used as substitutes for diesel appear much lower than the benchmark, leading to a tax expenditure relative to the tax rate on gasoline, which is shown on the graph in grey. Gasoline and biofuels used as substitutes to gasoline, which represent about 40% of emissions of the transport sector, are taxed at higher rates with regards to CO_2 emissions. Fuels used for transport purposes account for 14% of energy use and 16% of carbon emissions in Finland.

In heating and process use, waste and biomass are not taxed and account for over 40% in terms of energy content and emissions from heating and process use of fuels. All heating fuels are taxed a lower rate than transport fuels.

In the maps, the amount of fuel used to generate electricity used by different consumers has been shown. Electricity used by industry is taxed at a much lower rate than commercial and residential usage; and energy used for the transformation of other fuels, and for rail, is exempt. The fuels used to produce electricity account for less than 25% of total carbon emissions from fuel usage in Finland in 2010, but for 29% of energy use. This difference is explained by the proportion of electricity which is derived from renewable sources. The fuels used to generate electricity are set out below:

Figure 9.1. **Fuels used to generate electricity in Finland (TJs)**



Source: OECD calculations using 2009 IEA Energy Balance data (IEA, 2011a)

StatLink http://dx.doi.org/10.1787/888932766168

Reported tax expenditures and rebates

Finland reports several tax expenditures which are shown on the maps in light grey. In the transport sector, these include: the reduced energy tax rate on diesel used for transport purposes, where the benchmark is set by reference to energy content and CO_2 emissions; and the reduced energy tax rates for natural gas that is used in transport, shown as the tax expenditure reported on biofuels and natural gas. In the heating and process use category, the maps show the reduced energy tax rate for natural gas used in heating; shown under "Natural gas (all use)" in the heating and process use category; reduced energy tax rates for oil fuels used in agriculture; the exemption of LPG from taxation; and the reduced energy tax on peat.

The map does not show the tax rebates that apply to certain industrial consumers with a minimum energy intensity, or the reduction in the carbon tax for CHP plants (as electricity is shown on the maps by user rather than by fuel).

Key assumptions and caveats

A further tax applies to diesel-driven vehicles that is not shown on the maps. This is the propelling force tax, which applies on average at EUR 420 per diesel vehicle per annum. This annual tax on diesel vehicles should be taken into account when considering the difference in tax rates between diesel and gasoline for transport use.

With regards to biofuel taxation, bioethanol and biodiesel tax rates under the RES directive have been used and have been combined into a signle category, together with natural gas for road use, due to their small proportion of use.

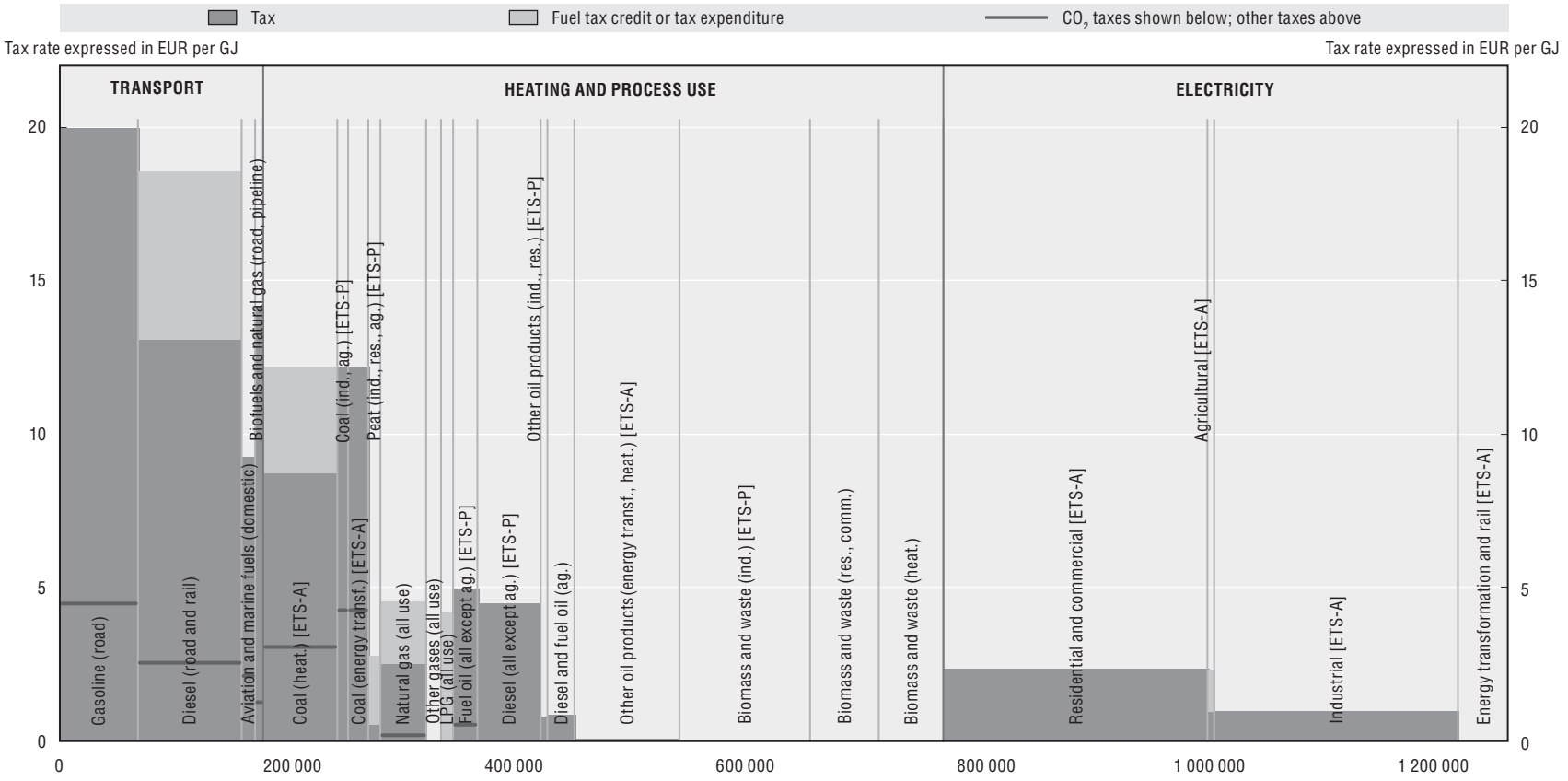
Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials.

Notes

1. This reform has been structured as an Environmental Tax Reform, as it compensates the increase in some energy tax rates (especially heating fuels and electricity) with the abolition of a national pension contribution for employers.
2. Under the Finnish CO_2 tax a life-span approach is adopted, considering that greenhouse gas emissions caused by biofuels occurs in the production of the raw material and during transportation and distribution.

Figure 9.2. **Taxation of energy in Finland on an energy content basis**

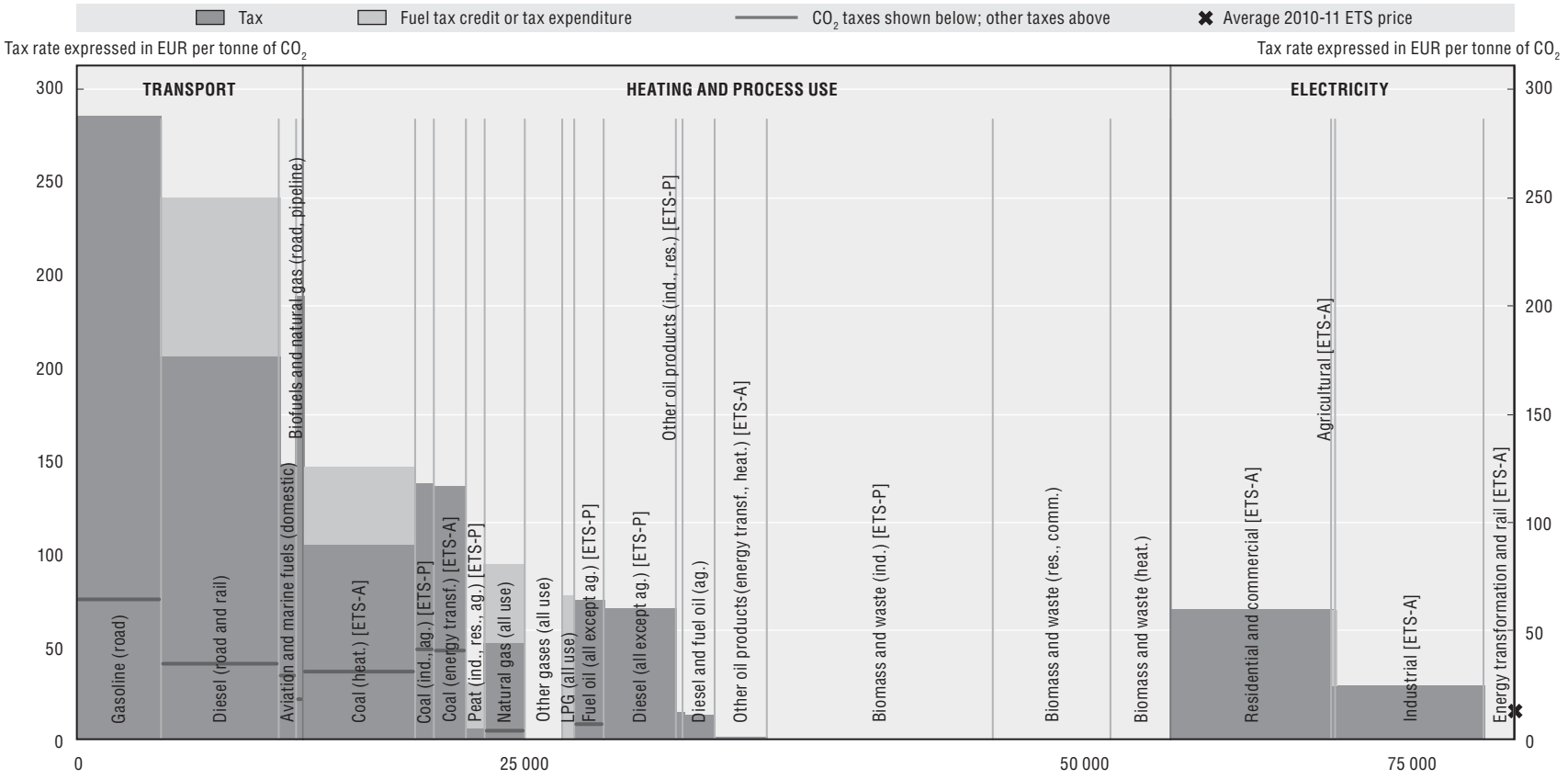


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766187

Figure 9.3. **Taxation of energy in Finland on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766206

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France

Figures 10.1 and 10.2 map the use and taxation of energy in France on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In France energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). Tax rates are generally above the minimum rates set by the Directive, except for LPG and natural gas used as propellants, coal and natural gas used for heating purposes in the non-business sector, and fuels used by taxis (as provided for in Articles 5, and 15(1)(h) and (i), of the Directive).

With respect to transport, as in many countries, fuels used in domestic aviation and navigation are exempt. Fuels used in rail transport are taxed at a reduced rate. Process use of fuels is almost always taxed, whereas heating use of fuels is in many cases exempt. A refund is applied to diesel, fuel oil and natural gas consumed in agriculture, and fuels used by the fishing sector are exempt.

Biomass, waste, and renewable energy forms are not taxed when used to produce heat or electricity, and the consumption of heat is not taxed. Fuels used to generate electricity are not taxed. The consumption of electricity is taxed differently according to the user. Residential users pay a lower tax rate than the standard rate applied to industrial users. However,electricity consumed by large industrial consumers is taxed at a reduced rate which is slightly below that faced by residential users. Electricity used in the transport sector is exempt.

Energy use and taxation in France

The highest tax rate in the transport category is applied to motor gasoline, both on a volume and CO_2 content basis. Diesel is taxed at a lower rate than gasoline on a per litre, CO_2 content and energy content basis. Because of its higher carbon intensity per unit of energy relative to gasoline, diesel accounts for 71% of energy use in transportation and 72% of CO_2 emissions, relative to 19% of energy use and 18% of CO_2 emissions for gasoline. Emissions from fuel used in domestic aviation amount to 3% of transport emissions, and fuel used for this purpose is tax exempt. Reduced rates apply to biofuels (5% of CO_2 emissions in transport) and rail and marine fuels (respectively taxed at a reduced rate and exempt, and less than 1%).

With respect to heating and process fuel, tax rates are differentiated according to use. Process use of fuels is generally taxed. In particular, natural gas, coal, diesel, fuel oil and LPG are all taxed when used as process fuels. Residual oil products, such as naphtha, are tax exempt. Heating use of fuels is taxed only when diesel is used; natural gas, coal and LPG are exempt. Coal and natural gas account for the largest share of CO_2 emissions from heating and process use, at about 36%. More than one-third of coal and natural gas emissions relate to their use as heating fuel. Diesel oil also plays a significant role in terms of CO_2 emissions, with a share equal to 14% of the total. The portions of diesel oil, fuel oil and natural gas used in agriculture and taxed at a reduced rate account for around 4% of total CO_2 emissions from heating and process fuel use. LPG and fuel oil play a relatively

minor role in terms of emissions, at 3% (half of which exempt) and 2% respectively. 19% of CO_2 emissions come from biomass, waste and renewables.

Electricity taxation in France is differentiated by user, as shown in the maps. The tax rate applied to industrial users depends on the user's scale (measured in terms of installed capacity in kW), and is lower for larger consumers. Residential and commercial users are taxed at the same rate, which is set at an intermediate level between the rates for the two types of industrial users. Electricity consumption for transport purposes is exempt.

Reported tax expenditures

France has recently developed a detailed framework to analyse tax expenditures in a number of areas. In August 2011, the *Rapport du comité d'évaluation des dépenses fiscales et des niches sociales* was released by the *Inspection générale des finances*. Annex H to that report is entirely devoted to tax expenditures associated with energy taxes.

Several of the main tax expenditures reported by France can be identified in the maps:

- *Aviation fuel*: France estimates a tax expenditure corresponding to the exemption for aviation fuel used by commercial airlines. The value of the tax expenditure shown in the graph was computed using as the tax on kerosene used in aviation for leisure purposes as the benchmark. The column marked "Aviation fuels (domestic)" shows this exemption. The tax expenditure is one of the largest reported by France.
- *Rail and marine*: In France, fuels used in domestic navigation are exempt from tax and fuels used for rail transport are taxed at a reduced rate. The standard rates applied to the two fuels used in transport have been used as benchmarks for the tax expenditure computation. Consumption of energy for rail transport is constituted entirely from diesel and the standard diesel transport tax rate has been used as the benchmark. The relevant tax expenditure is in light grey in the column "Rail and marine fuels (domestic)". France reports a tax expenditure only for navigation, but the two categories have been aggregated since the total amount was very small compared to the other categories in the graph.
- *Biofuels*: In France a refund rate applies to biofuels. The tax expenditure has been calculated using the tax rates for gasoline and diesel as the benchmarks respectively for ethanol and biodiesel. The tax expenditure is shown in the graph in light grey in the column "Biofuels (road)".
- *LPG and natural gas for transport:* Natural gas used in transport is exempt, and a reduced rate applies to LPG. For natural gas, the benchmark used is the minimum tax rate set by the EU Energy Taxation Directive. For LPG, the benchmark used is the (GJ equilivant) tax rate imposed on motor gasoline, being the nearest substitute.
- *Diesel, fuel oil and natural gas in agriculture and fishing*: A refund rate is applied to fuel oil and natural gas used in agriculture. The fishing sector uses only diesel, which is exempt. The corresponding tax expenditure has been computed using the tax rates for diesel and fuel oil used as heating and process fuels, and for natural gas used as a process fuel, as the benchmarks. This tax expenditure is of a significant size.
- *Coal and natural gas for residential use*: The exemption for natural gas used in the residential sector is a large tax expenditure and is shown in the column "Coal and natural gas (res.)", where coal represents 2% of the total. The benchmark used is the tax rate for "Coal and natural gas (comm., ind.)".

Information which would allow the other tax expenditures in the *Inspection générale des finances* to be shown in the maps was not available (*i.e.* in the case of the tax refunds applied to fuel consumption in public transport or in Corse).

The maps show that differential tax rates are applied in a number of areas that are not reported as tax expenditures. With respect to transport, different tax rates apply to diesel and gasoline, and with respect to heating and process fuel, a lower rate is imposed on coal and natural gas used as process fuel than on LPG. Similarly, no tax expenditure is computed for the lower tax rate applied to electricity consumed by large installations.

Key assumptions and caveats

Key assumptions and caveats are as follows:

- While gasoline and diesel tax rates vary by region, only the national tax rate has been considered.
- When a different tax rate is levied on process and heating use, *i.e.* natural gas and LPG, all industrial consumption has been treated as process fuel use, while the entire amount consumed by the commercial and public sectors is treated as heating fuel use.
- As for industrial electricity use, the law introduces differential tax rates for industries with an installed capacity below and above 250 kW.[1] The proportion of industries with an installed capacity higher than 250 kW has been assumed to be 60%. This hypothesis was confirmed during the bilateral consultation on the basis of data from an annual survey of energy consumption in the industrial sector.
- When computing the electricity tax rate, the coefficients that are set at both the departmental and municipal levels have been assumed to be at the average of the range established in law.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Government of France, "Code des Douanes", version consolidée au 16 mars 2011.

Ministère de l'Écologie, du Développement Durable, des Transports et du Logement (2010), "La fiscalité des hydrocarbures applicable au 1er janvier 2011". Available at: *www.developpement-durable.gouv.fr/La-fiscalite-des-hydrocarbures,11221.html*.

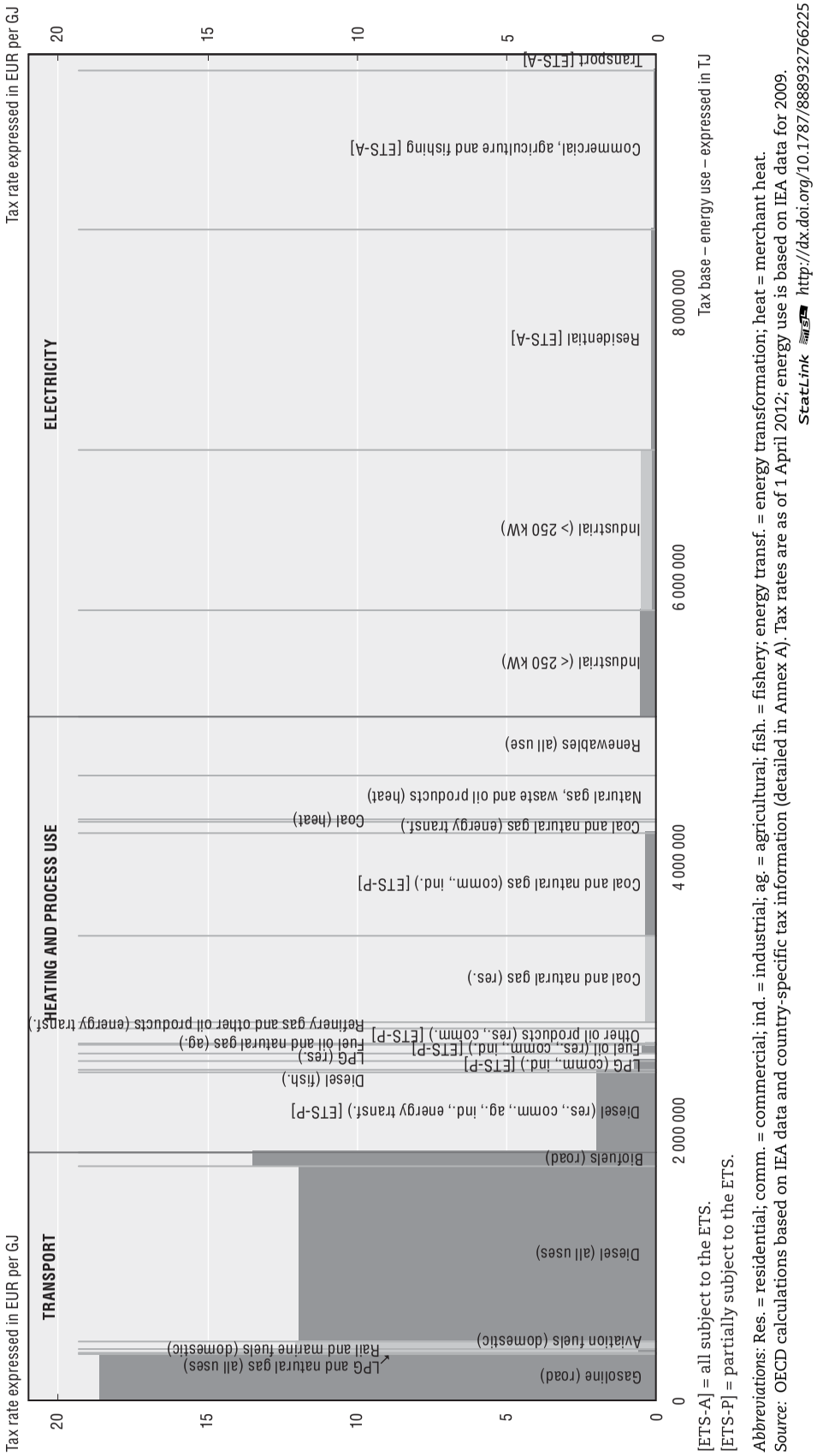
Ministère de l'Économie et des Finances (2011a), "Fiscalité sur les Produits Energétiques". Available at: *www.douane.gouv.fr/menu.asp?id=322*.

Ministère de l'Économie et des Finances (2011b), "Rapport du Comité d'Evaluation des Dépenses Fiscales et des Niches Sociales". Available at: *www.economie.gouv.fr/rapport-du-comite-d-evaluation-des-depenses-fiscales-et-des-niches-sociales-2011*.

Note

1. In the French national law, the threshold is originally expressed in kVa (*kilovoltampere*) and referred to the "*puissance maximale souscrite*".

Figure 10.1. **Taxation of energy in France on an energy content basis**



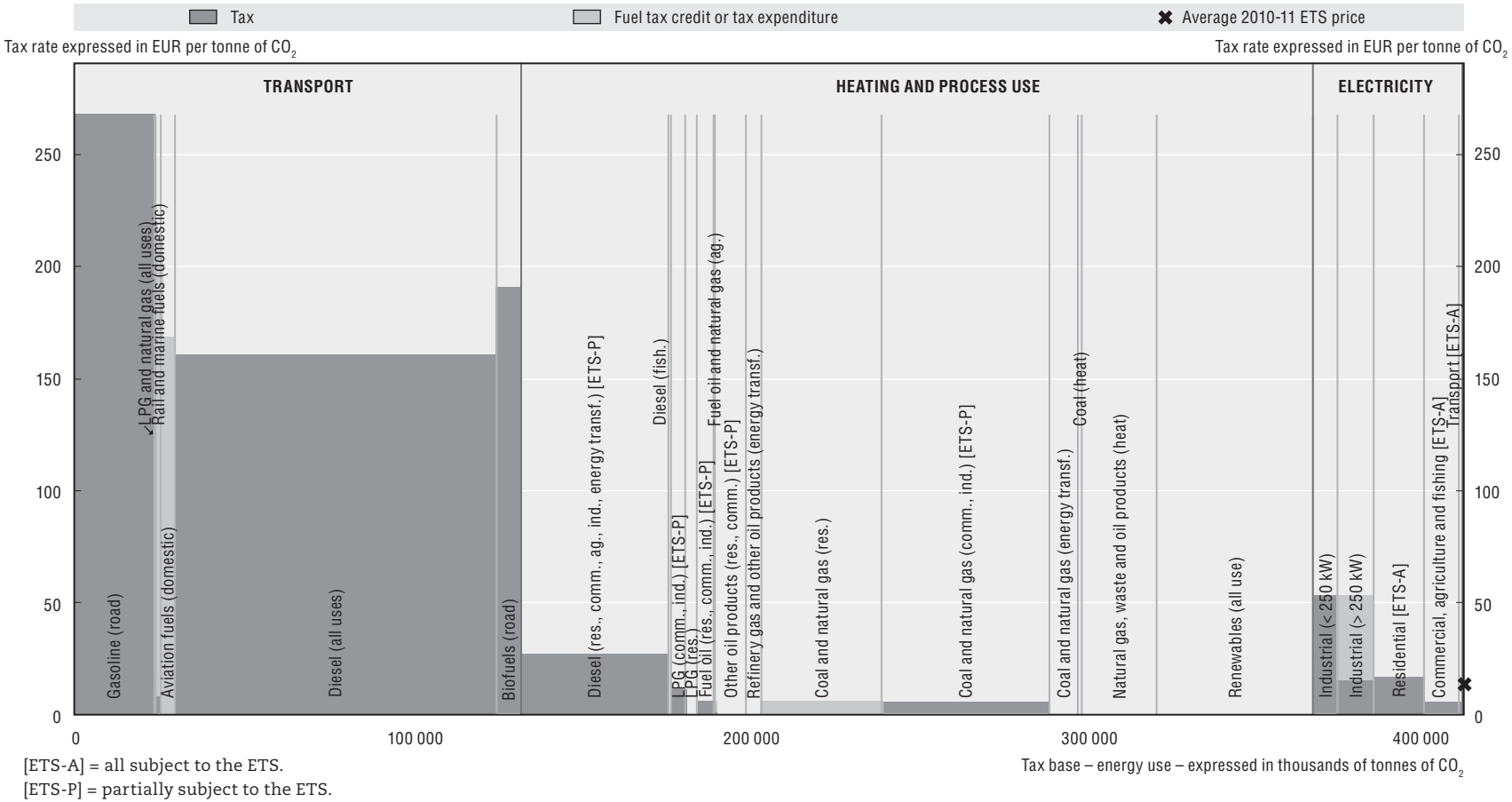
[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766225

Figure 10.2. **Taxation of energy in France on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766244

Germany

Figures 11.1 and 11.2 map the use and taxation of energy in Germany on the basis of energy content and carbon content, respectively

Structure of energy taxation

In Germany energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). In transport, biogasoline and biodiesel are generally taxed at the same rates as gasoline and diesel. However, a partial refund of excise tax is provided for pure biodiesel and vegetable oil until the end of 2012, if the national biofuel quota has already been met. Furthermore, some innovative biofuels are tax-free until the end of 2015. Exemptions are provided for fuels used in domestic navigation and aviation.

Industrial uses of fuels are generally taxed. A refund is applied to LPG, natural gas and diesel consumption in manufacturing and agriculture. Exemptions are provided for coal, natural gas and heavy fuel oil used in certain energy-intensive processes. Fuels used to produce merchant heat are taxed, although tax reductions are provided when the heat is both generated and consumed in the industrial sector. Waste used to produce merchant heat is taxable if it has an average heating value of more than 18 megajoules per kilogram.

Electricity is taxed in Germany, with differential tax rates applying to electricity used by different sectors. Energy products used to generate electricity are untaxed where the power station has a capacity of more than 2 megawatts. In power stations with a capacity of less than 2 megawatts, energy products are still untaxed where certain requirements for power-heat-cogeneration are fulfilled.

Energy use and taxation in Germany

As can be seen in the maps, road-use gasoline and diesel dominate the transport category. Together they account for 89% of both energy used in transport, and the resulting CO_2 emissions. Road-use diesel is taxed at a lower rate than motor gasoline on a per litre, CO_2 content and energy content basis. The remainder of the transport category is made up of small quantities of LPG, natural gas, biofuels, aviation fuels, and rail and marine fuels (all of which is diesel). While diesel used in rail is taxed at the standard rate, marine-use diesel is untaxed, as are aviation fuels.

With respect to heating and process fuel, taxes differ widely according to the user. Residential fuel consumption is taxed at the standard rate. For industrial consumption, several refunds and exemptions can apply. Natural gas accounts for 47% of the energy used and 40% of the CO_2 emissions from heating and process fuel use. Almost half of the natural gas use is exempt (if used in certain energy-intensive industrial processes) or taxed at a reduced rate (in manufacturing and agriculture). Many exempted energy-intensive industrial processes, however, are covered by the European Emission Trading Scheme (ETS). Diesel also plays a relevant role in terms of both energy use and CO_2 emissions, with a partial refund lowering the effective rate for industrial and agricultural use. Fuels used in energy transformation are untaxed as are renewables and biomass and waste that are not used for heating.

Electricity consumption is taxed in Germany and the maps show the tax rates for different users. Some of the refunds and exemptions described before for heating and process fuel also apply to electricity.

Reported tax expenditures

Several tax expenditures reported by Germany in *Subventionsberichte* can be identified in the maps:

- *Aviation fuel:* Germany reports a tax expenditure for domestic flights operated by commercial air carriers. The tax on kerosene used in aviation for leisure purposes is used as the benchmark. This exemption can be seen on the maps in the column marked "Aviation fuels (domestic)".
- *Domestic navigation:* Germany exempts domestic use of shipping fuel – entirely diesel – and calculates a tax expenditure. Since diesel oil consumption in navigation represents a small percentage of total fuel consumption, it is shown together with consumption in rail, to which a positive tax rate applies. The relevant tax expenditure is shown in light grey in the column "Rail and marine fuels (domestic)".
- *Biofuels:* In Germany biogasoline and biodiesel are generally taxed as gasoline and diesel. However, a partial refund of excise tax is provided for pure biodiesel and vegetable oil until the end of 2012, if the national biofuel quota has already been met. Furthermore, some innovative biofuels are tax-free until the end of 2015. For example, a full refund is available for ethanol as part of E85-motor gasoline until the end of 2015. These tax expenditures are not shown in the maps as the quantities receiving the tax concessions were not available.
- *Refunds for fuel used in manufacturing and agriculture:* Germany reports a tax expenditure for the refunds for natural gas, light fuel oil (included in diesel) and LPG used by manufacturing industries, agriculture and forestry. The map shows the lower rates applied to diesel and natural gas used in manufacturing and agriculture relative to that used by the residential and commercial sectors. Tax expenditures were computed using the tax rate that applies to the particular product for heating and process use as the benchmark. They are shown on the maps in light grey, in the columns "Diesel (ind., ag.)", "Natural gas (ind., ag.)" and "LPG (all use)". For LPG, manufacturing and agriculture use has not been disaggregated since it represents a small percentage of the total. The corresponding tax expenditure has been calculated referring only to the relevant share of consumption, namely LPG used in manufacturing and agriculture.
- *Fuel use in certain energy intensive processes:* Germany reports a separate tax expenditure for the energy-intensive processes in which natural gas, coal and heavy fuel consumption is exempt. The maps illustrate these exemptions and show the corresponding tax expenditures. They have been computed using the tax rate that applies to natural gas, fuel oil and coal for heating and process use for the residential and commercial category as the benchmark.
- *Electricity used in manufacturing and agriculture and in certain energy-intensive sectors:* A similar tax treatment is applied to electricity consumption in manufacturing, agriculture and certain energy-intensive sectors. The corresponding tax expenditures have been computed using the standard electricity tax rate applied to "Residential and commercial" as the benchmark. They are shown in the columns "Industrial and agriculture" and "Certain energy intensive sectors".
- *Electricity used in transport:* In Germany, a full refund is applied to electricity used in trollybuses and railway transport. The corresponding tax expenditure has been calculated adopting the standard electricity tax rate as the benchmark. It is illustrated in the column "Transport".

Key assumptions and caveats

In terms of assumptions:

- For energy intensive industries, the law exempts certain steel and chemical processes from paying the standard tax rate on energy products. The share of coal and natural gas consumption affected by this measure has been assumed to equal three-quarters of the total in the Iron and steel, non-ferrous metals, non-metals and chemical and petrochemical sectors included in the 2009 IEA Energy Balances (IEA, 2011a).
- Consistent with *Energiesteuergesetz*, the following sectors in the 2009 IEA Energy Balances (IEA, 2011a) have been considered to be manufacturing sectors: transport equipment; mining; machinery; food and tobacco; paper, pulp and printing; wood and wood products; textile and leather.
- Information on energy used in electricity generation broken down by size of power station was unavailable. Therefore, in the maps electricity generation is assumed to occur in power stations with a capacity of more than 2 megawatts.
- As information on the types of fuels replaced by biomass and waste was unavailable, biomass and waste used to generate electricity and/or merchant heat are assumed to replace coal. Waste products are also assumed to have an average heat value of more than 18 megajoules per kilogram. As a result, biomass and waste used to generate electricity are shown as untaxed in the maps. Meanwhile, biomass and waste used to produce merchant heat are shown as taxed at the same rate as coal used to produce merchant heat (EUR 0.33 per GJ).
- As a breakdown of quantities of biofuels subject to tax relief was unavailable, it is assumed that all biofuels are taxed at the full gasoline or diesel excise rates, as applicable.
- As a breakdown of merchant heat consumption by sector was not available, all merchant heat is assumed to be consumed by residential and commercial users, and hence fully taxed.
- Information on electricity used in transport was not available. Therefore, in the maps all electricity used in transport has been assumed to be used in either trollybuses or railway transport.
- Only federal taxes have been taken into account in the maps.
- Fuel used in public transport and diesel used as propellant in agriculture could not be disaggregated due to the unavailability of data.

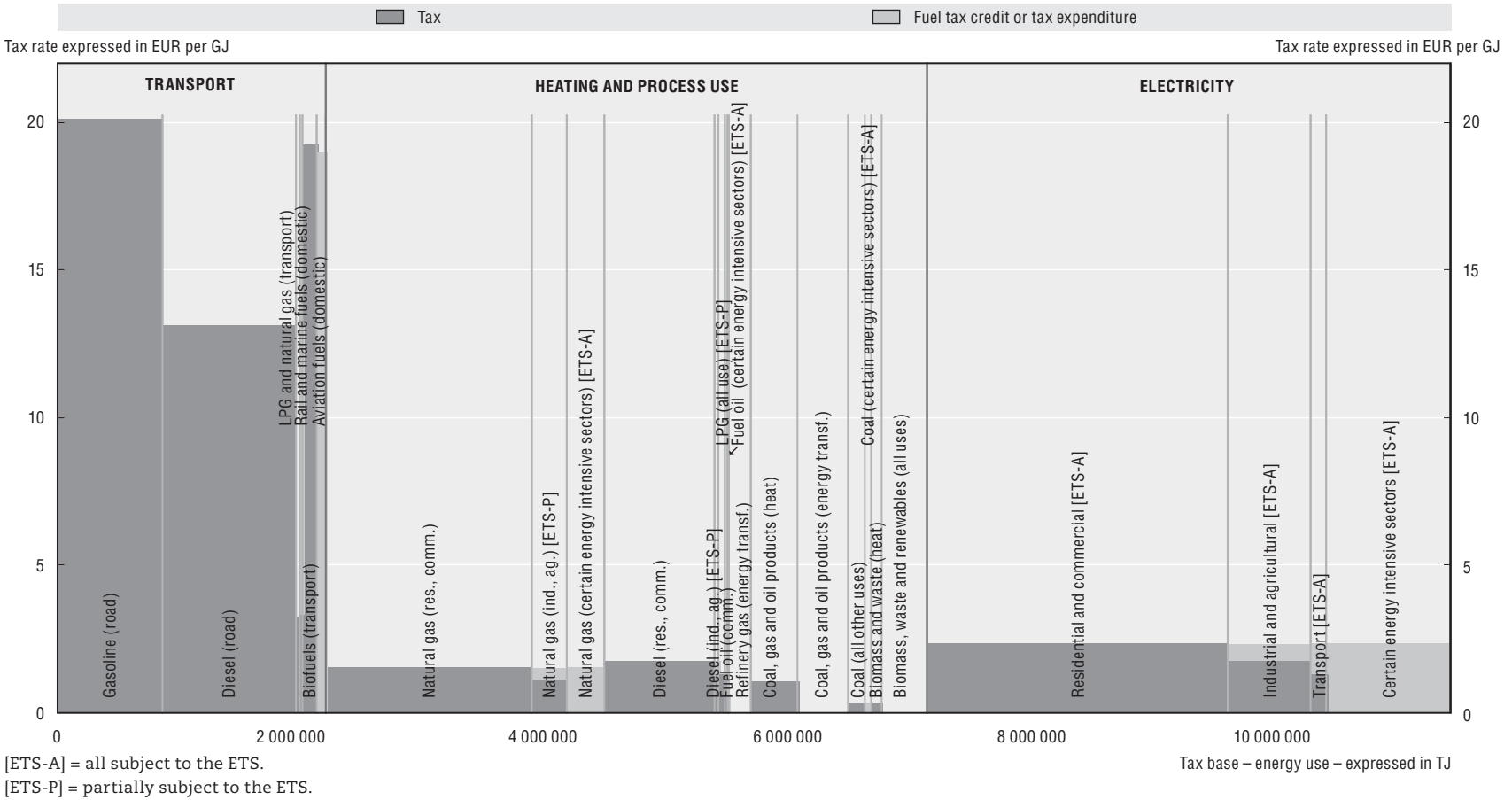
Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

German Federal Ministry of Finance (various years), "Subventionsberichte". Available at: *www.bundesfinanzministerium.de/*.

German Federal Ministry of Justice (2006), "Energiesteuergesetz". Available at: *www.gesetze-im-internet.de/bundesrecht/energiestg/gesamt.pdf*.

Figure 11.1. **Taxation of energy in Germany on an energy content basis**

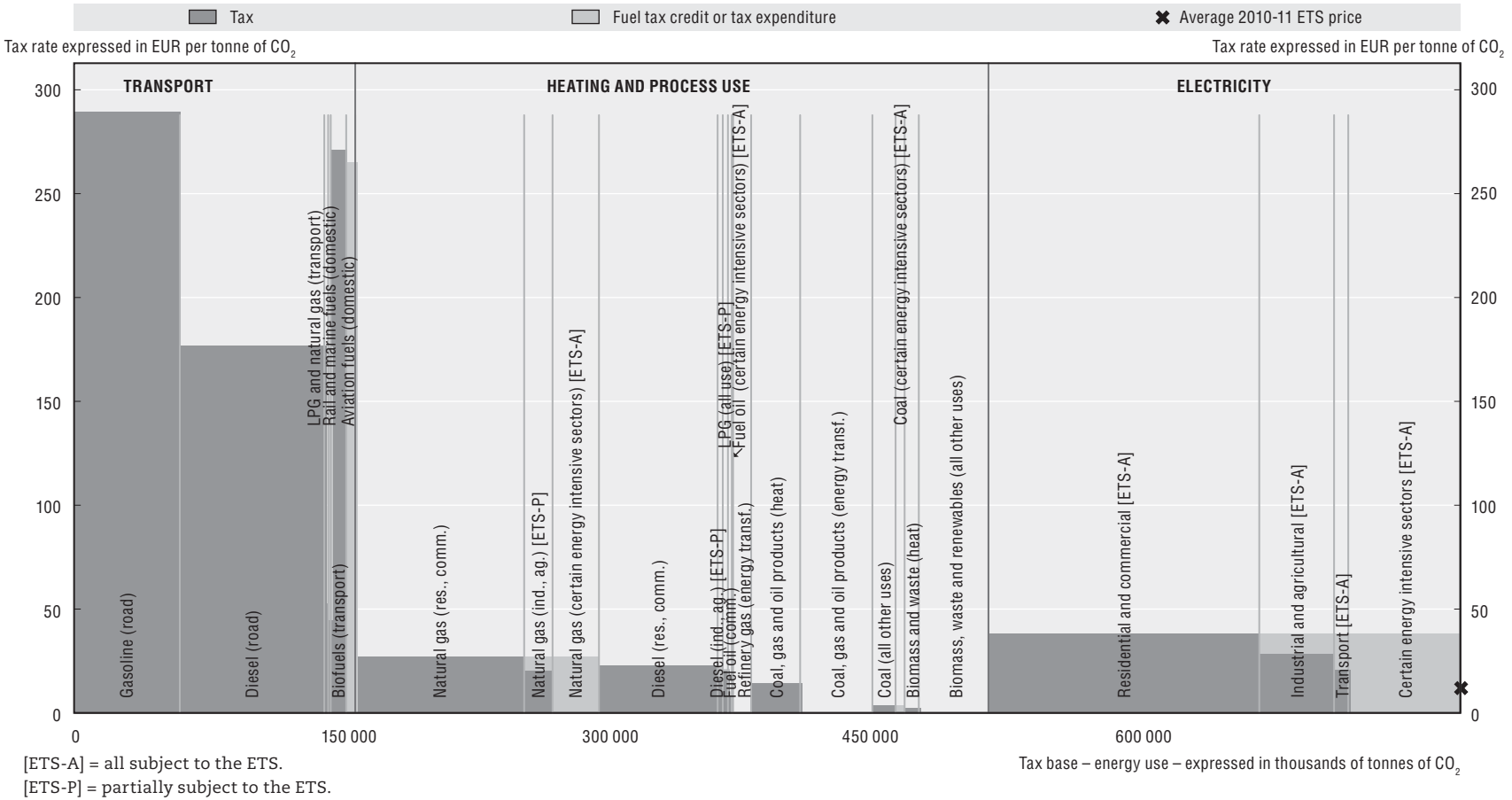


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766263

Figure 11.2. **Taxation of energy in Germany on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766282

Greece

Figures 12.1 and 12.2 map the use and taxation of energy in Greece on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In Greece, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). Tax rates are generally levied well above the minimum level prescribed by the Directive. Excise taxes on fuels used for domestic shipping purposes are fully refunded. Natural gas used in transport, waste, biomass, petroleum coke and refinery gas are all untaxed.

A partial refund of EUR 0.125 per litre (reducing the effective tax rate from EUR 0.412 to EUR 0.287 per litre) is provided for excise taxes on diesel used for industrial or commercial purposes. As of 1 April 2012 (the date to which the maps refer), a partial refund of EUR 0.391 per litre was also provided for excise taxes on diesel used in agriculture. Note, however, that on 5 November 2012 this partial refund was reduced from EUR 0.391 per litre to EUR 0.264 per litre. Additionally, as of 15 October 2012 the tax rate on motor diesel was reduced from EUR 0.412 to EUR 0.33 per litre and the tax rate on heating diesel was increased (from EUR 0.06 per litre) to the same level. As of 5 November 2012, the tax rate on LPG used as a motor fuel was increased from EUR 200 to EUR 330 per tonne.

Electricity is taxed, with a slightly higher rate imposed for business use than for residential use. Electricity used in agriculture is exempt, as is electricity generated from renewables. Fuels used for the purpose of electricity generation are also taxed, with the exception of coal and coke.

Energy use and taxation in Greece

As can be seen from the maps of energy use and taxation that follow, gasoline and diesel dominate the transport category. Together they constitute 85% of energy used in transportation and 84% of CO_2 emissions produced in transportation. Marine fuels make up an additional 11% of both energy used and CO_2 emissions from transportation. The remainder of the transport category is made up of aviation fuel and small quantities of biofuels, LPG and natural gas. Gasoline and aviation fuel are taxed at significantly higher effective rates than diesel, biofuels and LPG (both in terms of energy and CO_2 content), while marine fuels and natural gas are untaxed. Note that the increase in the tax rate on LPG that was introduced after 1 April 2012 is not captured in the maps.

The heating and process use category is dominated by diesel, which accounts for 43% of the heating and process energy use, and 42% of the CO_2 emissions in this category. The rest of this category is distributed relatively evenly amongst other fuels. The small quantity of gasoline is taxed at by far the highest effective tax rate (both in terms of energy and CO_2 content). Diesel faces the next highest rates, with rates varying according to user. Diesel for industrial and commercial use is taxed at the highest rate (both in terms of energy and CO_2 content). This is more than three-times the rate that applies to diesel for residential use, which itself is substantially higher than the rate applying to diesel used in agriculture (again, in terms of energy and CO_2 content). As noted above, petroleum coke, refinery gas, waste and biomass are all untaxed. This results in 26% of energy use, and 30% of the CO_2

emissions, in this category being untaxed. Note that the changes to the taxation of diesel that were introduced after 1 April 2012 are not captured in the maps.

The electricity category is dominated by coal, which accounts for 65% of energy used to generate electricity (including electricity used in agriculture), and 77% of the resulting CO_2 emissions. Fuels are taxed at varying effective tax rates due to the varying tax rates imposed on both the use of fuels to generate electricity and on the consumption of the electricity itself. The highest effective tax rate applies to diesel, fuel oil and refinery gas, both in terms of energy and CO_2 emissions. The lowest effective tax rate (excluding untaxed renewables) applies to the large quantity of coal used to generate electricity. The carbon emissions from coal result in the electricity category being proportionately larger in CO_2 terms than in energy terms, despite the small countering presence of some renewables (hydro, solar and wind).

Reported tax expenditures and rebates

Greece reports a number of tax expenditures that can be identified in the maps:

- *Domestic shipping:* Greece provides a full refund of excise duty paid on fuels used for domestic shipping purposes. As can be seen in the maps, the fuels used for domestic shipping in Greece are diesel and fuel oil. The standard excise rate for each fuel is used as the benchmark in the maps.
- *Agriculture:* As of 1 April 2012, Greece provided a partial refund (EUR 0.391 per litre) of excise duty paid on diesel used in agriculture. The standard excise rate for diesel is used as the benchmark in the maps. Note, however, that on 5 November 2012 this partial refund was reduced from EUR 0.391 per litre to EUR 0.264 per litre. This reform is not captured in the maps.
- *Diesel:* Greece provides a partial refund (EUR 0.125 per litre) of excise duty paid on diesel used for industrial or commercial purposes. The standard excise rate for diesel is used as the benchmark in the maps.
- *Electricity:* Coal and coke used exclusively for electricity generation are exempt from fuel excise tax. Additionally, electricity used in agriculture, or generated from solar, wind, tidal, or geothermal sources are exempt from excise tax on the consumption of electricity. The standard excise rate for each fuel, or for electricity consumption, as applicable, is used as the benchmark in the maps. Due to the small amount of diesel used to generate electricity used in agriculture, it has been grouped together with all other oil products in the maps. As such, this particular tax expenditure cannot be identified in the maps.
- *Other:* A number of additional minor exemptions are also provided in Greece that are not identifiable on the maps. These include: diesel, kerosene, white spirit and other light oils used by the industry exclusively as raw material for production purposes; diesel destined as electro-insulating material for electric alternators; aromatic hydrocarbons used in industry exclusively as raw material for production purposes; coal and coke used exclusively in mineralogical process, for chemical reduction, or in electrolytic and metallurgical process.

Key assumptions and caveats

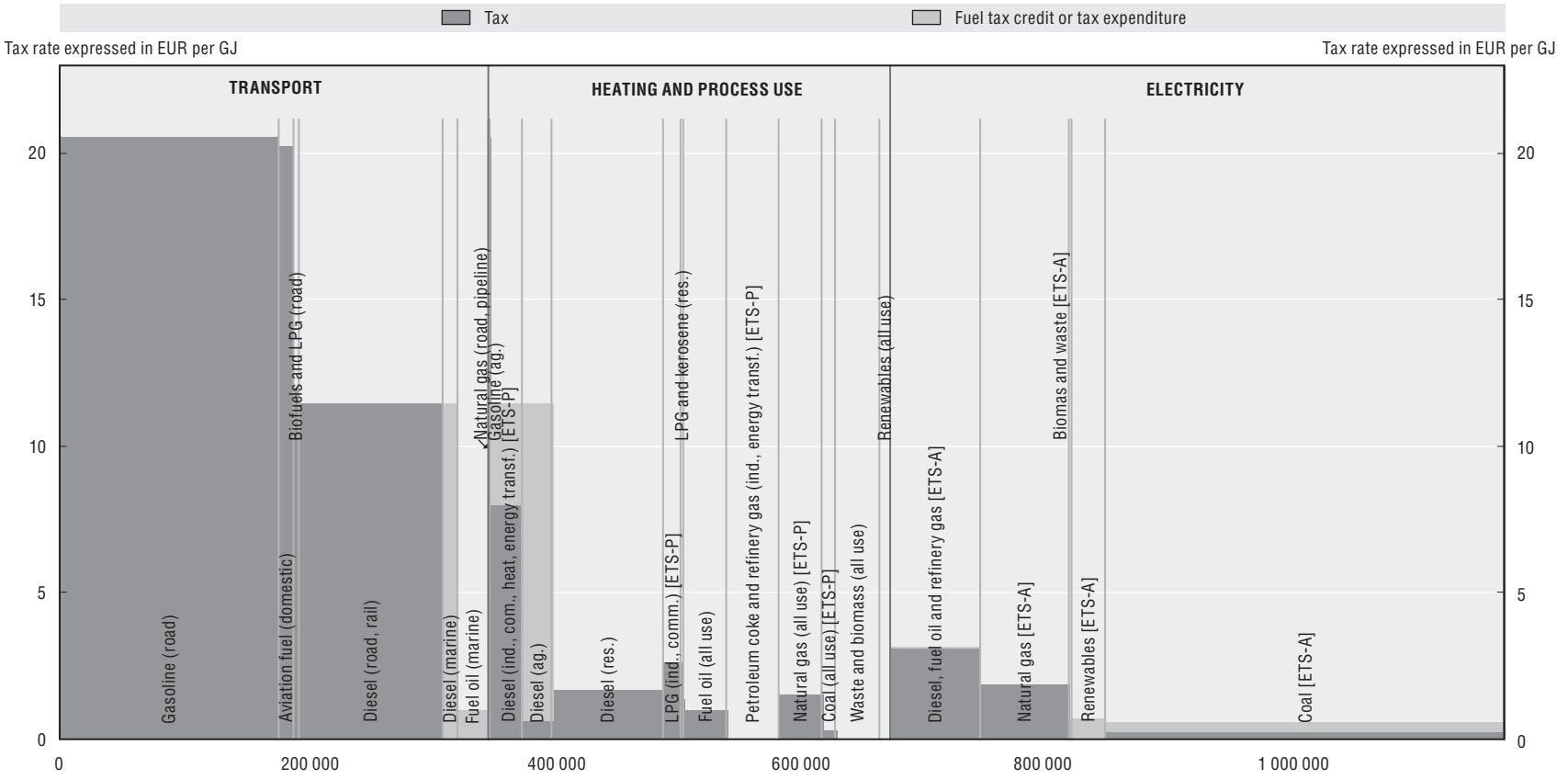
A weighted average tax rate on the consumption of electricity of EUR 2.41 per MWh has been applied in constructing the maps, rather than the actual separate rates for

residential and business use of electricity (EUR 2.2 and EUR 2.5 per MWh, respectively). This enables a breakdown by fuel type rather than user to be presented in the maps.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials.

Figure 12.1. **Taxation of energy in Greece on an energy content basis**

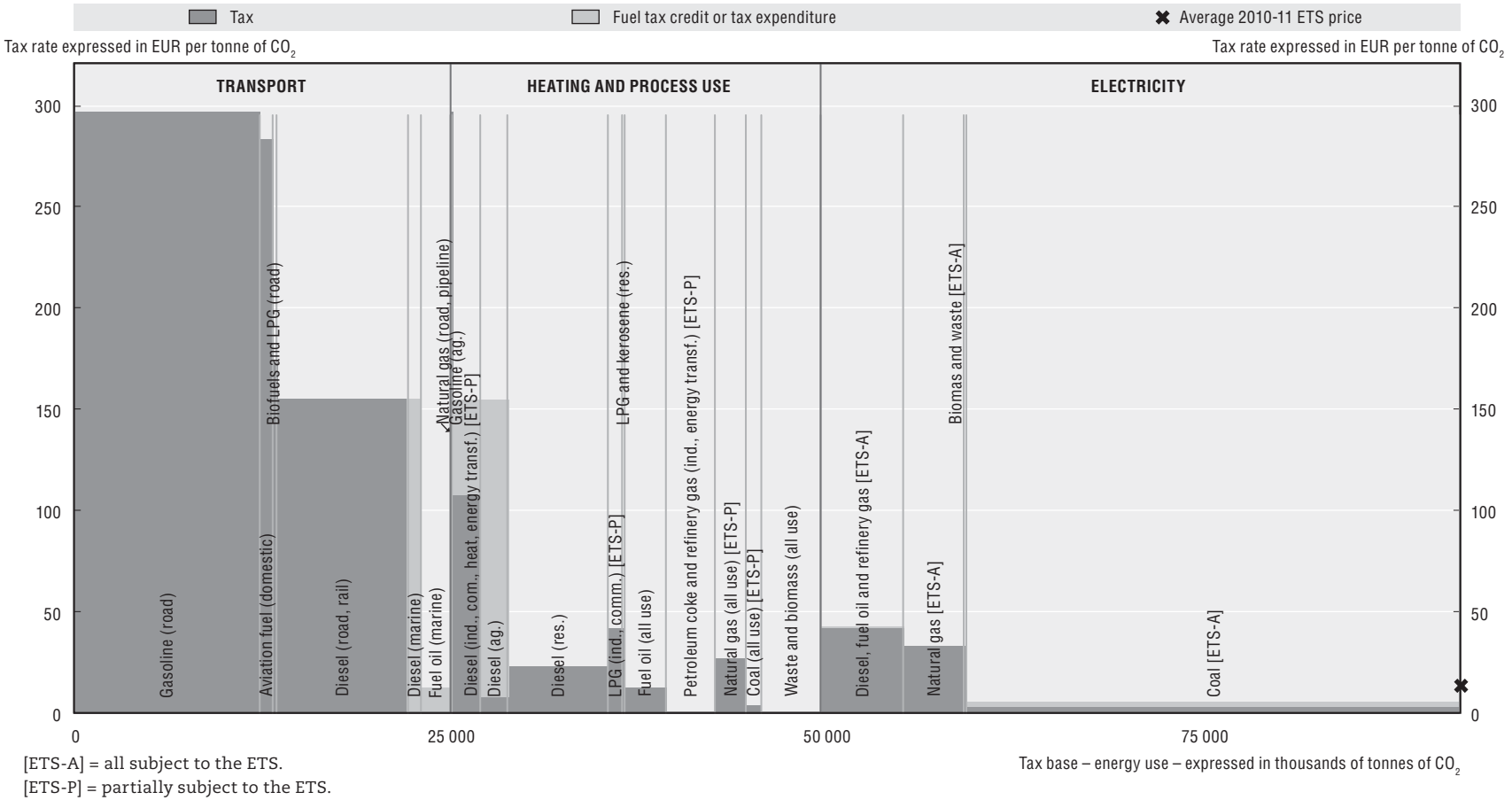


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766301

Figure 12.2. **Taxation of energy in Greece on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766320

Hungary

Figures 13.2 and 13.3 map the use and taxation of energy in Hungary on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In Hungary, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). Industrial use of LPG is taxed at the minimum rate set by the Directive, and natural gas used as transport fuel is taxed below the minimum rate. Fuels used in domestic aviation and shipping are exempt from tax, and excise duty levied on fuels used in rail transport is completely refunded.

Residential use of LPG, coal and natural gas are tax exempt, as are fuels used to produce merchant heat or to transform energy. Waste and renewables are also untaxed. 82% of the tax rate paid on fuels for agricultural use is refunded.

Electricity is taxed when consumed by industrial and commercial users, but residential consumption is exempt. Fuels used to produce electricity are not taxed.

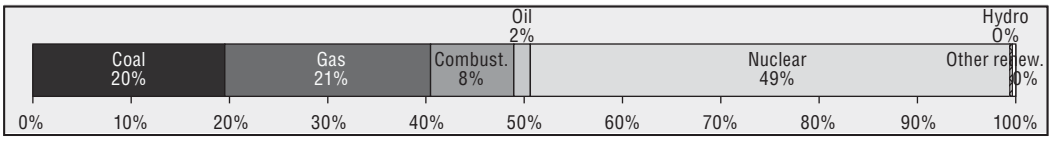
Energy use and taxation in Hungary

As can be seen in the maps, diesel accounts for the majority of the energy used in transport (58%) and the resulting CO_2 emissions (60%). Gasoline accounts for a further 36% of energy used in transport, and 34% of transport emissions. The tax rate levied on diesel is lower than that on gasoline on a per litre, CO_2 and energy basis. The remainder of the category is made up of LPG, and untaxed natural gas, biofuels and rail and marine fuels.

Natural gas accounts for more than half of energy used (59%) and CO_2 emissions (54%) in the heating and process use category. In contrast, diesel – which faces the highest effective tax rate in this category – accounts for less than 3% of both energy use and CO_2 emissions. Around half of natural gas is for residential use and therefore exempt. The tax rate levied on (non-residential use) coal is the same on an energy content basis as the rate on natural gas, but is significantly lower on a carbon content basis. In addition to residential use coal being exempt, coal is the fuel most widely used by the (untaxed) energy transformation sector. The exemptions for some natural gas and coal use, together with untaxed fuels used for merchant heat production and energy transformation, and waste and renewables, result in 67% of both energy use and CO_2 emissions in the category being untaxed.

As is shown in the maps, only industrial and commercial users pay any excise duty on electricity consumption. The main primary energy source used to generate electricity in Hungary is nuclear energy (see Figure 13.1), followed by natural gas and coal. As a result of the substantial use of nuclear energy, the electricity category is proportionately smaller in CO_2 terms than in energy terms.

Figure 13.1. **Fuels used to generate electricity in Hungary (TJs)**



Source: OECD calculations using 2009 IEA Energy Balance data (IEA, 2011a)

StatLink http://dx.doi.org/10.1787/888932766339

Reported tax expenditures and rebates

- *Diesel used by rail and domestic shipping*: Diesel consumed by domestic shipping is exempt, and excise duties levied on diesel for rail use is completely refunded. The corresponding tax expenditure has been computed using the standard rate for diesel as the benchmark.
- *Diesel used in agriculture*: From 1 November 2011, 82% of the tax rate applying to diesel if it is used for agricultural purposes. The tax expenditure has been computed using the tax rate levied on diesel used by the industrial and commercial sectors as the benchmark.

Key assumptions and caveats

In terms of assumptions:

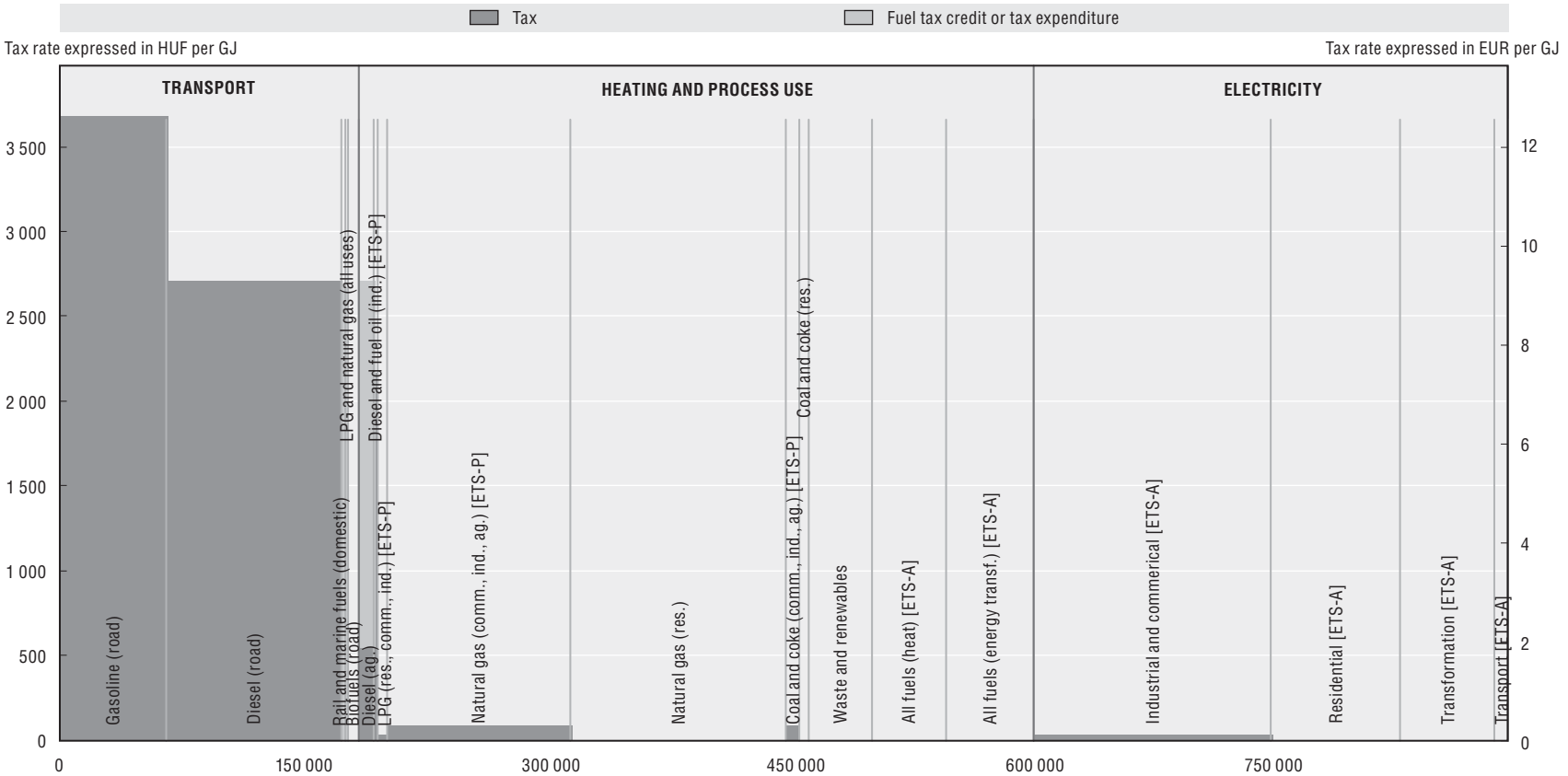
- Natural gas and LPG for transport use were included in the same sub-category since the respective tax basis was too small to be disaggregated. Similarly, diesel and fuel oil consumed by the industrial and commercial sectors are aggregated. In both cases, the corresponding tax rate has been computed as the weighted average of the excise duties levied on natural gas (equal to zero) and LPG.
- In Hungary, two tax rates are levied on fuel oil according to its sulphur content. According to data provided by Hungary, fuel oil with sulphur content of less than 10 mg per kilogram is the most widely-used type of fuel oil used in Hungary (82% of fuel oil consumption). For this reason the tax rate corresponding to this type of fuel oil is shown in the graph.

The exemption from the excise duty for domestic aviation is not shown in the map since the 2009 IEA Energy Balances (IEA, 2011a) reports no fuel consumption for domestic aviation.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials.

Figure 13.2. **Taxation of energy in Hungary on an energy content basis**

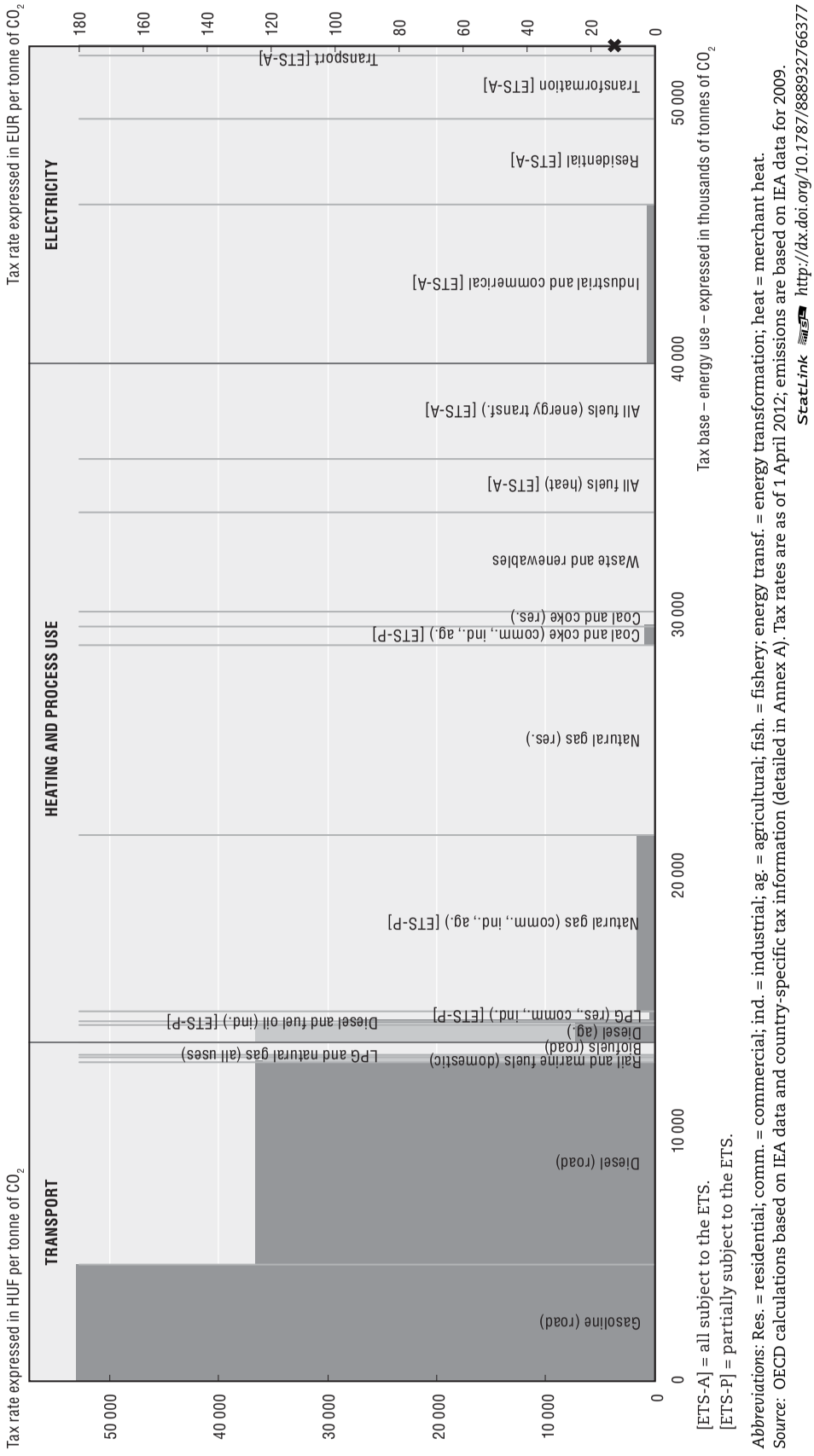


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink *http://dx.doi.org/10.1787/888932766358*

Figure 13.3. **Taxation of energy in Hungary on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766377

Iceland

Figures 14.2 and 14.3 map the use and taxation of energy in Iceland on the basis of energy content and carbon content, respectively.

Structure of energy taxation

Due to the high usage of renewable resources, energy taxes in Iceland have traditionally low until 2008, when excise tax rates were substantially increased and a carbon tax on liquid fossil fuel was introduced (Act on Environmental and Resource Taxes No. 129/2009). In 2012, Iceland introduced aviation emission quotas, after joining the EU Emissions Trading System (EU ETS) as a part of the Agreement on the European Economic Area. Iceland will join the full EU-ETS system in its third phase (2013-20).

The energy tax system currently encompasses several components. A general excise tax rate (ISK 23.86 per litre) is levied on all petroleum products. However, aircraft, ship, home heating and industrial uses are exempted.

A special excise tax, earmarked for road maintenance, applies to transport fuels. The rates are differentiated according to the fuel type (for example, ISK 38.55 per litre of gasoline and ISK 54.88 per litre of diesel). Mineral oils used off-road and for special purposes (tractors, rescue teams) are exempt. Liquefied petroleum gas (LPG) and liquefied and compressed natural gas also receive a complete exemption.

Finally, a carbon tax is levied on liquid fossil fuels, electricity consumption and hot water. It was introduced as a temporary measure, to be replaced in 2013 by the EU-ETS. With regards to fossil fuels, the tax rates range from ISK 4.1 per litre (aviation fuel) to ISK 7.1 per kilogram (fuel oil). There is a levy on hot water set at 2% of the selling price. The electricity tax is set at ISK 0.12 per kWh for all users (household and industry), but small firms are exempted.

Table 14.1. **Energy taxes in Iceland (1 April 2012)**

General excise tax		
Petroleum products	23.86	ISK per litre
Special excise tax		
Gasoline	38.55	ISK per litre
Diesel	54.88	ISK per litre
Other fuels	40.55	ISK per litre
Carbon tax		
Gasoline	5.0	ISK per litre
Diesel	5.75	ISK per litre
Fuel Oil	7.1	ISK per kilogram
Aviation fuel	4.1	ISK per litre
Electricity and hot water taxes		
Electricity All users	0.1	ISK per KWh
Hot water	2%	price

The levy on hot water is not considered in the maps, since it is fixed in relation to price rather than fuel quantity and hot water is not included in the 2009 IEA Energy Balances (IEA, 2011a).

Energy use and taxation in Iceland

The substantial role of renewables in Iceland's total energy supply (more than 85% of energy use in 2009) makes the energy content and CO_2 emission maps remarkably dissimilar. The difference is attributable to the electricity category, which is unusually large in terms of share of total energy use (about 70%), but almost totally generated from carbon-free geothermal and hydro sources, resulting in virtually no CO_2 emissions.

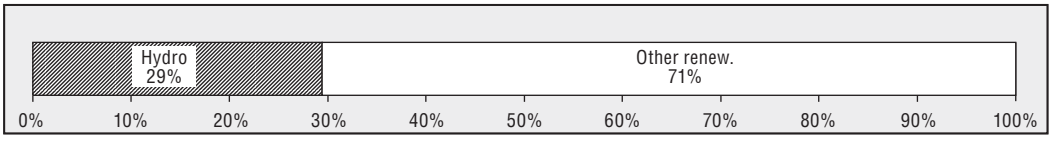
As can be seen from the maps, the transport category represents only about 6% of total energy use, much lower than in most other OECD countries. Nonetheless, it accounts for about 40% of total carbon emissions from energy use. Gasoline accounts for more than 50% of the energy use in transport and is taxed at the highest tax rate. Diesel, which has smaller share, is taxed at a lower rate, in both energy and carbon terms. The CO_2 tax components of both rates are also shown in the graph. Only the carbon tax is levied on aviation and marine fuels and, as a result, they are taxed at a lower rate than road fuels.

Within the heating and process use category, renewables account for about 70% of energy use. Oil products, taxed under the carbon levy, account for about 20% of energy use and 72% of carbon emissions in this category. The residual source is coal, which accounts for less than 2% of total energy use but about 16% of total carbon emissions. Nonetheless, it is untaxed. Oil products and coal account for more than half of total carbon emissions in Iceland.

The energy content map illustrates that electricity represents more than 70% of total energy use in Iceland. The industrial sector uses the vast majority of electricity, in particular the non-ferrous metal sector (*e.g.* aluminium smelting), which uses more than 70% of electricity production. A relatively low uniform tax rate is levied on electricity consumption, but small firms are exempted.

Due to the extensive reliance on renewable sources (99.9%) to generate electricity – geothermal (71%) and hydro (29%) – CO_2 emissions from electricity are nearly zero. For this reason, electricity is not shown in the carbon content map.

Figure 14.1. **Fuels used to generate electricity in Iceland (TJs)**



Source: OECD calculations using 2009 IEA Energy Balance data (IEA, 2011a)

StatLink http://dx.doi.org/10.1787/888932766396

Reported tax expenditure and rebates

Iceland does not provide any fuel tax rebates or report any of the differences in tax rates between various fuels and users as tax expenditures.

Key assumptions and caveats

The exemption from the tax on electricity consumption for small firms has not been considered in the map.

Sources

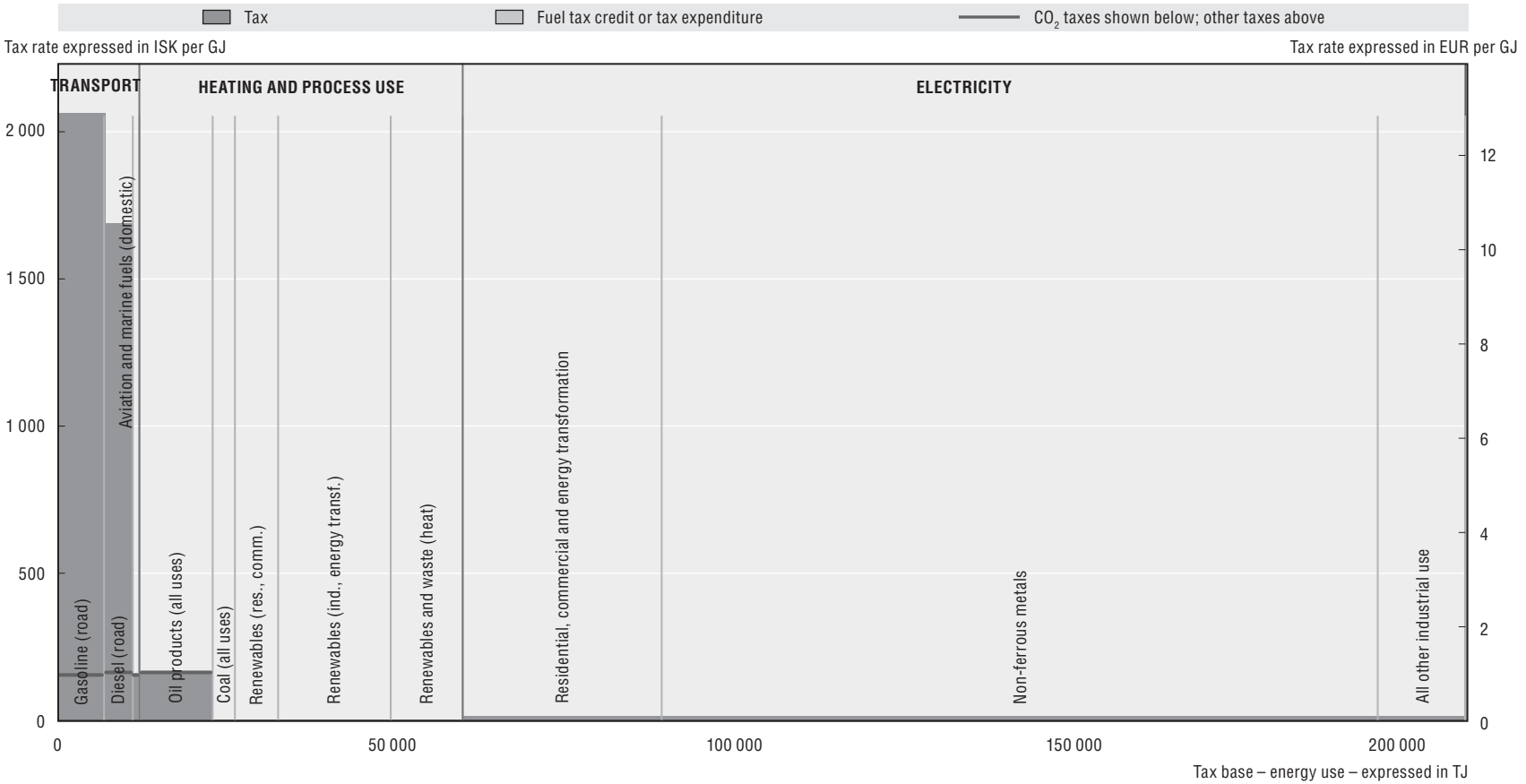
Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

European Commission (2011), "Screening Report for Iceland". Available at: *http://ec.europa.eu/enlargement/pdf/iceland/key-documents/screening_report_16_is_internet_en.pdf*

IMF (2011), *Iceland: Advancing Tax Reform and the Taxation of Natural Resources*, IMF Country Report No. 11/138. Available at: *www.imf.org/external/pubs/ft/scr/2011/cr11138.pdf*,

Price Waterhouse Coopers (2012), *Taxes in Iceland*. Available at: *www.pwc.com/is/en/assets/PwC_Tax_Brochure_2012.pdf*.

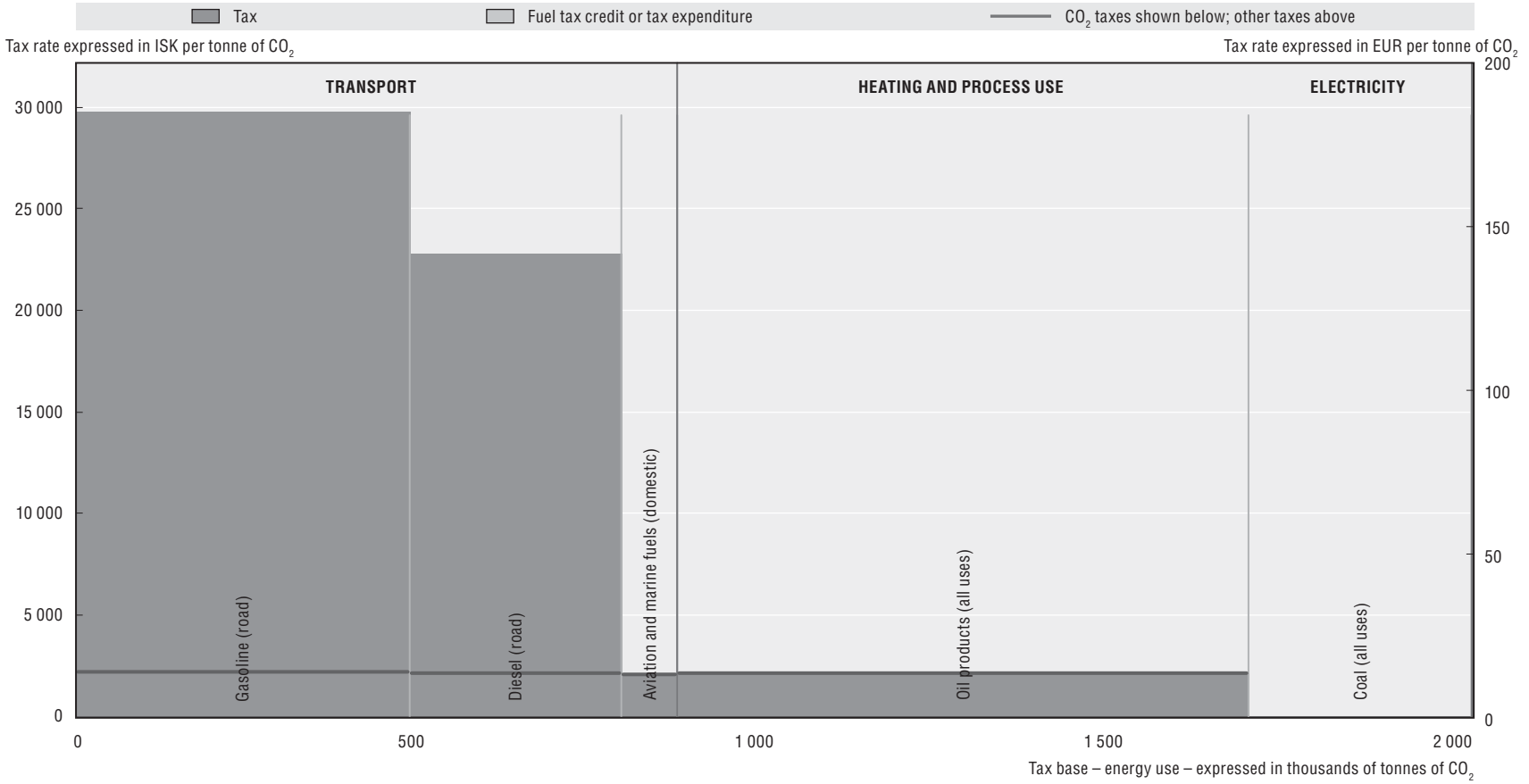
Figure 14.2. **Taxation of energy in Iceland on an energy content basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766415

Figure 14.3. **Taxation of energy in Iceland on a carbon content basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766434

Ireland

Figures 15.1 and 15.2 map the use and taxation of energy in Ireland on the basis of energy content and carbon content, respectively.

Structure of energy taxation

Energy taxation in Ireland consists of a carbon tax, a mineral tax, and taxes on the consumption of electricity. These taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail).

Carbon taxes apply to most oil products used in the transport and heating and process use categories, including fuel oil, diesel, kerosene gasoline and LPG at similar rates for both sectors. The mineral tax also applies to fuels in these sectors, with the exception of kerosene. The same rates are used for gasoline and fuel oil in both sectors; diesel and LPG are taxed at lower rates in the heating and process use sector. Coal is taxed under the mineral tax, and peat is untaxed.

Taxes apply to the consumption of electricity; with the tax rate for industrial and commercial use of electricity set at half that of residential use. Fuels used to generate electricity are exempt from tax.

Energy use and taxation in Ireland

As can be seen from the maps, transport fuels account for around 29% of energy use and 32% of emissions from energy use in 2009, and are comprised almost exclusively of emissions from gasoline and diesel. These products are taxed at higher rates than other products shown in the maps. Biofuels (2% of emissions from transport fuels) are also taxed at similar rates to gasoline; LPG (at only 0.02% of transport emissions) is taxed at a lower rate. Domestic aviation is exempt and accounts for less than 1% of emissions from transport.

Oil products in the heating and process use category are effectively taxed at lower rates, due to the reduced mineral tax rate on diesel and the absence of mineral taxation on kerosene. Oil products account for 54% of emissions from the heating and process use category. Natural gas is taxed under the carbon tax alone, and accounts for the second largest group of emissions in this category at 25% (30% of energy use). Other than coal used by the industrial sector, a total of 25% of fuels used in this category (coal for energy transformation, other oil products, waste, biomass, and peat) are untaxed.

Fuels used to generate electricity account for 34% of energy used in electricity production and 27% of emissions from fuel use and are taxed at very low rates compared to other fuels. Natural gas accounts for 66% of fuels used to generate electricity when measured by energy content, and for 61% of CO_2 emissions from electricity production. Coal and peat is the second largest source of energy and CO_2 emissions from electricity, accounting for at 20% of energy used and 32% of carbon emissions. Due to the differences in the efficiency of electricity generation for each fuel, and in their respective carbon emissions per unit of energy, natural gas is effectively taxed at a higher rate when measured in terms of energy or carbon emissions. The remainder of electricity generation is from oil products (5% of energy content and 7% of carbon emissions) and from biomass and renewables (9% and 1%, respectively).

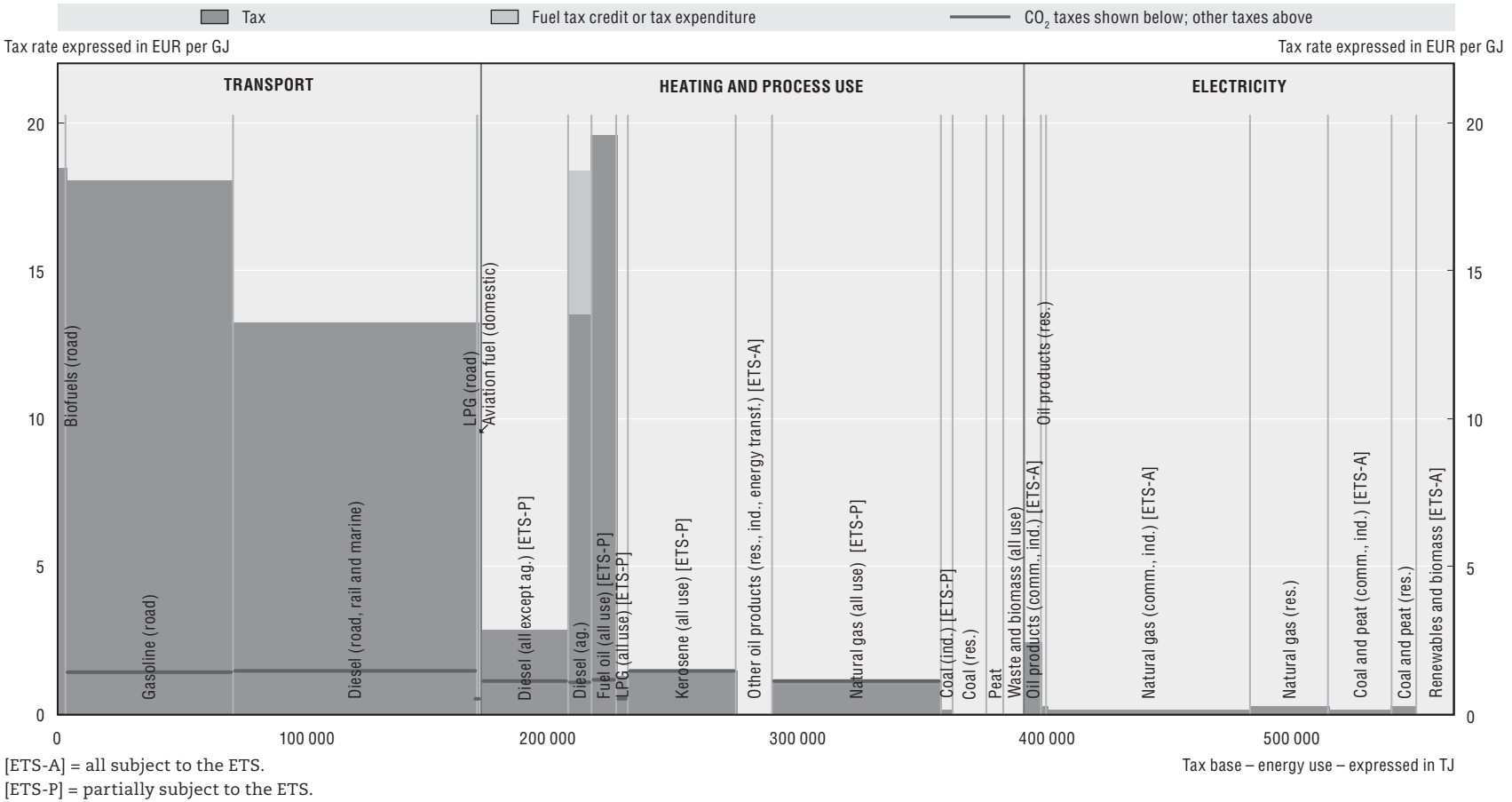
Reported tax expenditures and rebates

No tax expenditures or rebates are reported in respect of taxes on final energy consumption in Ireland.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials.

Figure 15.1. **Taxation of energy in Ireland on an energy content basis**

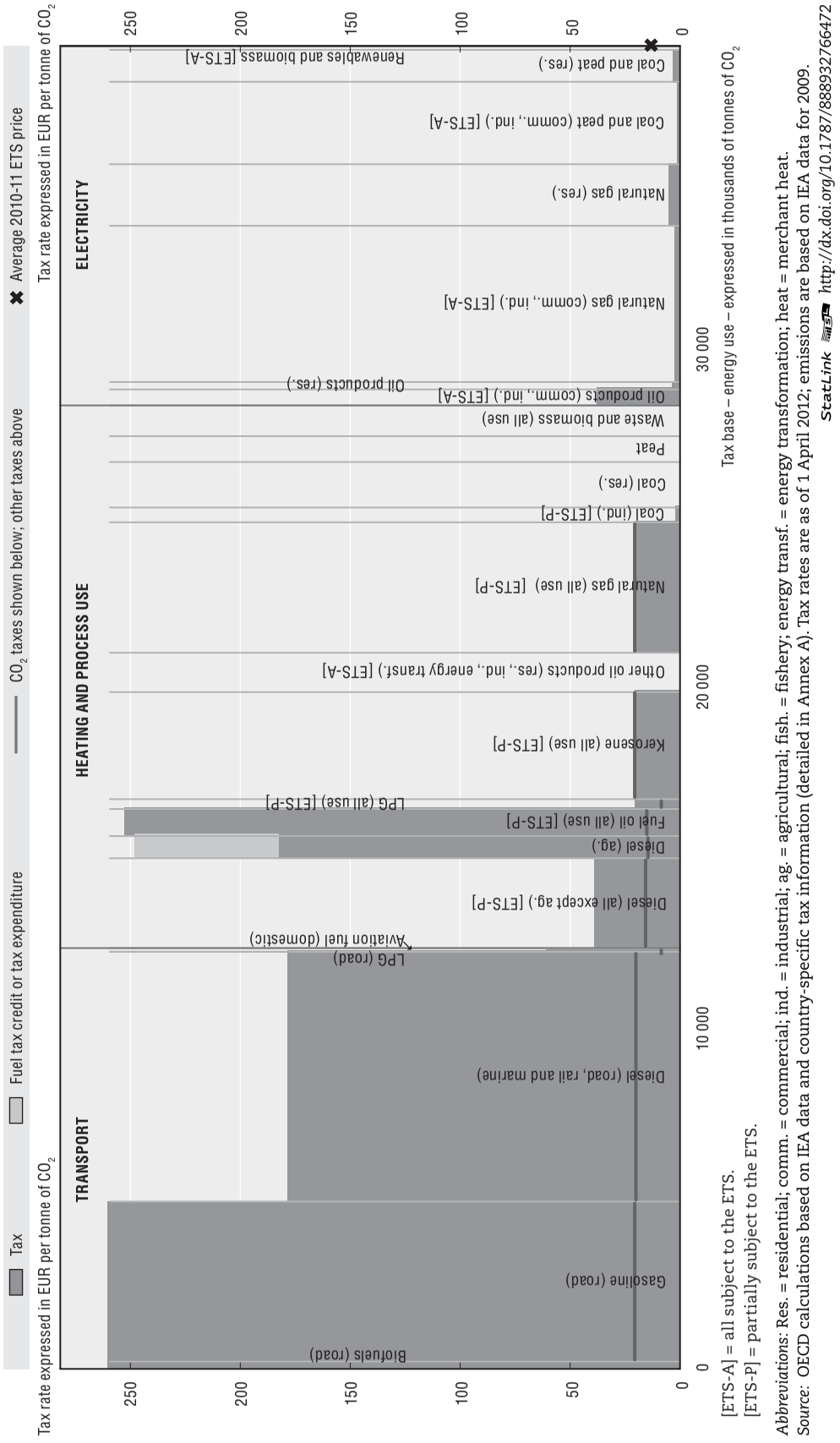


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766453

Figure 15.2. **Taxation of energy in Ireland on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766472

Israel

Figures 16.1 and 16.2 map the use and taxation of energy in Israel on the basis of energy content and carbon content, respectively.

Structure of energy taxation

Israel taxes most primary energy products other than biomass, in all uses other than energy transformation. The taxes are levied on a per litre basis for gasoline and diesel, and on a per kilogram basis for natural gas, fuel oil, LPG and coal. Exemptions are provided for fuel use in aviation and navigation.

Electricity is not taxed, though fuels used to generate it are taxed at the standard rate applied to other uses. Fuel oil, the main fuel used in energy transformation, is untaxed in that use.

Energy use and taxation in Israel

As shown in the maps, gasoline and diesel are each responsible for roughly half of the energy used in transportation, and the resulting CO_2 emissions. Diesel used in transport is taxed at a lower rate than motor gasoline on a per litre, energy content, and CO_2 content basis. The other fuels used in the transport sector are biodiesel (taxed at the same rate as diesel), diesel consumed in navigation (exempt), and jet kerosene consumed in aviation (exempt). The contribution of these three fuels to energy usage in the transport category could not be determined due to data limitations (see assumptions section, below).

With respect to heating and process fuels, 38% of energy used and 54% of CO_2 emissions come from fuel oil. Almost half of the fuel oil use is tax exempt, as it is used for energy transformation purposes. Other oil products, predominantly the residential consumption of LPG and kerosene, account for another 30% of energy use (39% of CO_2 emissions) in this category. Diesel plays a relatively minor role in terms of energy use (6%) and CO_2 emissions (8%). The same rate applicable to propellant use of diesel is applied to heating use by the residential sector. In contrast, commercial, industrial, agricultural and fishing use of diesel are taxed at a reduced rate. Untaxed biomass and other renewables account for about 26% of energy use in the heating and process use category, but less than 1% of CO_2 emissions.

Coal is not used as heating and process fuel in Israel. In contrast, in the electricity generation mix, it represents 66% of the total energy and 75% of the CO_2 emissions. It is taxed at a significantly lower rate than diesel used to generate electricity, even though it has a higher carbon content. Diesel accounts for just 2% of energy used and CO_2 emissions in generating electricity. The second most important fuel for electricity generation is natural gas, which accounts for 30% of energy used to generate electricity and 20% of CO_2 emissions. It is taxed at a lower rate than coal.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Reported tax expenditures and rebates

In Israel reduced rates are applied to certain uses of diesel:

- *Commercial, industrial, agricultural use of diesel*: Diesel consumed by the commercial, industrial and agricultural sectors is taxed at a lower rate than residential consumption. The corresponding tax expenditure has been computed using as benchmark the tax rate paid by the residential sector on diesel used for heating. The tax expenditure is shown in light grey in the map.
- *Diesel used to generate electricity*: A reduced rate is applied to diesel consumed to generate electricity. The same benchmark as the previous category was used to compute the tax expenditure shown in the map. The tax rate on this specific use of diesel was changed as of 1 April 2012, more than doubling, from 340.22 to 878.91 ILS per litre.

Key assumptions and caveats

In terms of assumptions:

- Renewable energy sources used to generate electricity have been assumed to be untaxed.
- Since the 2009 IEA Energy Balances (IEA, 2011a) does not allow disaggregation of diesel for consumption in non-road use, it was hypothesised that 40% is consumed by residential and 60% represents commercial, industrial, agricultural and fishing use.
- Natural gas used in the transformation sector is assumed to be taxed at the standard rate.

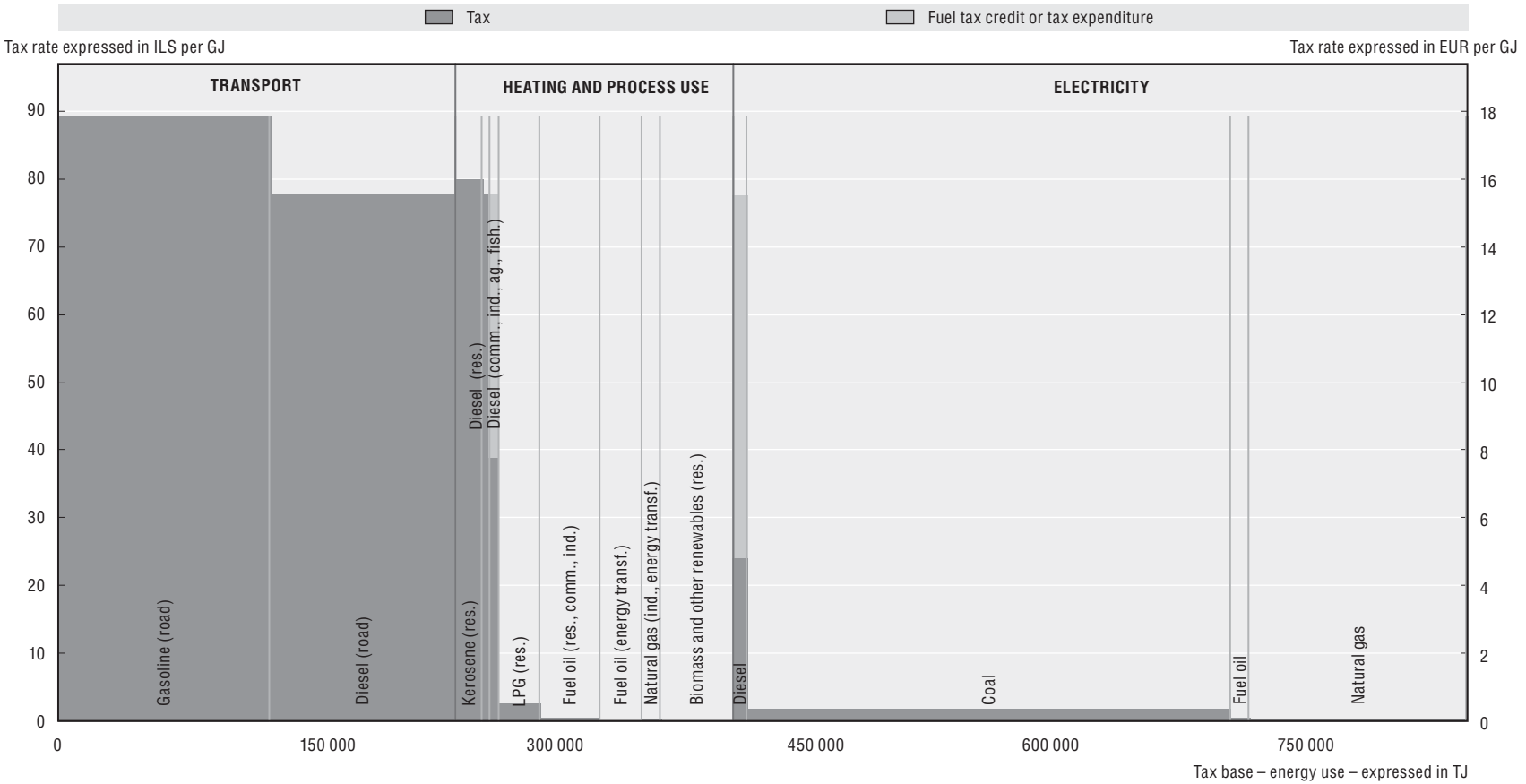
A few existing reduced rates are not shown in the map:

- The exemption existing for jet kerosene used by aviation and diesel used by shipping could not be represented because the tax base could not be disaggregated using the data included in the 2009 IEA Energy Balances (IEA, 2011a).
- Biofuels tax treatment is not shown since the 2009 IEA Energy Balances (IEA, 2011a) does not report any biofuels consumption.
- The reduced tax rate applied to diesel used by public transport is not shown in the map since the tax base is too small to be disaggregated.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials.

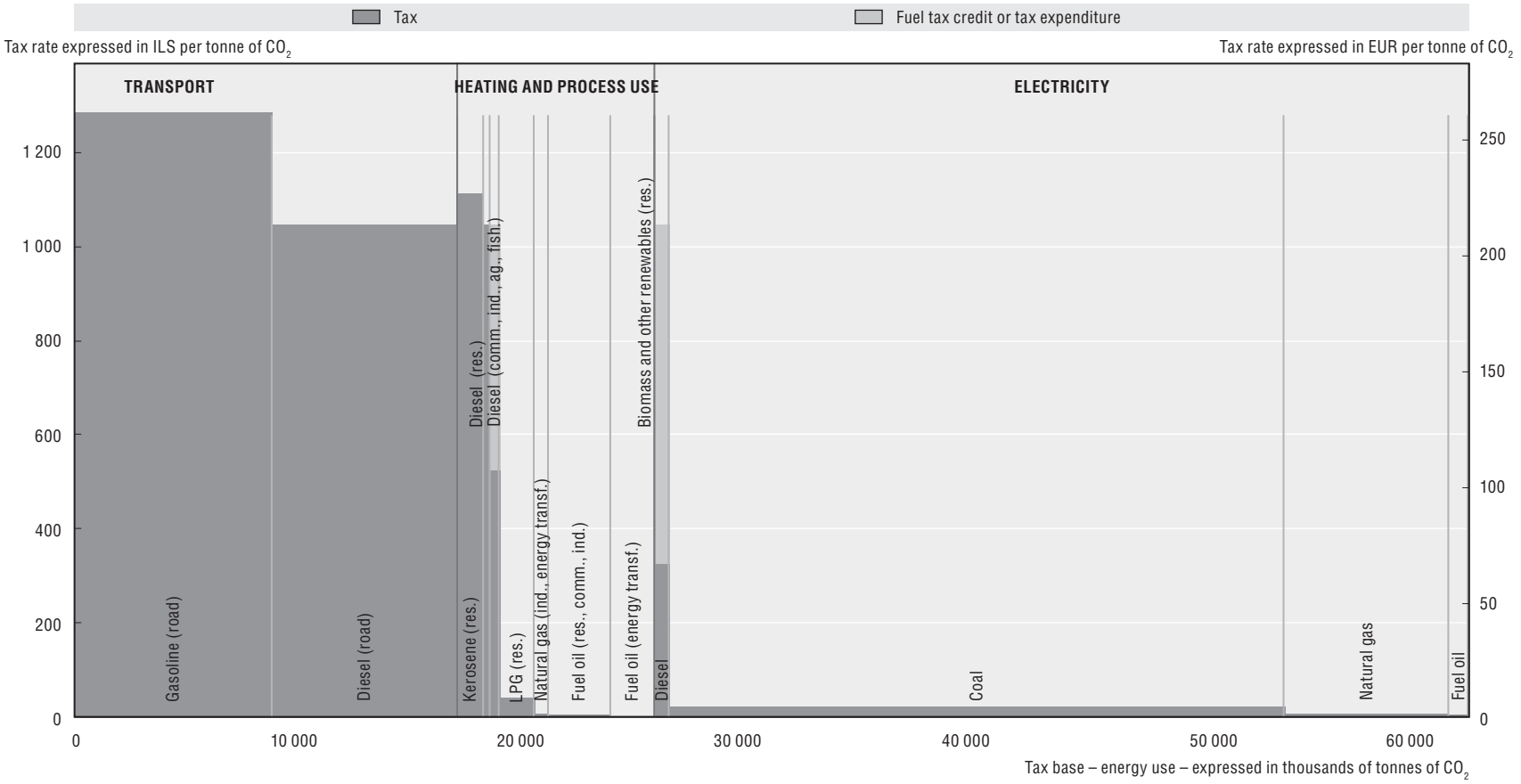
Figure 16.1. **Taxation of energy in Israel on an energy content basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766491

Figure 16.2. **Taxation of energy in Israel on a carbon emission basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766510

Italy

Figures 17.1 and 17.2 map the use and taxation of energy in Italy on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In Italy, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). The tax rates are above the minimum rates set by the EU Directive, except for natural gas used in transport.

Taxes on fuels used in transport differ widely according to fuel type, whereas in the heating and process fuel category they are defined according to the user. With respect to transport, fuels for aviation and shipping are exempt, and energy consumed in rail transport is taxed at a reduced rate. Heating and process fuel is in general taxed at a lower tax rate for commercial and industrial use than for residential use. Gasoline, diesel oil and LPG are taxed at a reduced rate when used in agriculture and fishing. The tax rate for natural gas is differentiated by geographical location and consumption level.

Electricity is taxed differently when consumed by business and non-business users. Fuels used to generate electricity are also taxed at significantly lower rates (almost nil) than other uses. Electricity used in transport is exempt. Waste, biomass, and the different forms of renewable energy are not taxed when used to produce heat or electricity. The consumption of heat is not taxed.

Energy use and taxation in Italy

As shown in the maps, diesel is the main source of energy use and CO_2 emissions in the transport category, followed by gasoline: the two fuels account respectively for 58% and 29% of energy used in transport, and 60% and 28% of the resulting CO_2 emissions. Diesel used in transport is taxed at a lower rate than gasoline, on a per litre, energy content, and CO_2 content basis. Biofuels are taxed according to the corresponding blending fuels (namely, gasoline and diesel) since the support program setting reduced tax rates has not been in force since the end of 2010. The remainder of the transport category consists of small quantities of LPG, natural gas, and fuels used in rail transport, aviation, and shipping. These fuels face far lower effective tax rates than (road-use) diesel and gasoline.

Natural gas is by far the main source of energy (63%) and carbon emissions (54%) in the heating and process use category. In this category, fuel used for heating purposes is generally taxed at a higher rate than fuel used for process purposes. The highest tax rate is applied to diesel oil used for heating. A lower rate applies to diesel when used as process fuel and a partial refund is paid for diesel used by the agricultural sector. The total tax bases for diesel accounts for around 9% of both energy use and CO_2 emissions in this category. After diesel, natural gas consumed in central and northern Italy has the highest tax rate. Natural gas consumed in southern Italy is taxed at a reduced rate, while natural gas used in industry – which is the major component of natural gas consumption – is taxed at a lower rate. LPG, fuel oil and other oil products (such as kerosene) are taxed differently when used as process or heating fuels, with the former use taxed at lower rates. They account for 13% and 14% of energy use and CO_2 emissions from this category. Coal, which is taxed at a comparatively low rate, contributes a further 7% of energy use and 10% of CO_2

emissions. Renewables and waste are exempt, and represent 5% and 7% of energy use and CO_2 emissions from heating and process fuels.

Electricity consumption is taxed in Italy at different levels according to the user. In particular, residential use is taxed at a higher rate than non-residential use. Electricity consumption for transport purposes is exempt from tax . Fuels used to produce electricity are also taxed, though at very low level. The maps show electricity by fuel used for generation (natural gas, mineral oils and renewable and waste), with this then further broken down by users (residential and commercial, industry and energy transformation, transport). Natural gas accounts for 47% in term of energy content, whereas oil products and coal account for 29%. The share of renewables and waste in electricity production, rapidly increasing in recent years, has reached 23% in 2009. Taking into account both the level of taxation and fuel efficiency in generating electricity, the maps show different levels of taxation for different fuels and users, with the lowest levels for transport (exempted from consumption taxation) and highest for renewables (due to their higher efficiency in electricity generation).

Reported tax expenditures

Three major tax expenditures relating to fossil fuels are estimated by Italy and can be identified in the maps:

- *Aviation fuel*: Jet kerosene used in commercial aviation is exempt from the excise duty and a corresponding tax expenditure is estimated. The benchmark for the tax expenditure shown in the graph is the tax rate applied to kerosene used as fuel in aviation for leisure or training purposes. The tax expenditure can be seen in the graphs in the column "Rail, marine and aviation fuels (domestic)".
- *Rail and marine*: Fuel consumption in navigation is exempt and rail transport pays a reduced tax rate. While energy consumption in rail is entirely constituted by diesel, energy consumption in navigation is half diesel and half heavy fuel oil. The tax rate for diesel used in transport has been used as the benchmark to compute the tax expenditure shown in the graph in the column marked "Rail, marine and aviation fuels (domestic)".
- *Oil products used in agriculture and fishing*: a reduced rate is applied to diesel, motor gasoline and LPG used in agriculture and fishing. The corresponding tax expenditure has been calculated adopting the tax rates applied to transport use of these fuels as the benchmark. The graph shows the tax expenditure in the column "Other oil products (ag., fish.)".

As set out in the *Inventory of estimated budgetary support and tax expenditures for fossil fuels* (OECD, 2013), many measures targeting very specific fuel uses exist in Italy, such as tax relief for certain industrial consumers of natural gas and for consumers living in disadvantaged areas. Due to difficulties associated with obtaining the information needed for defining the bases for these tax expenditures, they are not shown in the maps.

Tax expenditures are not reported by Italy for the differential tax rates in force in a number of areas, including: the lower tax rate on diesel relative to motor gasoline; the exemption for natural gas consumed in transport; the lower tax rate applied to natural gas and coal used as process fuels relative to fuel oil and diesel oil; the lower tax rate applied to natural gas consumed as a heating fuel in southern Italy; and the lower tax rate applied to electricity used in business.

Key assumptions and caveats

In terms of assumptions:

- When a different tax rate is levied on process and heating use, *i.e.* natural gas and LPG, all the industrial consumption has been treated as process fuel use, while the entire amount consumed by the commercial and public sectors is treated as heating fuel use.
- As for natural gas used for residential purposes, data on consumption of natural gas in 2010 provided by the Italian Customs was used to obtain the share of consumption in central and northern Italy and in southern Italy, which was then applied to the 2009 IEA Energy Balances data (IEA, 2011a). An arithmetic average of the tax rates applied to different consumption classes was computed in both cases.

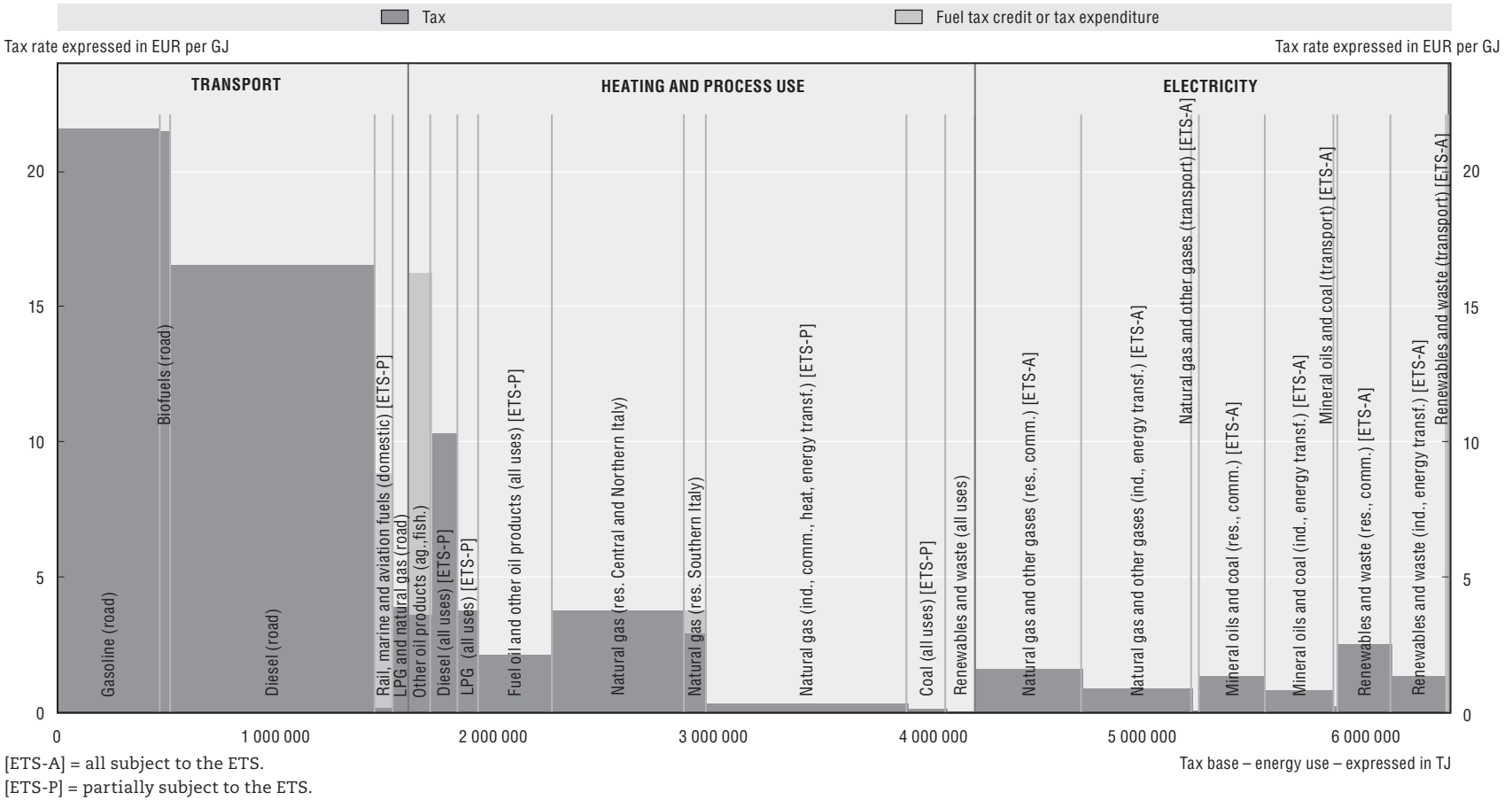
Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Government of Italy, *Decreto Legislativo* 26/10/1995, No. 504.

Italian Customs Department (2012), "Aliquote di imposta vigenti nel settore delle accise". Available at: *www.agenziadogane.it/wps/wcm/connect/40d910804573601d8329e79503fb0af3/aliq-naz-gennaio_2011.pdf?MOD=AJPERES*.

Figure 17.1. **Taxation of energy in Italy on an energy content basis**

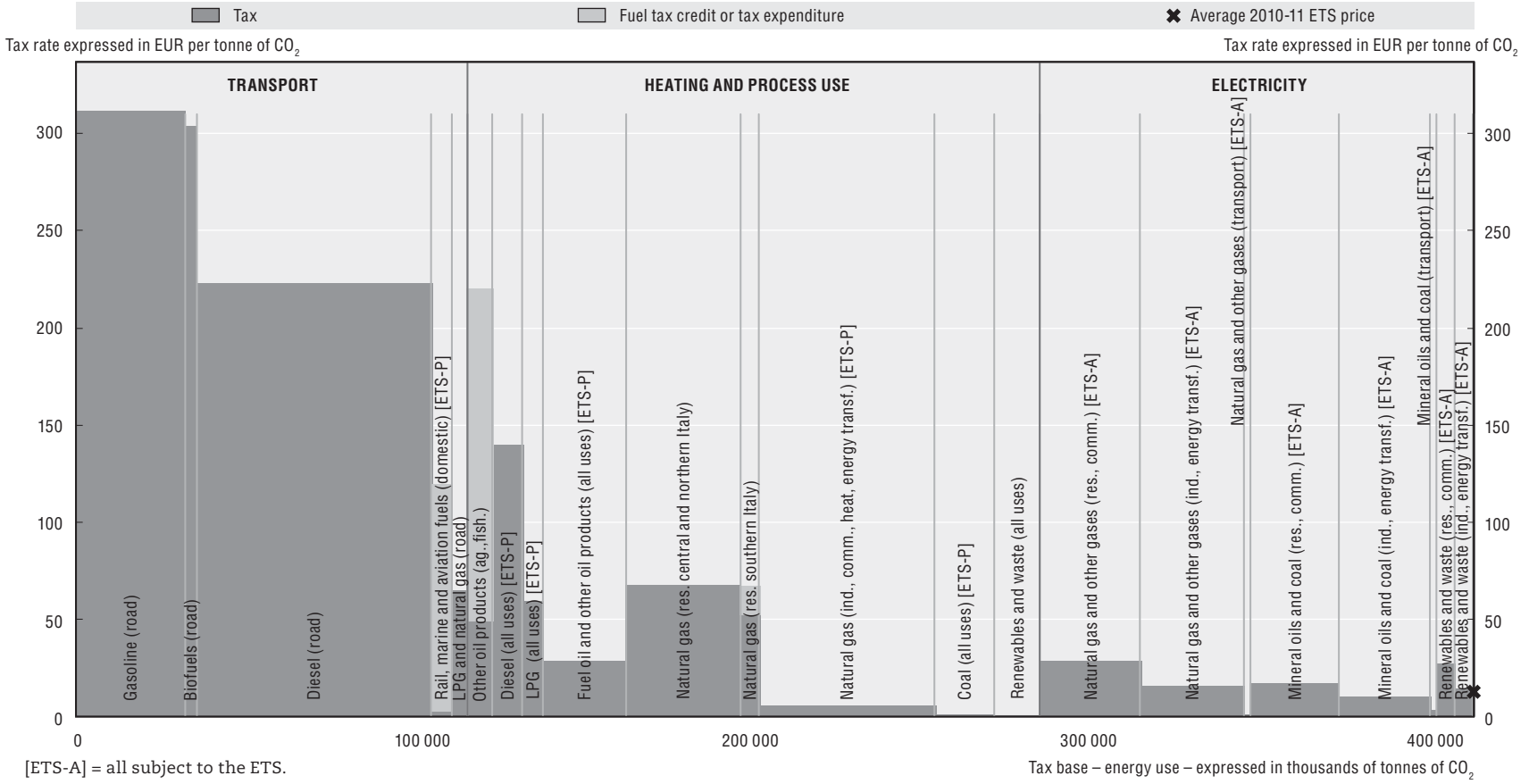


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766529

Figure 17.2. **Taxation of energy in Italy on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766548

Japan

Figures 18.1 and 18.2 map the use and taxation of energy in Japan on the basis of energy content and carbon content, respectively.

Structure of energy taxation

Taxation of energy use in Japan is based on several different taxes that apply based on the fuel type and intended use, as set out below.

Table 18.1. **Energy use in Japan**

	Transport use	Heating and process use	Electricity production	Electricity consumption
Gasoline tax	Yes			
Diesel tax	Yes			
LPG tax	Yes			
Aviation fuel tax	Yes			
Petroleum and coal tax (crude petroleum and petroleum products)	Yes	Yes (with exemptions)	Yes	
Petroleum and coal tax (natural or petroleum gas)	Yes (with exemptions)	Yes	Yes (with exemption)	
Petroleum and coal tax (coal)	Yes	Yes (with exemptions)	Yes (with exemptions)	
Local gasoline tax	Yes			
Promotion of power resources tax				Yes

Taxes that apply to transport use include the petroleum and coal tax, which applies to petroleum products (including crude oil), natural gas and petroleum gases, and coal; and specific taxes by fuel type as set out in the table above. These specific taxes are set at a much higher rate than the petroleum and coal tax, and include separate taxes on gasoline, diesel and aviation fuels (on a per-kilolitre basis) and LPG (on a per-kilogram basis). A local tax on gasoline for transport use also applies.

For energy used for heating or process purposes, the petroleum and coal tax applies. Under this tax, crude petroleum and petroleum products are taxed at a rate of JPY 2040 per kilolitre. Natural gas and petroleum gases are taxed at JPY 1 080 rate on a per-tonne basis. The petroleum and coal tax also taxes coal at a rate of JPY 700 per tonne. Some exceptions are made for particular sectors, including heavy fuel used by the agriculture and forestry sectors, and for certain oil products used by the petrochemical industry etc.

The consumption of electricity is taxed at a rate of JPY 375 per thousand kilowatt hours. In addition, fuels that are used for the production of electricity are taxable under the petroleum and gas tax described above. One exception to this is the use of imported coal and liquefied natural gas for power generation in the Okinawa prefecture.

Biomass, waste and renewable energy sources are not taxed.

While not shown in the maps, which illustrate the situation as of 1 April 2012, a special provision for taxation on petroleum and coal came into effect in Japan on 1 October 2012 as a "climate change countermeasure". This special provision will be implemented by effectively adding JPY 289 (= EUR 2.82) per tonne of CO_2 to the rates of the petroleum and

coal tax that currently applies to crude oil and oil products, gaseous hydrocarbons (LPG/LNG) and coal. The rate will be subsequently increased by one-third at a time in three stages to avoid a rapid increase in burden. The revenue from the petroleum and coal tax has been used to promote reductions in CO_2 emissions from energy through such means as greater energy efficiency and the use of renewable energy, and the revenue from the special provision will be used in the same way.

Energy use and taxation in Japan

As can be seen from the maps, transport fuels account for 17% of energy use and 19% of emissions from fuel combustion. Fuels used for transport are taxed more heavily than fuels used for other purposes. This is because in addition to the petroleum and coal tax, specific taxes apply to gasoline, diesel, aviation fuel, and LPG. These taxes apply at different rates to each fuel. Gasoline is the most highly taxed, and accounts for more than half the total CO_2 emissions from transport use. Diesel is taxed at a lower rate and accounts for most of the remaining carbon emissions. Domestic aviation and LPG are comparatively smaller as a proportion of carbon emissions from transportation.

The petroleum and coal tax is the only tax that applies to fuel used for heating and process use. For this reason, the taxes on a carbon content basis are much lower than those that apply to fuels used for transport. Different rates apply to petroleum products, gases, and coal. When converted to a carbon emission basis, the tax rates are highest for the use of oil products; taxed oil products make up 38% of energy use and 34% of carbon emissions from heating and process use. Natural gas and coal are taxed at lower rates, and together comprise another 44%. Based on the map and the assumptions below, the remaining 22% of carbon emissions in this category are untaxed, either due to exemptions (for agriculture and petrochemical production approximately 5%) or non-taxation (*e.g.* biomass and waste, at 17%).

Fuels used to generate electricity in Japan comprise 48.36% of total energy use and 38% of carbon emissions from fuel use. This is due to the use of nuclear and renewable generation sources, which together represent 39% of electricity generation. Electricity is taxed in two different ways. Firstly, the petroleum and coal tax applies to the fuels used to produce electricity, except in the case of coal and liquefied natural gas used in the Okinawa prefecture. Secondly, the consumption of electricity is taxed. In the map, both taxes have been combined. The consumption tax has been scaled down to reflect the implicit tax it represents on the fuels used to generate electricity, and added to the petroleum and coal tax applying to these fuels. The presence of the tax on electricity means that fuels used to produce electricity are implicitly taxed more highly than the fuels used for heating and process use. Oil used to generate electricity is more heavily taxed on a carbon emission basis than natural gas and coal. As the use of biomass and waste is not taxed under the petroleum and coal tax, the promotion of power resources and the consumption tax apply to electricity generated by these fuels. Coal accounts for approximately 47% of the carbon emissions from the production of electricity (but only 25% of energy used to generate electricity); gas for 41% (28% of energy) and oil for approximately 12% (8% of energy). The remainder of carbon emissions are derived from the use of gas, biomass and waste for the generation of electricity.

Reported tax expenditures and rebates

No tax expenditures or rebates are reported in respect of taxes on final energy consumption in Japan.

Key assumptions and caveats

Some smaller categories have been combined into larger categories to make the graph easier to read. Where this has occurred a weighted tax rate based on the CO_2 emissions generated by each fuel has been used.

Key assumptions and caveats include:

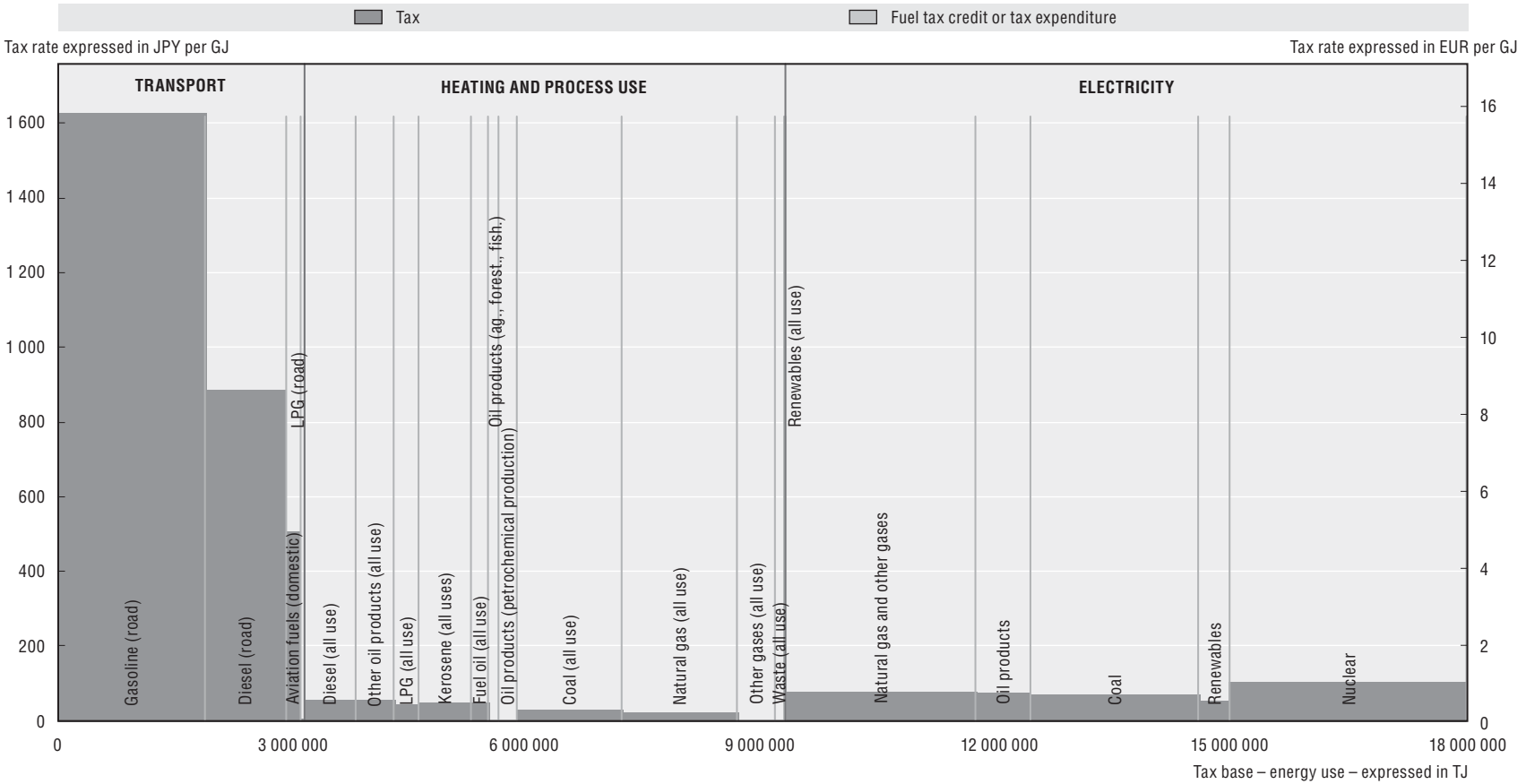
- The diesel tax has been assumed to apply only to diesel used for transport purposes.
- The exception for coal used to produce electricity in the Okinawa prefecture has not been shown on the graph due to difficulties in separating this coal from total coal used to produce electricity.
- The category on the map for agriculture, forestry, and fisheries includes only light fuel oils, diesel, and heavy fuel oil. This category is treated as exempt based on information derived from the OECD/EEA database and from the Comprehensive Handbook of Japanese Taxes.
- All petrochemical use of naphtha, kerosene and light fuel oil has been assumed to be exempt from the petroleum and coal tax. However, this may overstate the exemption as it applies only to particular uses within this industry.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Japanese Ministry of Finance (2010), *Comprehensive Handbook of Japanese Taxes*. Available at: *www.mof.go.jp/english/tax_policy/publication/taxes2010e/index.htm*

Figure 18.1. **Taxation of energy in Japan on an energy content basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766567

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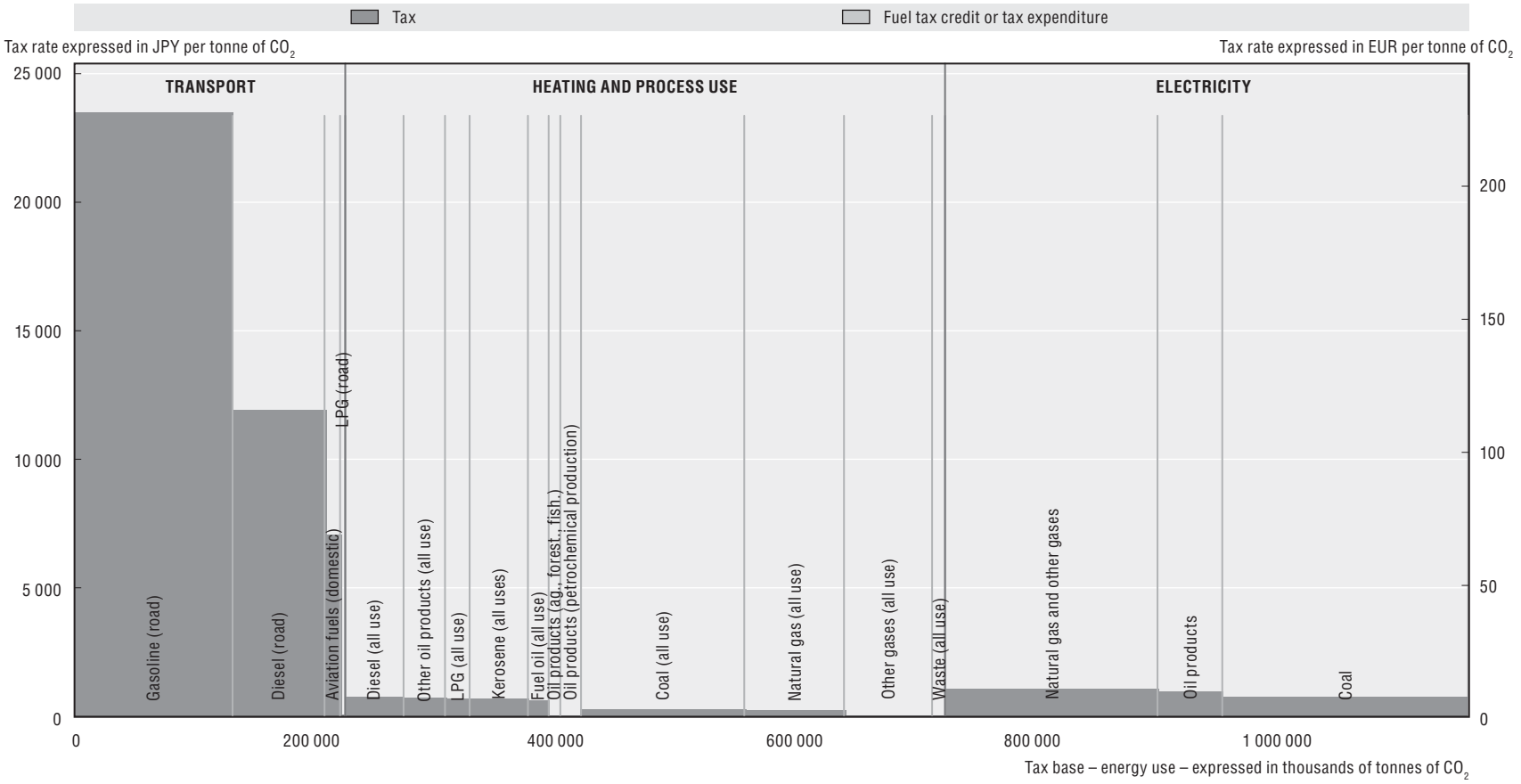
Figure 18.2. **Taxation of energy in Japan on a carbon emission basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766586

Korea

Figures 19.1 and 19.2 map the use and taxation of energy in Korea on the basis of energy content and carbon content, respectively.

Structure of energy taxation

Korea applies an individual consumption tax to consumption of kerosene and fuel oil on a per litre basis and liquefied petroleum gas and natural gas (including liquefied forms) on a per kilogram basis. An education tax applies to gasoline, kerosene, diesel fuel oil, and LPG (butane gas) on the same basis for each fuel as described above.

In addition to the education tax, gasoline and diesel are subject to a transportation energy environment tax and a motor fuel tax. The transportation energy environment tax is currently set at a higher temporary rate which is due to expire at the end of 2012.

The individual consumption tax, education tax, transportation environment tax, and the motor fuel tax are shown in the map. Taxes not shown include tariffs and VAT which also apply to these products:

Table 19.1. **Other taxes on energy products in Korea**

Percentage

	Gasoline	Kerosene	Diesel	Fuel oil	LPG (propane)	LPG (butane)	LNG
Base tariff	3	3	3	3	3	3	3
Temporary tariff	–	–	–	–	0	0	2
VAT	10	10	10	10	10	10	10

Exemptions from the fuel taxes included in the map are provided for fuels used in agriculture, fisheries, and aviation.

Coal and peat, as well as all fuels used to produce merchant heat, are not taxed. The consumption of electricity is also not taxed; although the fuels used to generate electricity are taxed. As shown on the maps, this means that natural gas and oil products used to produce electricity are taxed at their applicable rates.

Energy use and taxation in Korea

As can be seen from the maps, gasoline for transport purposes is the most heavily taxed fuel in Korea whether measured in KRW per GJ or KRW per tonne of carbon emitted. Gasoline is responsible for a substantial proportion of CO_2 emissions from transport at 28% of energy use and emissions from the transport sector. The largest proportion of emissions from transport, at 51% (49% of energy use), arise from the use of diesel, which is taxed at a lower rate on both an energy and a carbon content basis. Other fuels, such as natural gas and electricity comprise 6% of energy use and 5% of emissions from transport. Domestic aviation, which is exempt from fuel taxes, accounts for less than 1% of both energy used in and carbon emissions from transport.

Oil products used for heating and process purposes are taxed in Korea at lower rates than those used in transport as the transportation taxes do not apply to these uses of the fuels. Oil products represent 24% of energy use and 34% of carbon emissions from heating and process use. An exemption applies to oil fuels used for agricultural purposes (2% of energy and 3% of carbon emissions from heating and process use of fuels). Natural gas for heating and process use is also taxed and represents 21% of fuel use in this category. On a CO_2 basis, oil accounts for the largest proportion of carbon emissions (34%) from heating and process use. Coal, which is untaxed, accounts for just under a quarter of emissions from this use.

As mentioned, the consumption of electricity is not taxed in Korea. However, the taxes on oil products discussed above apply to the fuels used to generate electricity and are shown on the maps. When measured on a CO_2 basis, oil accounts for a small proportion of emissions from electricity production; the largest proportion (45% of energy used to produce electricity and 75% of emissions from electricity production) are generated by the use of coal to produce electricity, which is untaxed.

Reported tax expenditures

Korea reports tax expenditures in relation to the exemption from fuel tax for fuel used in agriculture and fishing. This exemption can be seen on the graph in the column marked "All other oil (ag., forestry, fish)" in the lighter grey shaded area. It is also represented on the graph by the very slightly lower rate for "Natural gas (comm., ind.)" as this consists of a weighted average of the tax rates for agriculture and for other business (although the use of natural gas for agriculture is extremely small relative to other business uses).

To estimate the level of this tax expenditure, we have used a benchmark set at the level of the tax rate that applies to the particular product for heating and process use. Because this category includes a number of different oil products, a weighted average of the applicable benchmark for each product has been used as the overall benchmark shown on the graph.

Tax expenditures are not reported for the exemption for domestic aviation, the lower rate of tax on LPG and fuel oil for heating and process use, or the non-taxation of fuel such as coal in other uses.

Key assumptions and caveats

Some very small categories have been combined into larger categories to improve the readability of the maps. Where this has occurred a weighted tax rate based on the CO_2 emissions generated by each fuel has been used. Examples include "Other transport fuels" in the "Transport" category, which includes kerosene, residual fuel oil, natural gas, and electricity and "All other oil (ag., forestry, fish)" in the "Heating and Process Fuel Use" category.

In relation to the exemption for farmers and for fishing:

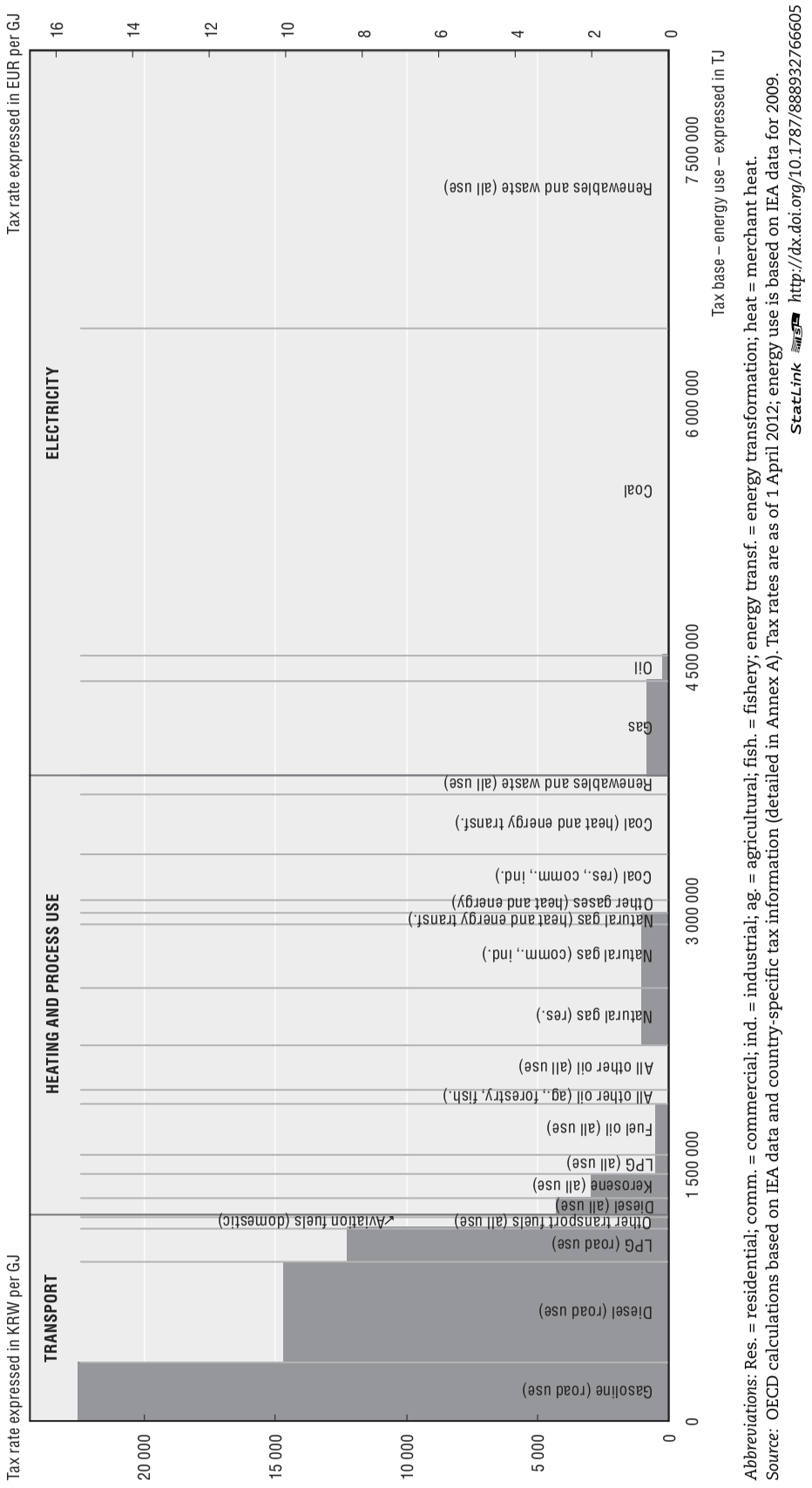
- The zero rate of tax shown in the graph in "All other oil (ag., forestry, fish)" is based on an assumption that the exemption applies to all agricultural activity and fishing. Forestry is included as part of this exemption, since information to separate this from agriculture as shown in the *Energy Statistics of OECD Countries* (IEA, 2011b) has not been found;
- To the extent this exemption relates to the use of fuel for transport for farming or fishing purposes, this is not captured in the graph. Information to separate this usage from the transport usage has not been found.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

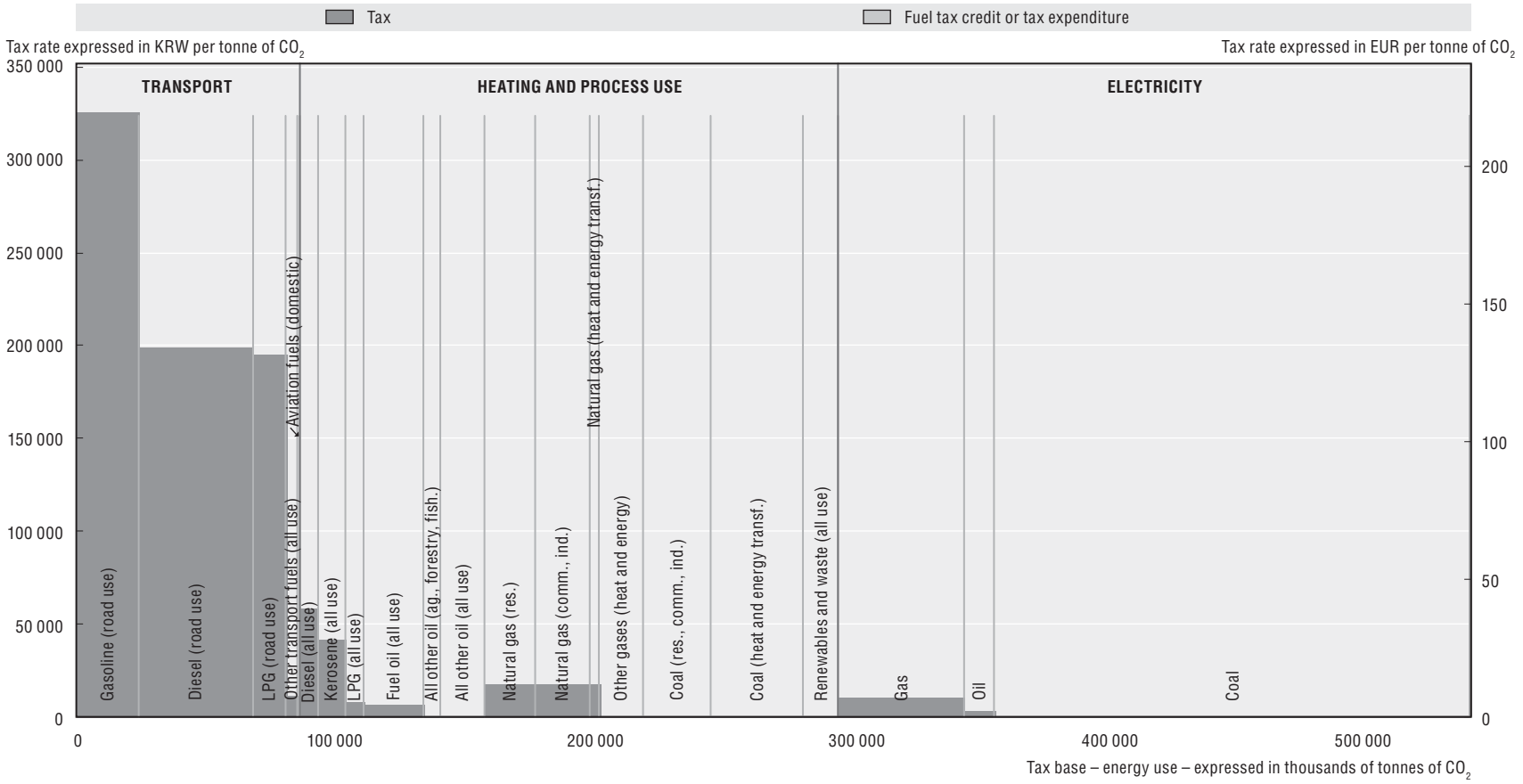
Korean Ministry of Strategy and Finance (2010), *Korean Taxation*. Available at: *www.nts.go.kr/eng/data/KOREANTAXATION2010.pdf*.

Figure 19.1. **Taxation of energy in Korea on an energy content basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.
StatLink http://dx.doi.org/10.1787/888932766605

Figure 19.2. **Taxation of energy in Korea on a carbon emission basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766624

Luxembourg

Figures 20.2 and 20.3 map the energy taxes in Luxembourg on an energy content and a carbon content basis respectively.

Structure of energy taxation

In Luxembourg, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). Tax rates are generally levied at or slightly above the minimum level prescribed by the Directive. Zero rates apply to coal, coke, and natural gas not used for heating purposes. Additionally, a concessionary rate is applied to LPG used as a propellant or for industrial/ commercial use, in accordance with Article 18(1) of the Directive. Diesel and LPG are taxed at differing rates according to purpose. Biofuels and biomass are exempt from tax.

Electricity is taxed, with a lower rate imposed on high volume users than regular users. Fuels used for the purpose of electricity generation are exempt from tax.

Energy use and taxation in Luxembourg

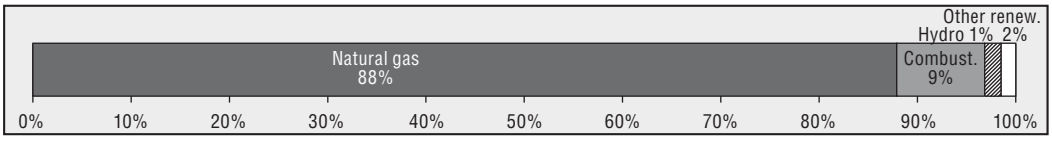
As can be seen from the maps of energy use and taxation that follow, the use of energy, and the resulting carbon emissions, in the transport category (and in fact, across all three categories) is dominated by diesel. It constitutes 79% of energy used in transportation and 80% of CO_2 emissions from transport. The remainder of the transport category is made up of gasoline, with small quantities of LPG and (untaxed) biofuels. Gasoline is taxed at a significantly higher effective rate than diesel (both in terms of energy and CO_2), while the tax rate on LPG is very low in comparison.

Overall, gasoline and diesel used for transport constitute 63% of energy use and 66% of CO_2 emissions from energy use in Luxembourg. The predominance of these fuels in both bases can be largely explained by sales of gasoline and diesel to foreign drivers, with truck drivers and cross-border commuters taking advantage of Luxembourg's lower excise taxes on these fuels as compared with neighbouring countries. Indeed, domestic transport is estimated to account for just one-fifth of total transport fuel sales (OECD, 2013).

The heating and process use category is dominated by natural gas and diesel, which constitute 61% and 26%, respectively, of the heating and process energy use, and 52% and 30% of the CO_2 emissions in this category. Both fuels are taxed at differing rates according to user. Diesel for commercial use is taxed at the highest effective rate (both in terms of energy and CO_2), and is twice the rate that applies to diesel used for producing commercial heat. Meanwhile, 38% of the natural gas use (both in terms of energy and CO_2) is in industry or agriculture, and is untaxed.

Given the predominance of fuels used in transport, fuels used to generate electricity constitute less than 3% of total energy use and CO_2 emissions in Luxembourg. As can be seen on the maps, industrial users and energy transformation users – who are assumed to consume more than 25 MWh per year of electricity – are taxed at a lower rate than all other users. The main energy source used in generating electricity in Luxembourg is natural gas, with small quantities of biomass and waste, and renewables (see Figure 20.1).

Figure 20.1. **Fuels used to generate electricity in Luxembourg (TJs)**



Source: OECD calculations using 2009 IEA Energy Balance data (IEA, 2011a).

StatLink http://dx.doi.org/10.1787/888932766643

Reported tax expenditures and rebates

Luxembourg does not provide any fuel tax rebates, nor does it report any of its fuel tax rate discrepancies for various fuels and users as constituting tax expenditures.

Key assumptions and caveats

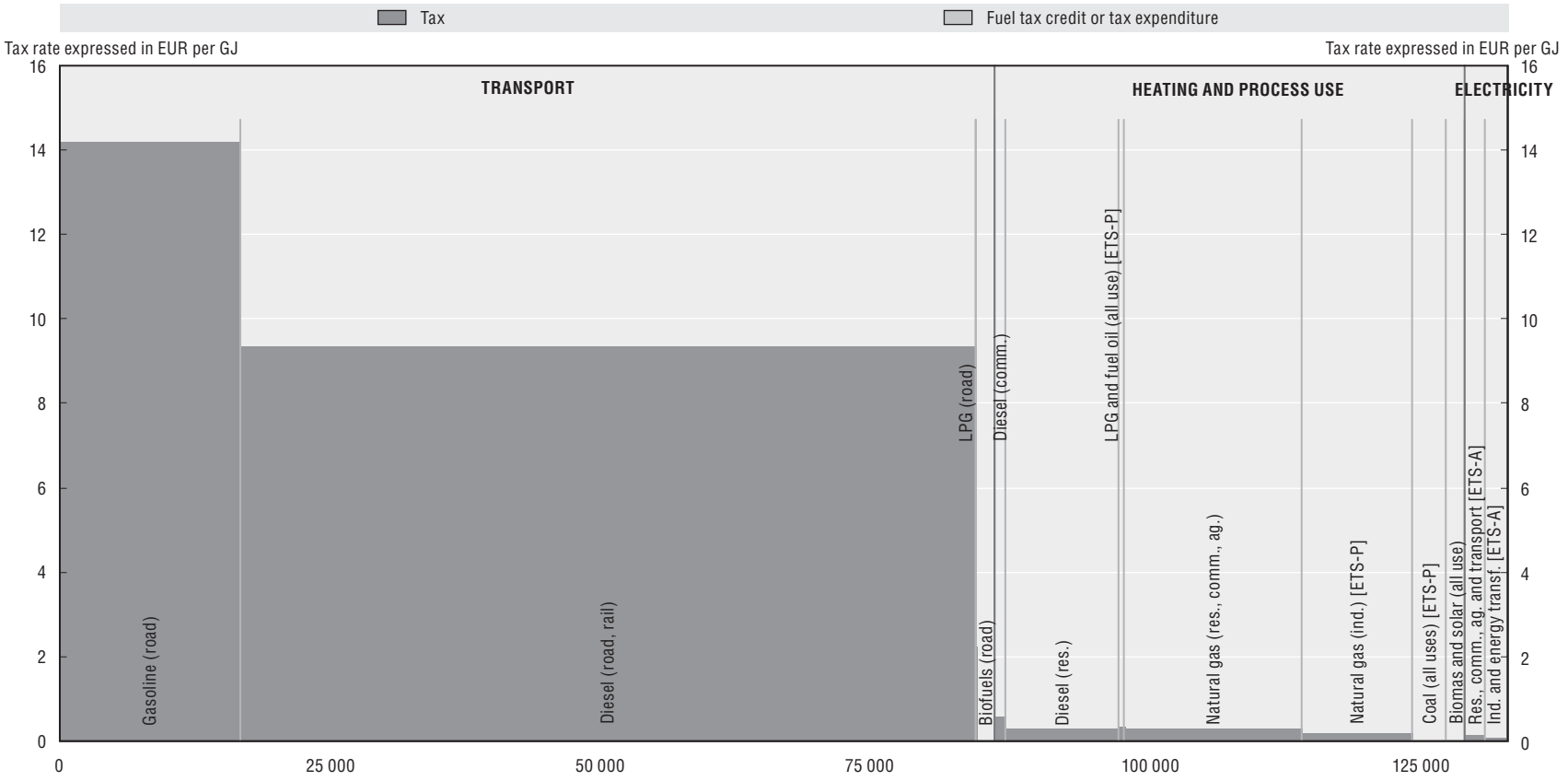
Key assumptions include:

- Electricity consumption is assumed to be greater than 25 MWh per year when used in industry or energy transformation. As such a reduced rate of EUR 0.50 per MWh is applied in the maps. Electricity consumption for all other uses is assumed to be less than 25 MWh per year, and therefore a rate of EUR 1.00 per MWh is applied.
- In the heating and process use category, natural gas consumption is assumed to be greater than 550 MWh per year for industrial users. As such a rate of EUR 0.54 per MWh is applied in the maps. Natural gas consumption for all other users is assumed to be less than 550 MWh per year, and therefore a rate of EUR 1.08 per MWh is applied.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials.

Figure 20.2. **Taxation of energy in Luxembourg on an energy content basis**

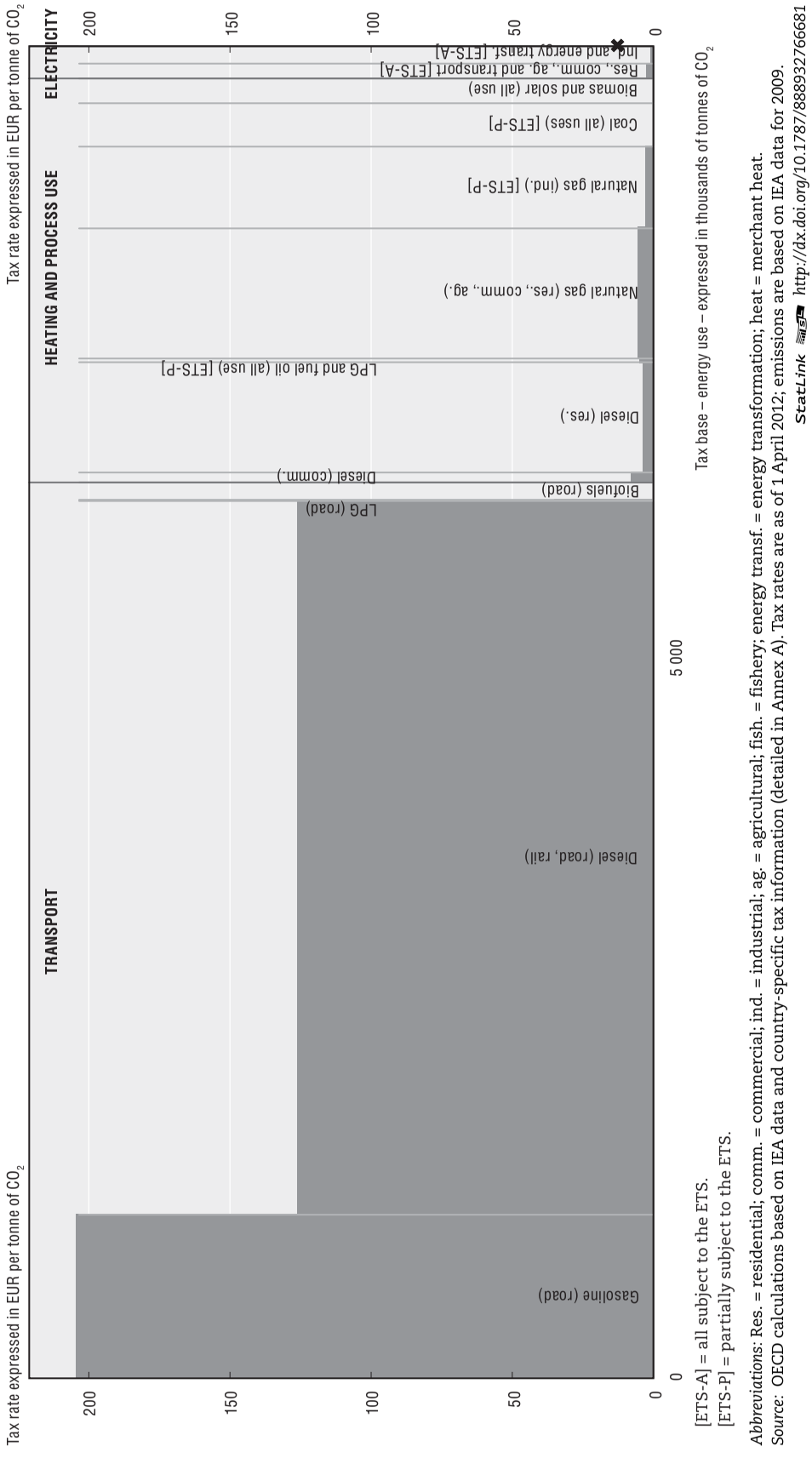


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766662

Figure 20.3. **Taxation of energy in Luxembourg on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766681

Mexico

Figures 21.1 and 21.2 map the energy taxes in Mexico on an energy content and a carbon content basis, respectively. Neither of these principal maps include the variable component of the *Impuesto Especial sobre Producción y Servicios* (IEPS, see below) which can act as either a tax or subsidy on gasoline and diesel consumption. The overall IEPS rate (whether positive or negative) is illustrated separately in Figures 21.3 to 21.6, on an energy content and a carbon content basis.

Structure of energy taxation

In Mexico energy product prices are set by the government for gasoline, diesel and LPG. The state-owned oil company Pemex (Petróleos Mexicanos) has a monopoly on the production and sale of virtually all oil products, excluding some petrochemicals.

The taxation of gasoline and diesel is governed by the *Ley del Impuesto Especial sobre Producción y Servicios (IEPS)*. Under the IEPS, a tax is levied on gasoline and diesel sold by Pemex to retailers. The subsequent sale to final consumers is not directly taxed under the IEPS. There are two components to the IEPS tax on gasoline and diesel. The first is a variable component that may be positive (a tax) or negative (a subsidy). The second component is a fixed positive tax imposed at the following rates: unleaded gasoline (*gasolina magna*) – MXN 0.36 per litre, premium gasoline (*gasolina premium UBA*) – MXN 0.4392 per litre, and diesel – MXN 0.2988 per litre.

The variable component of the IEPS enables the government to smooth the retail prices of gasoline and diesel against fluctuations in the international price of oil. It is determined by comparing the domestic prices of gasoline and diesel (set by government) with benchmark prices that reflect Pemex's production costs (these are largely based on the international prices of gasoline and diesel). If domestic prices are set by the government below the benchmark prices, a subsidy is provided to Pemex by way of a tax credit against its payments of the IEPS variable component, VAT, and the ordinary fee on hydrocarbon production. (In most cases, Pemex does not face a positive variable IEPS liability and the tax credit is credited by Pemex against its VAT and ordinary hydrocarbons fee obligations.) In contrast, if domestic prices are set above the benchmark prices, then a positive tax is levied on Pemex (in addition to the IEPS fixed component). The IEPS variable component is calculated every month for every kind of fuel (regular and premium gasoline, and automotive, industrial and marine diesel), and for every one of Pemex's 74 sales agencies.

Diesel oil used in the agricultural and industrial sectors, with the notable exception of mining, benefits from a tax credit equal to the entire amount of the variable component of the IEPS (when it is positive). The same tax credit is applied to the consumption of diesel for shipping and fishing purposes (again, when the IEPS is positive).

Energy products not subject to the IEPS are not taxed. This means that natural gas, coal, LPG and electricity are untaxed.

Energy use and taxation in Mexico

As shown in Figures 21.1 and 21.2, road use of gasoline and diesel play a significant role in both total energy use and CO_2 emissions in Mexico, representing respectively 22% and 8% of total energy use and 27% and 9% of the resulting CO_2 emissions. These figures

mean that 30% of energy use and 36% of CO_2 emissions are subject to the IEPS, but also that the same amount of energy use and emissions may be subsidised under the variable component of the IEPS. The actual amount of energy use and emissions covered by the IEPS is actually slightly higher as it also includes other uses of gasoline and diesel (mainly diesel for agriculture and industry), adding a further 3.5% of energy use and 4% of emissions.

In transport, 97% of energy consumption is subject to the IEPS. Figures 21.1 and 21.2 show that the effective tax rate on gasoline due to the fixed component of the IEPS is higher than that on diesel.

With respect to heating and process use, diesel is subject to the IEPS, and amounts to around 9% of both energy used and the resulting CO_2 emissions from this category. Furthermore, taxpayers that consume diesel in agricultural activities receive a tax credit[1] which is usually higher than the fixed component of the IEPS, that is illustrated in Figures 21.1 and 21.2. Note that when the variable IEPS rate is positive a number of different tax credits apply to diesel used for heating and in process use, including agriculture (see below). Of the fuels that are not subject to the IEPS, natural gas accounts for the greatest share of energy (37%) and CO_2 emissions (30%) from heating and process use. Biomass and renewables account for a further 12% of energy use and 19% of CO_2 emissions, primarily from solid biomass. LPG consumption accounts for 12% of energy use and 11% of emissions in heating and process use. Note that even though LPG is not taxed by the IEPS, it also benefits from an implicit subsidy through domestic prices (this subsidy is reflected on the Pemex financial statements).

Emissions from fuels used for electricity production, as shown by the maps, mainly arise from natural gas (44% of energy use and 47% of CO_2 emissions), with substantial amounts also of coal, oil products (fuel oil and diesel) and renewables. Of these fuels, only diesel used to generate electricity is taxed with IEPS.

Turning to Figures 21.3 to 21.6, these show the overall (fixed plus variable component) IEPS tax rates on gasoline and diesel. Rates are shown in terms of both energy and carbon content for the period 1995-2011. These figures illustrate the substantial variation in the overall IEPS rate, which is driven by the variable component. While positive between 1995 and 2005, the overall IEPS rate has been predominantly negative since early 2006 for both gasoline and diesel, thereby providing a subsidy to consumers.

Reported tax expenditures

The Mexican Tax Expenditures Budget (*Presupuesto de Gastos Fiscales*) reports tax expenditures in respect of several tax credits on diesel consumption. A tax expenditure related to the variable component of the IEPS for gasoline and diesel is also reported.

Several tax expenditures reported by Mexico can be identified:

- *Marine:* Diesel consumed as fuel both for shipping and fishing benefits from a tax credit equal to the whole amount of the variable component of the IEPS, when the variable IEPS rate is positive. The tax expenditure is not shown in the maps as the variable component of the IEPS was negative in 2012.
- *Diesel oil used in agriculture:* When the variable IEPS rate is positive, a tax credit equal to the whole amount of the variable component of the IEPS is available for diesel consumed in agricultural use. When the variable IEPS rate is negative, a 35.5% tax credit may instead be

claimed against the taxpayer's income tax liability or that withheld to his employees. The latter tax credit is presented in Figures 21.1 and 21.2. The fixed component IEPS rate has been used as the benchmark in calculating this tax expenditure.

- *Diesel oil used as process fuel:* A tax credit equal to the whole amount of the variable component of the IEPS is also available for diesel consumed as process fuel in a large portion of the industrial and agricultural sectors, when the variable IEPS rate is positive. This tax expenditure is not shown in the maps as the variable component of the IEPS was negative in 2012.

The *Secretaría de Hacienda y Crédito Público* includes in the *Presupuesto de Gastos Fiscales* reports the tax expenditure for the variable component of the IEPS on gasoline and diesel.[2] As noted earlier, this is because Pemex can credit the amount of any subsidy against the payment of other taxes.

Key assumptions and caveats

Key assumptions include:

- Diesel consumed in railways has been treated as subject to the IEPS rate.
- Only the tax rate on unleaded gasoline (*gasolina magna*) is shown.
- When a different tax rate is levied on process and heating use, *i.e.* diesel oil, all the industrial consumption has been treated as process fuel use, while the entire amount consumed by commercial and public sectors has been treated as heating fuel use.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Government of Mexico (2011), *Ley del Impuesto Especial sobre Producción y Servicios (IEPS)*. Available at: *www.diputados.gob.mx/LeyesBiblio/pdf/78.pdf*.

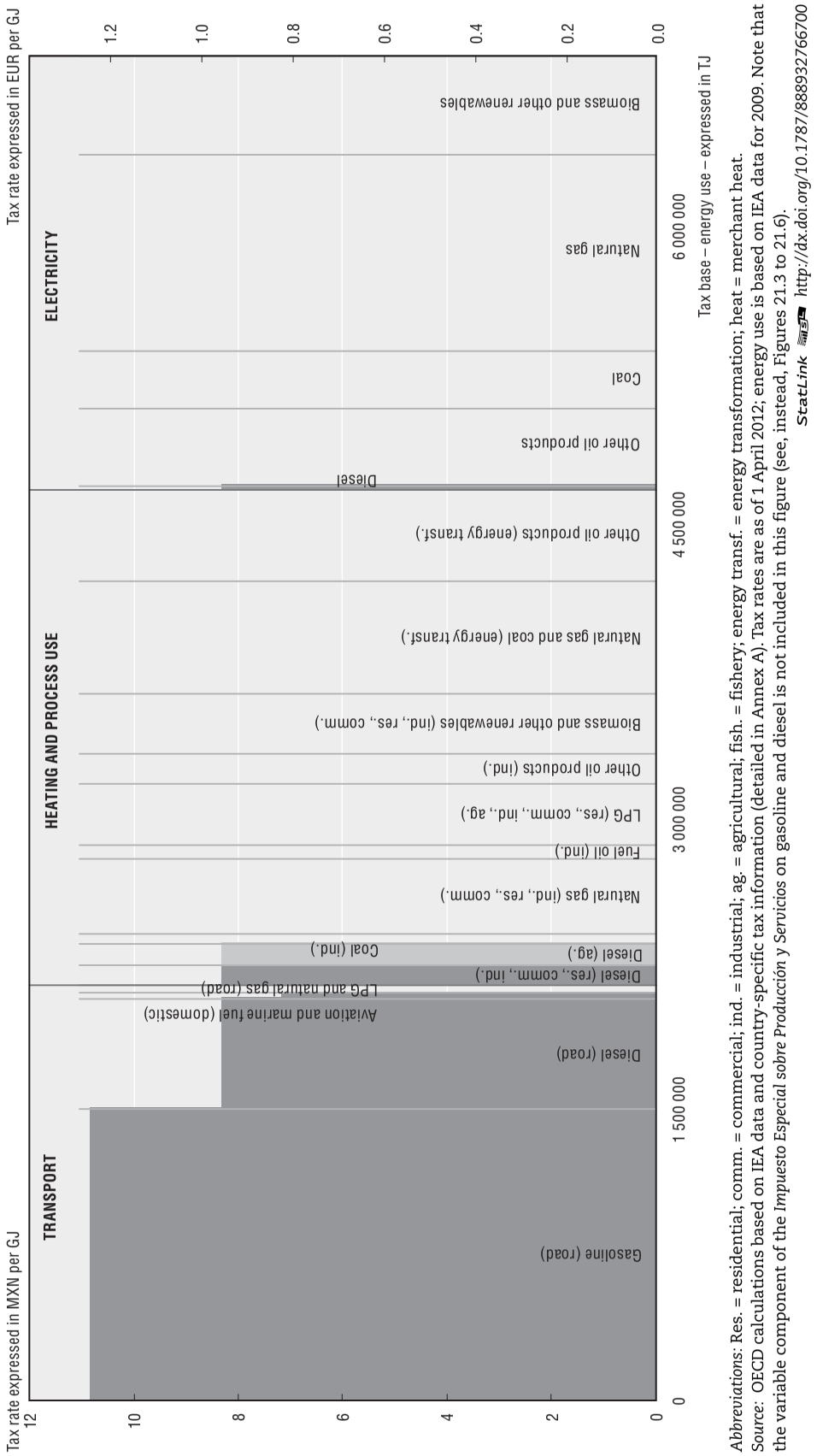
Secretaría de Hacienda y Crédito Público (2008), *Presupuesto de Gastos Fiscales 2008*. Available at: *www.shcp.gob.mx/INGRESOS/Ingresos_pres_gasto/presupuesto_gastos_fiscales_2008.pdf*.

Secretaría de Hacienda y Crédito Público (2009), *Presupuesto de Gastos Fiscales 2009*. Available at: *www.shcp.gob.mx/INGRESOS/Ingresos_pres_gasto/presupuesto_gastos_fiscales_2009.pdf*.

Notes

1. Taxpayers from the agriculture sector have the option to apply a tax credit equal to: *a)* the whole amount of the IEPS of diesel consumed in agriculture (when the variable component is positive); or *b)* a tax credit equivalent to 35.5% of the diesel price (regardless of whether the variable component of the IEPS is positive or negative). Both options are creditable against the taxpayer's income tax liability or that withheld to his employees.
2. While this tax expenditure is not explicitly presented in any of the figures, it can be calculated by subtracting the relevant IEPS fixed component rate presented in Figures 21.1 and 21.2 from the overall IEPS rate presented in Figures 21.3 to 21.6. Note though that while the rates in Figures 21.1 and 21.2 are as at 1 April 2012, the most recent rates presented in Figures 21.3 to 21.6 are for December 2011.

Figure 21.1. **Taxation of energy in Mexico on an energy content basis**

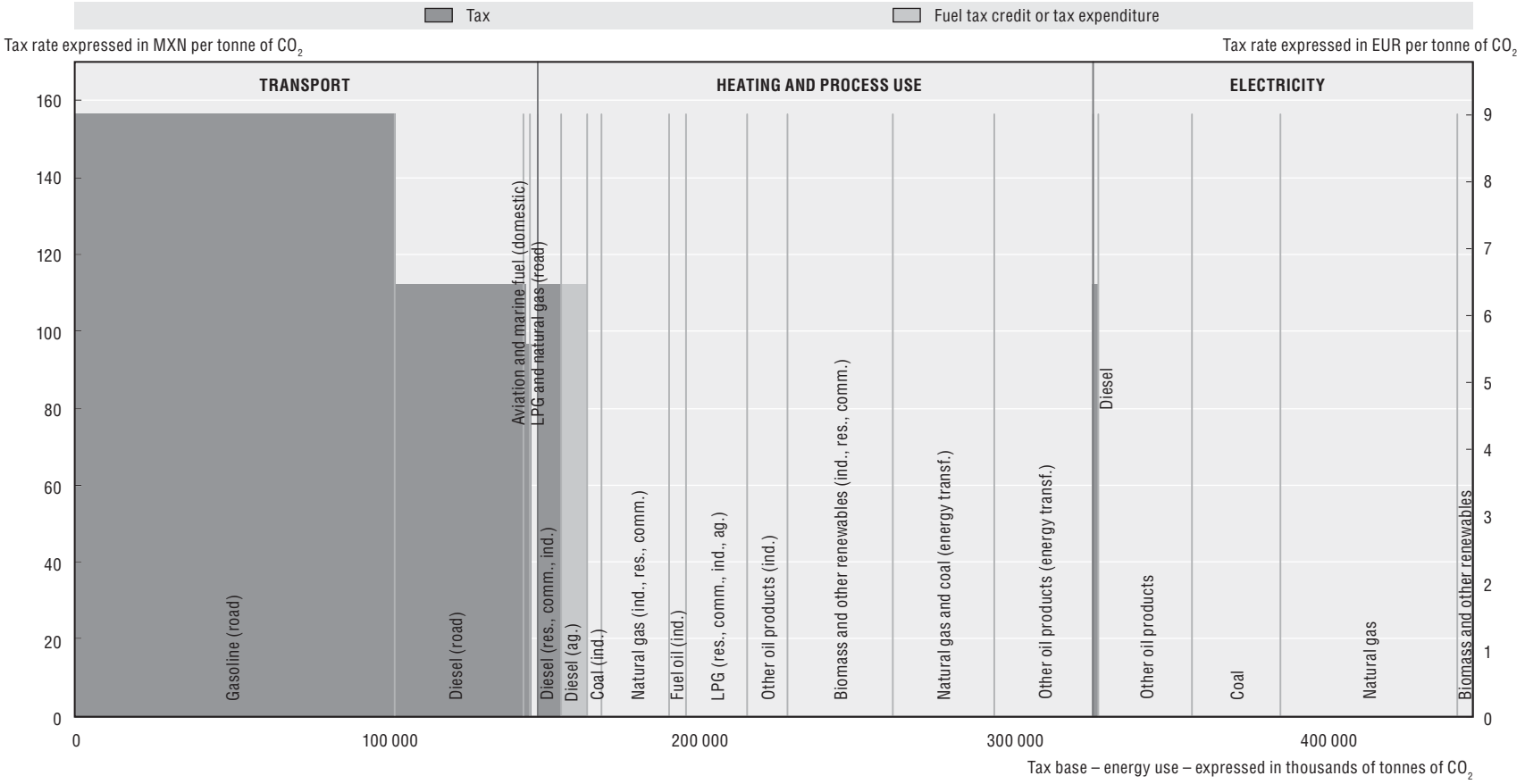


Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009. Note that the variable component of the *Impuesto Especial sobre Producción y Servicios* on gasoline and diesel is not included in this figure (see, instead, Figures 21.3 to 21.6).

StatLink http://dx.doi.org/10.1787/888932766700

Figure 21.2. **Taxation of energy in Mexico on a carbon emission basis**

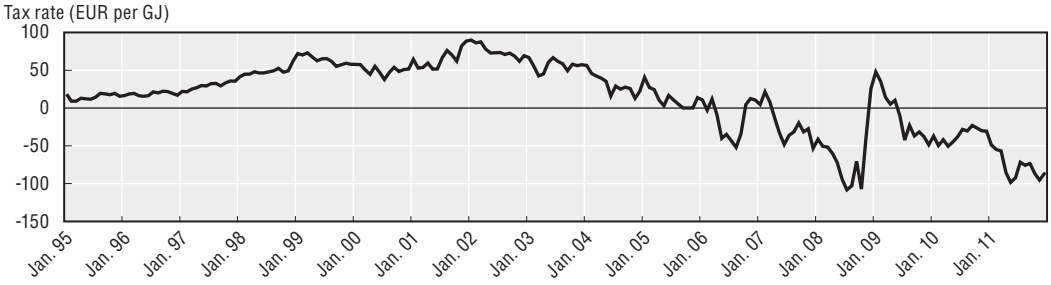


Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009. Note that the variable component of the *Impuesto Especial sobre Producción y Servicios* on gasoline and diesel is not included in this figure (see, instead, Figures 21.3 to 21.6).

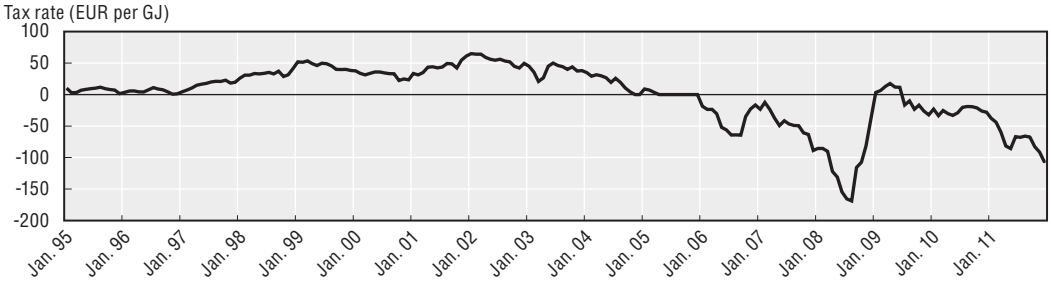
StatLink http://dx.doi.org/10.1787/888932766719

Figure 21.3. **IEPS tax rate (variable plus fixed component) on unleaded gasoline on an energy content basis, 1995-2011**



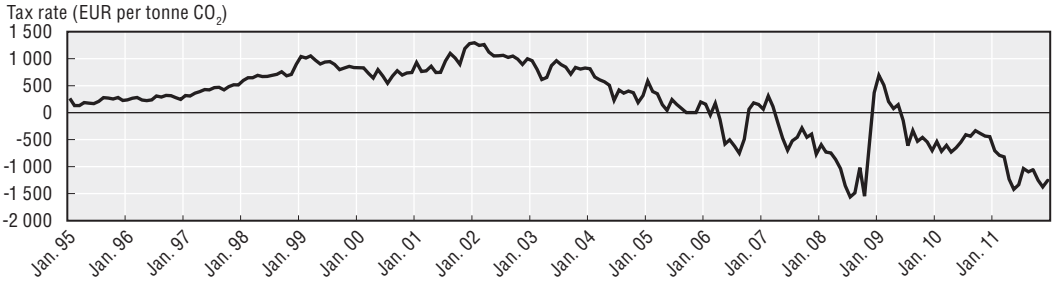
StatLink http://dx.doi.org/10.1787/888932766738

Figure 21.4. **IEPS tax rate (variable plus fixed component) on diesel on an energy content basis, 1995-2011**



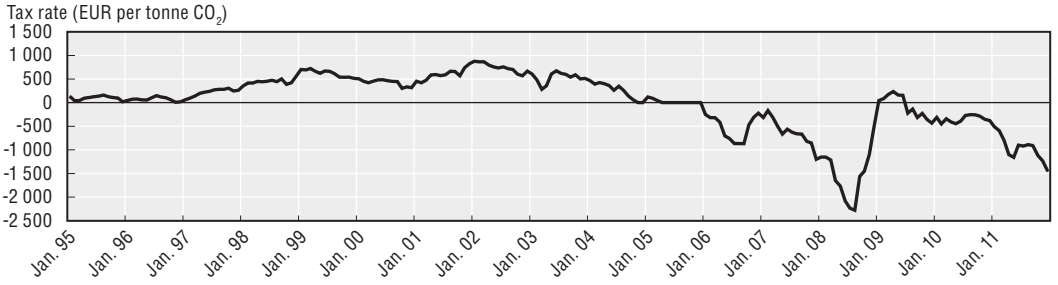
StatLink http://dx.doi.org/10.1787/888932766757

Figure 21.5. **IEPS tax rate (variable plus fixed component) on unleaded gasoline on a carbon emission basis, 1995-2011**



StatLink http://dx.doi.org/10.1787/888932766776

Figure 21.6. **IEPS tax rate (variable plus fixed component) on diesel on a carbon emission basis, 1995-2011**



StatLink http://dx.doi.org/10.1787/888932766795

Netherlands

Figures 22.1 and 22.2 map the use and taxation of energy in the Netherlands on the basis of energy content and carbon content, respectively.

Structure of energy taxation

Taxation of energy in the Netherlands has two main components: excise taxes and the strategic stockpiling levy, which together determine the level of tax payable on most fuels. These taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail).

Excise tax rates are payable on most oil fuels, including petrol, diesel, fuel oil, and LPG; and on coal. These rates apply at a higher level if the fuel is used for transport than if it is used for heating and process purposes. If used for the production of electricity, a rebate of the excise duty paid is available to installations with a capacity of more than 1 Mw. Some minor exemptions to these excises exist; for example, for aviation and shipping and for the use of coal in energy transformation (subject to certain conditions on the efficiency or fuel used by the transformation plant). Consumers who buy these products in very large quantities may apply for a limited rebate of the excise duty of around EUR 0.03 per litre or kilogram. These limited exemptions and rebates are not shown in the map.

The strategic stockpile levy is payable on most oil and coal fuel products at either EUR 0.00590 per litre or per kilogram.

Taxes on natural gas and the consumption of electricity in the Netherlands is based on a bracket system, which provides a schedule of marginal rates for the consumption of natural gas and electricity based on the amount of use. For example, a consumer who uses 6 000 m^3 of natural gas will pay one rate on their consumption up to 5 000 m^3, and a higher rate on the remaining 1 000 m^3. These rates decrease with increased use; and different rate schedules apply for industrial, residential, and agricultural use. Business use of electricity that is greater than 10 million kWh per year per electricity connection is exempted if the consumer has agreed to obligations for improving energy efficiency with the government.

The government of the Netherlands has proposed an additional levy on electricity to finance the commitment to develop renewable energy sources. This rate system is a bracket system similar to the current tax system, and is intended to come into force on 1 January 2013. In addition, in 2013, the lower excise duty rate on diesel for use in mobile machinery (agriculture and construction) will be abolished and taxes on natural gas and coal will be increased.

Energy use and taxation in the Netherlands

As seen in the maps for the Netherlands, the transport category accounts for 19% of energy use and 20% of carbon emissions from energy use. In the transport category, gasoline for road use is taxed at the highest rate in both energy and CO_2 terms, and accounts for 37% of energy used in transport and 35% of carbon emissions from transport. Diesel is taxed at a rate approximately half that of diesel and accounts for a further 56% of energy use and 58% of transport emissions. Other fuels used in this category, with the exemption of biofuels, are untaxed. Biofuels are taxed at the per litre rate that applies to similar oil products, and together, comprise 3% of energy use and emissions from transport fuels.

In the heating and process use category, the maps show the excise duties for oil and coal products. Diesel used for heating and process use is taxed at a lower rate than that used for transport, and accounts 3% of energy used for heating and process purposes and 2% of emissions from heating and process use. Use of kerosene, fuel oil, and LPG are also taxed at varying rates, but together account for less than 1% of energy used in, and emissions from, heating and process use. Other oil products, including those used in the transformation of fuel, are untaxed. Coal represents 5% of energy used in this category (8% of emissions), and is taxed except where used for energy transformation. The tax rates applying to coal is the lowest in the heating and process category.

Natural gas generates the most emissions in the heating and process category, at 56% of emissions from this category (63% of energy used for heating and process purposes). While taxed, the map does not show a single tax rate for natural gas. Instead, it shows by a series of scatter-points the different marginal rates that apply depending on the amount of use of the consumer. A single representative rate is therefore difficult to show, although households generally pay the highest rate as their use rarely exceeds 5 000 m^3 per year.

The rates shown on the map are in decreasing order of use, and reflect the following underlying rates:

Table 22.1. **Natural gas rates in the Netherlands (EUR per m^3) on the marginal amount of usage**

Amount of usage (m^3)	Residential	Agricultural	Commercial and industrial
< 5 000	0.16670	0.01519	0.16670
– 170 000	0.14430	0.02416	0.14430
– 1000 000	0.04000	0.02023	0.04000
– 10 000 000	0.01270	0.01270	0.01270
> 10 000 000	0.01190	0.00830	0.00050

Other products used in this category, including waste and biomass, are untaxed.

Fuels used to generate electricity represented 28% of energy use and 30% of emissions from energy use in the Netherlands in 2009. These fuels are subject to the excise tax, which can be refunded if the installation has a capacity of more than 1 Mw. Similarly, coal used for energy transformation may be subject to a reduced rate of taxation based on the efficiency of the transformation plant. These taxes and rebates are not shown on the map, which instead focuses on the consumption taxes that apply to electricity.

Consumption taxes that apply to electricity are also based on a bracket system similar to that for natural gas, at the following marginal rates:

Table 22.2. **Tax rates on the consumption of electricity in the Netherlands (EUR per kWh) on the marginal amount of usage**

Amount of usage (kWh)	Residential and agricultural	Commercial and industrial
< 10 000	0.1140	0.1140
– 50 000	0.0415	0.0415
– 10 000 000	0.0111	0.0111
> 10 000 000	0.0010	0.0005

These tax rates have been adjusted to apply to the fuels used to generate electricity rather than to the direct consumption, and have been shown on the map as scatter-points.

The effective tax rates for the Netherlands in Part I have been calculated based on average rates for each sector provided by national officials. The rates used are shown in Table 22.3.

Table 22.3. **Average tax rates used in calculation of effective tax rates**

Average rate	Natural gas (EUR per m^3)	Electricity (EUR per kWh)
Residential	0.158	0.113
Agriculture	0.025	0.089
Commercial services and other sectors	0.045	0.040
Industry	0.048	0.006

Reported tax expenditures and rebates

The Netherlands reports a tax expenditure in respect of the lower tax rate that is applied to diesel used for heating and process use if compared to road use. This tax expenditure has been shown in light grey on the map. Tax expenditures are also reported for exemptions from excises that apply to greenhouses, churches, and non-profit institutions. Due to the small base size of these expenditures, these have not been shown on the maps.

Key assumptions and caveats

Assumptions included that all oil products used for the conversion of energy into another form of energy were exempt from the excise duty. In addition, several minor exemptions, as discussed above, were not included in the maps due to their limited size.

One category on the maps combines fuels that are taxed at different rates. This is the "Kerosene, fuel oil, LPG (all use)" category. In this case, the different tax rates on each fuel within this category were used to compute a weighted average (based on the respective consumption of each fuel) which is shown on the maps.

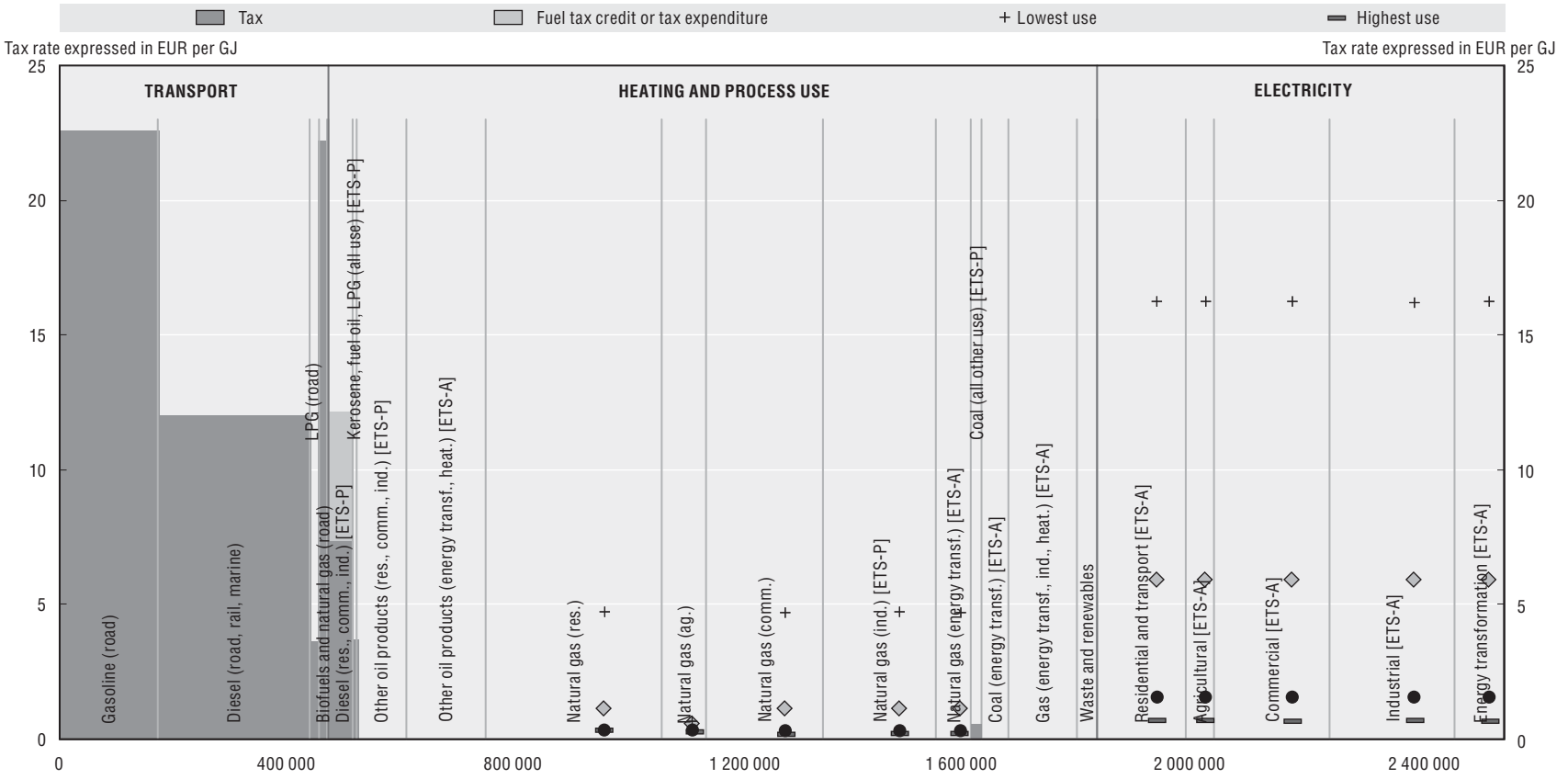
Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Netherlands Belastingdienst (2012), *Excise duty and consumer tax*. Available at: *www.belastingdienst.nl/wps/wcm/connect/bldcontenten/belastingdienst/customs/excise_duty_and_consumer_tax/excise_duty_and_consumer_tax/*.

Netherlands Belastingdienst (undated), *Gebruiksaanwijzing*. Available at: *http://download.belastingdienst.nl/douane/docs/tarievenlijst_accijns_acc0552z59fol.pdf*.

Figure 22.1. **Taxation of energy in the Netherlands on an energy content basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009. For illustrative purposes, the level of the different marginal rates for natural gas and electricity are shown as indicated.

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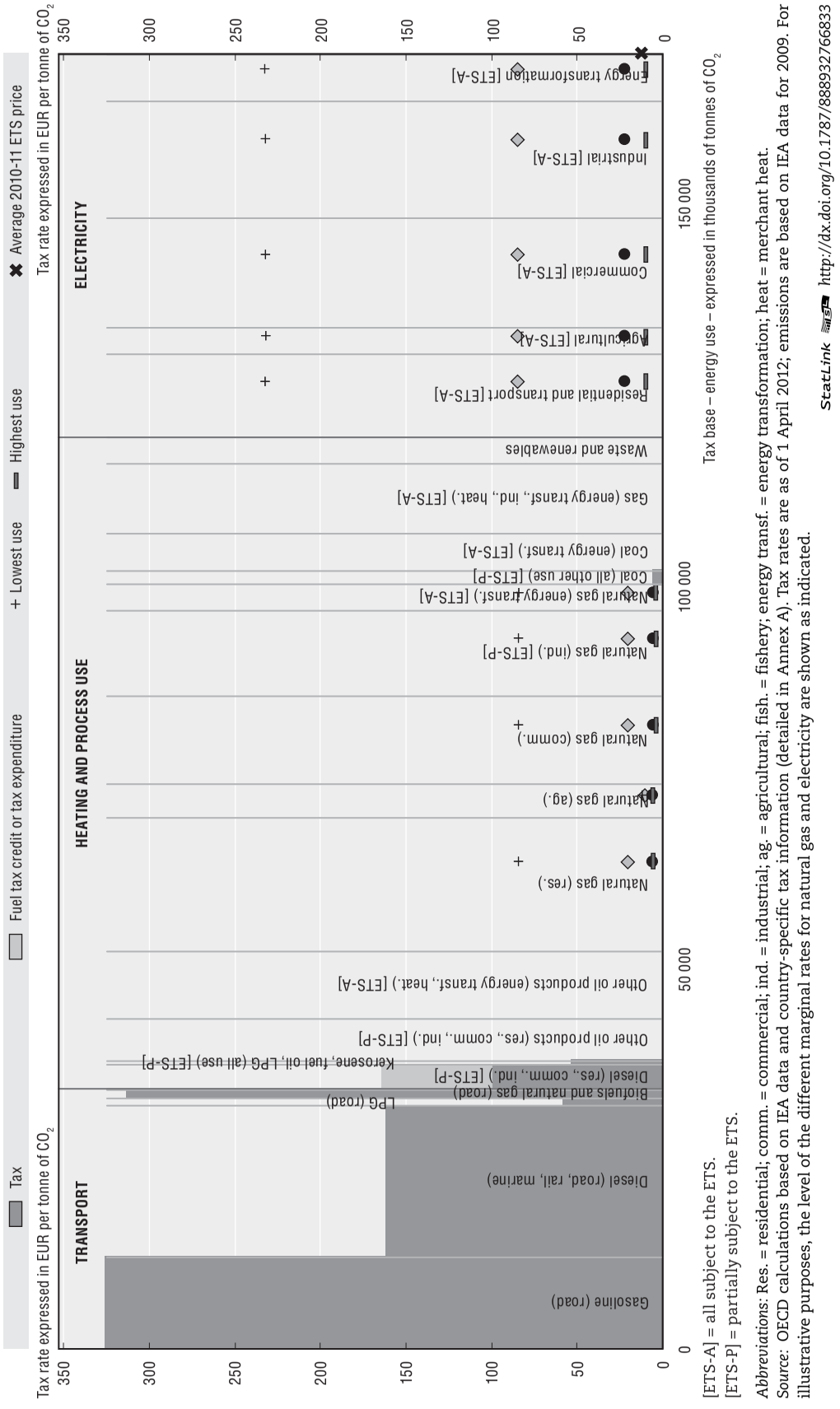
Figure 22.2. **Taxation of energy in the Netherlands on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009. For illustrative purposes, the level of the different marginal rates for natural gas and electricity are shown as indicated.

StatLink http://dx.doi.org/10.1787/888932766833

New Zealand

Figures 23.1 and 23.2 map the use and taxation of energy in New Zealand on the basis of energy content and carbon content, respectively.

Structure of energy taxation

New Zealand applies fuel excise taxes to gasoline, LPG, and other oil products. As well as these excises, a range of levies (the Accident Compensation Corporation Levy, the Petroleum or Engine Fuel Monitoring Levy, and the Local Authorities Fuel Tax) apply to gasoline, diesel, and LPG. The excise taxes and levies on petroleum products are set out below.

Table 23.1. **Excise taxes and levies on petroleum products (NZD per litre)**

NZD per litre	Excise taxes	Accident Compensation Corporation Levy	Petroleum or Engine Fuel Monitoring Levy	Local Authorities Fuel Tax	**Total**
Unleaded petrol	0.48524	0.0990	0.00045	0.066	**0.59129**
Ethanol	0	0	0.0045	0.066	**0.0705**
Automotive diesel	0	0	0.0045	0.033	**0.0375**
Biodiesel	0	0	0.0045	0.033	**0.0375**
Methanol	0.302	0	0	0.066	**0.3086**
LPG	0.104	0	0	0	**0.104**
CNG	0.105	0	0	0	**0.105**

Although not shown on the map, road user charges apply to the consumption of diesel for road use. These are based on the distance travelled and the type and weight of the vehicle.

For heating and process fuel use, the excises taxes also apply but can be refunded under the motor-spirits excise duty refund scheme. The Petroleum or Engine Fuel Monitoring Levy and Local Authorities Fuel tax cannot be refunded under this scheme, which means a low rate of tax continues to apply to gasoline after the tax is refunded. The refund is shown in light grey on the graph.

A levy at a low rate applies to natural gas used for transport and for heating and fuel use, but is difficult to identify on the graph because the rate per tonne of carbon emitted is comparatively low. Other fuels for transport and for heating and process use are not taxed. The consumption of electricity and fuels used to produce electricity are also not taxed.

Energy use and taxation in New Zealand

As can be seen in the maps, gasoline is taxed at the highest rate of any fuel due to the excise rate on gasoline fuel. Gasoline accounts for approximately 54% of the energy used in transport and 52% of transport carbon emissions, and the vast majority of fuel excise tax revenue. Diesel usage, the second largest area in the transport category, is shown to be taxed at a very low rate as the graph shows only the Petroleum or Engine Fuel Monitoring Levy and Local Authorities Fuel tax which are at a very low rate relative to the excise rate. LPG is also taxed at a lower rate than gasoline but accounts for less than 1% of energy use

or carbon emissions from transport use in New Zealand. The transport sector in total accounts for 27% of energy use and 37% of carbon emissions from fuel use in New Zealand.

In heating and process uses, most fuels are not taxed; and most of the tax paid on fuels subject to the excise duty is refunded. The amount of fuel consumption in these uses that is subject to the rebate is small, at approximately 4% of the total carbon emissions from heating and process use of fuel. Natural gas accounts for a further 26% of these emissions, and as for the remainder of carbon emissions from heat and process use, is not taxed.

Consumption of electricity and fuels used to produce electricity are not taxed. Fuels used to generate electricity in New Zealand represent a greater share of total energy use (45%) than they do of total carbon emissions from fuel use (22%) due to the significant proportion of electricity that comes from renewable sources; in particular geothermal and hydro sources.

Reported tax expenditures and rebates

New Zealand reports tax expenditures in relation to the refund of the motor-spirits excise duty. A tax expenditure is reported for the value of the refund and is shown in the light grey area on the graph.

Key assumptions and caveats

To convert tax rate information from NZD per litre, conversion factors derived from the IEA and the IPCC were used, as set out in Annex A. However, New Zealand uses different factors to convert information to gigajoules and carbon dioxide emissions domestically. Using these figures results in estimates of tax rates per carbon content that are generally lower than those set out in this report.

The maps do not attempt to illustrate the road-user charges that apply to diesel vehicles, as these apply to different vehicle types based on kilometres travelled, rather than on fuel use *per se*.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

New Zealand Ministry of Economic Development (2012), *Duties, Taxes and Direct Levies on Motor Fuels in NZ cents/litre (excluding GST)*. Available at: *www.med.govt.nz/sectors-industries/energy/liquid-fuel-market/duties-taxes-and-direct-levies-on-motor-fuels-in-new-zealand*.

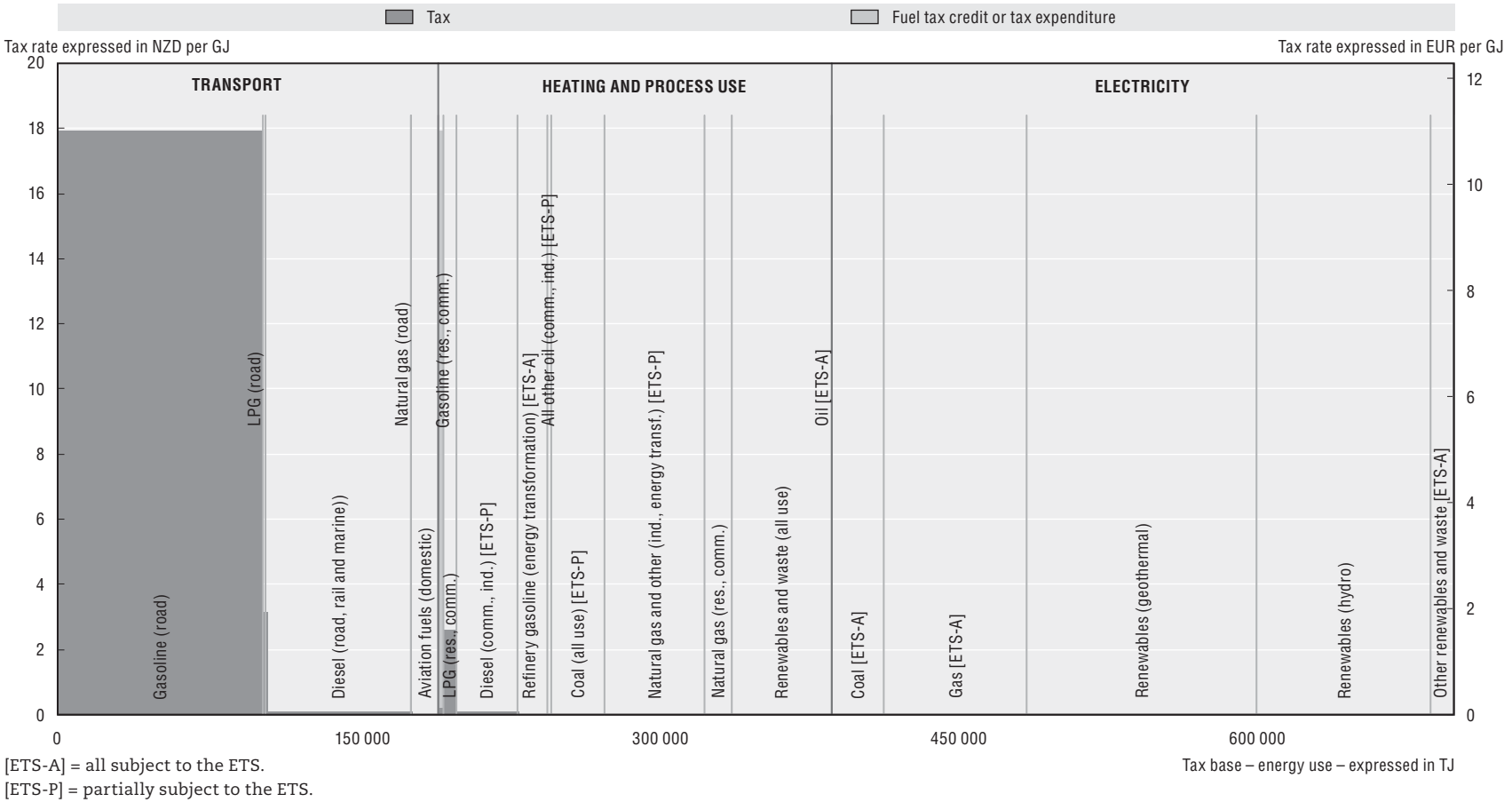
New Zealand Customs Service (2012), *Excise Duty*. Available at: *www.customs.govt.nz/manufacturers/Excise+duty.htm*.

New Zealand Transport Authority (2012), *Excise Duty: Who Can Get Refunds and How*. Available at: *www.nzta.govt.nz/resources/factsheets/14/excise-duty.html*.

New Zealand Ministry of Economic Development (2012), *Energy Greenhouse Gas Emissions Report*. Available at: *www.med.govt.nz/sectors-industries/energy/energy-modelling/publications/energy-greenhouse-gas-emissions*.

New Zealand Ministry of Economic Development (2012), *New Zealand Energy Data File*. Available at: *www.med.govt.nz/sectors-industries/energy/energy-modelling/publications/energy-data-file/new-zealand-energy-data-file-2012*.

Figure 23.1. **Taxation of energy in New Zealand on an energy content basis**

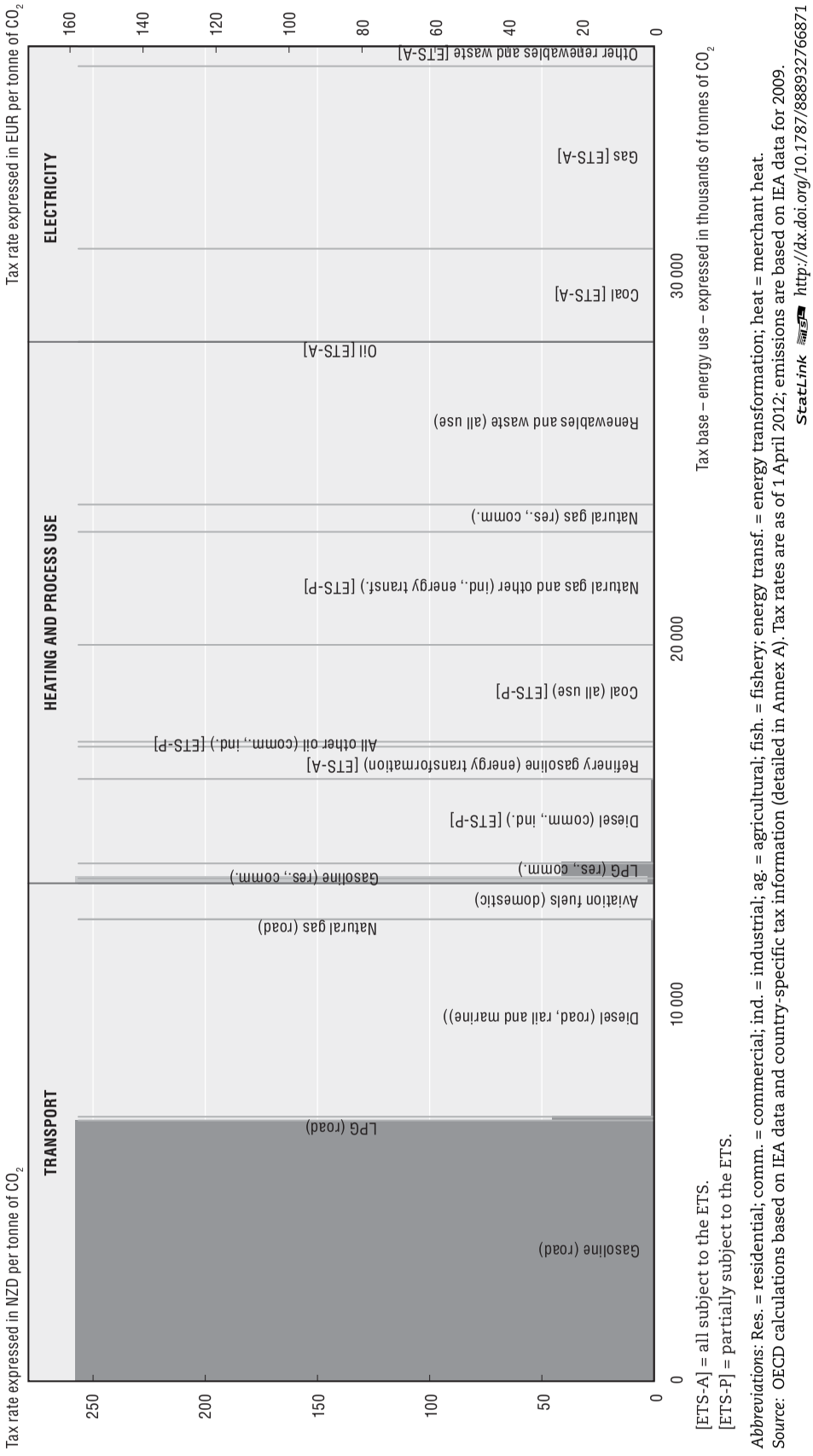


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766852

Figure 23.2. **Taxation of energy in New Zealand on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766871

Norway

Figures 24.2 and 24.3 map the use and taxation of energy in Norway on the basis of energy content and carbon content, respectively.

Structure of energy taxation

The Norwegian energy-related tax system encompasses several levies, with the aim of addressing different types of external costs and fiscal purposes. Norway joined the European Emission Trading System (ETS) in 2008 and included aviation in the ETS from 2012. As a result, tax rates have been revised in order to take into account the interaction between CO_2 taxes and the ETS.

Norway applies a tax on road usage fuels which covers petrol, diesel and biodiesel. The aim of the tax is to price the externalities linked to fuels for road use, such as accidents, congestion, road wear and tear, noise and local emissions. The road usage levy differentiates tax rates according to the sulphur content of different fuels. Today all petrol and diesel sold in Norway has the lowest sulphur content per the table below.

Table 24.1. **Road usage tax in Norway**

Road usage tax	NOK per litre
Diesel ultra low sulphur content[1]	3.68
Diesel low sulphur content	3.73
Biodiesel	1.84
Petrol ultra low sulphur content[1]	4.69
Petrol low sulphur content	4.73

1. Less than 10 ppm sulphur.

A tax on electricity was introduced in 1951 and a basic tax on mineral oils was introduced in 2000. The basic tax rate on mineral oils is NOK 0.999 per litre. This levy does not apply to fuels subjected to the road usage levy and to aviation fuels. Lower tax rates and exemptions have been set for particular activities, such as fishing, fishmeal industry and shipping.

Emissions (or the fuels that produce them) are taxed under carbon dioxide (CO_2), sulphur and nitrous oxide ($NO_{x)}$ taxes. The CO_2 excise is paid on mineral products, natural gas and LPG, and reduced rates or exemptions apply to industries subject to the ETS. The basic rate for mineral oil is NOK 0.6 per litre; however, a higher rate is applied to petrol (NOK 0.89 per litre) and lower rates (or exemptions) are applied to mineral products used in specific production processes (wood, paper, fishmeal) and usage covered by the ETS. A tax rate of NOK 0.7 per litre applies to domestic aviation fuels and a reduced rate (NOK 0.42 per litre) was introduced in 2012 for fuels used in aviation subject to the ETS .

A specific CO_2 tax is levied on oil and gas that is burnt off or emitted on platforms, installations and facilities used for the extraction or transportation of petroleum on the Norwegian continental shelf. This tax can be deducted from the direct tax base on petroleum activities. It is not shown in the maps due to data restrictions.

Table 24.2. **CO_2 tax in Norway**

CO_2 tax	NOK per litre
Mineral oil general rate	0.60
Petrol	0.89
Domestic aviation subject to ETS	0.42
Other domestic aviation	0.70
Reduced rate for specific industries	0.31

A sulphur tax is applied to mineral oils (paraffin, kerosene, heating kerosene, diesel, diesel oil and domestic heating oil) that contain more than 0.05% sulphur by weight, at a price of NOK 0.077 per litre for each additional 0.25% weight units of sulphur. The duty is therefore NOK 0.077 for a sulphur content between 0.05% and 0.25% and increases by the same amount for a sulphur content between 0.26 and 0.50 %.

A tax on NO_x was introduced in 2007 in order to fulfil the Gothenburg protocol on reduction of NO_x emissions. The tax rate is NOK 16.69 per kilo of NO_x emissions and is applied to propulsion machinery (capacity over 750 kW), motors, boilers and turbines (with a capacity of more than 10 MW) and to flares on offshore installations and on facilities on land. This excise duty is calculated on the basis of actual emissions or, if these are not available, on the basis of emission factors and the quantity of energy consumed. Several Norwegian business organisations (including airlines and shipping companies) have signed a voluntary environmental agreement and are currently members of the NO_x fund. Membership qualifies for an exemption from the NO_X-tax. The fund requires the businesses to pay a contribution to the fund in order to finance emission-reducing measures according to the agreement. The taxes on NOx and SOx are not included in the maps.

For electricity, the ordinary tax rate is NOK 0.1139 per kilowatt hour. A reduced rate (NOK 0.0045 per kWh) applies to manufacturing, mining, quarrying and steam and hot water supply, as well as to Finnmark and North Troms. Energy intensive industries that participate in a programme for energy efficiency are exempt from the electricity tax, as are certain industrial sectors and rail transport. Households and public services in Finnmark and North Troms are also exempt from the electricity tax.

Energy use and taxation in Norway

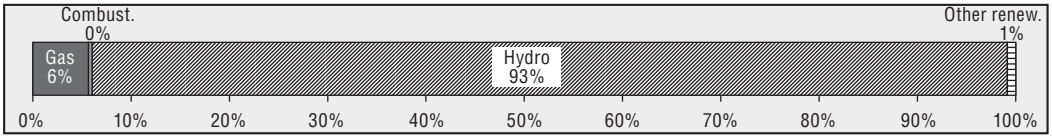
As can be seen from the maps, in the transport category, diesel and gasoline for road use accounted for more than 70% of both energy content and carbon emissions in 2009. As in many countries, diesel is taxed at a lower rate than gasoline on a per litre, energy content and CO_2 content basis. Unlike many countries, however, Norway reports this as a tax expenditure, which is shown in the graph as a light grey area. Biofuels, which have a minor role in road transportation, have a much lower tax rate. Domestic marine fuel use accounted for around 18% of the energy content in transport and is taxed – excluding NOx and SOx taxes – at reduced rates relative to other transport fuels.

For heating and industrial processes (including energy industries), natural gas was the main energy input in 2009, accounting for more than 40% of the category in terms of energy content (slightly less with regard to CO_2 emissions). The vast majority of natural gas was used for the production of electricity in gas turbines on oil and gas drilling platforms offshore. Natural gas is taxed at a very low level; however its use in industrial processes is

partially regulated under the European ETS. Diesel and other oil products (mainly LPG) account for about 30% of energy used for heating and process purposes and of carbon emissions from this use. Biomass and waste constituted another important energy source in the category, accounting for 15% of total carbon emissions and these fuels are not taxed. Coal represents the remainder of energy and emissions from this category.

The main energy source used to generate electricity in 2009 was hydro (93% of energy used to produce electricity), which, together with other renewable and waste sources, makes up 94% of energy used in electricity generation and 40% of all energy use in Norway. Natural gas accounted for 6% of energy used to generate electricity but for more than 80% of CO_2 emissions from energy used to generate electricity. The remaining emissions from energy used in electricity production came from combustibles, diesel and coal.

Figure 24.1. **Fuels used to generate electricity in Norway (TJs)**



Source: OECD calculations using 2009 IEA Energy Balance data (IEA, 2011a)

StatLink http://dx.doi.org/10.1787/888932766890

Due to this large contribution of non-carbon renewable sources, the electricity share of CO_2 emissions is very small (less than 5% of total emissions). Different tax rates are levied on electricity consumption: a higher rate applies for households (who use approximately 39% of electricity) and a much lower rate for industrial use, with the resulting tax expenditure shown in the maps.

Reported tax expenditure and rebates

Norway reports tax expenditure related to environmental taxes, which are calculated as deviations from the applicable reference rate. Lower rates and exemptions introduced to take account of the European ETS are not shown as tax expenditures in the maps.

As illustrated in the maps, the lower rates applied to diesel and biofuels in comparison to petrol are reported as tax expenditures. Fuels used in the fisheries sector (diesel, natural gas and LPG) are exempted from the CO_2 tax, and mineral oil used in the wood processing industry and in the production of colorants and pigments is taxed at lower rate. The manufacturing sector benefits from a lower rate on natural gas and a full tax exemption on LPG.

Key assumptions and caveats

A weighted average between the two tax rates (NOK 0.42 and NOK 0.7) has been used for aviation. The weights employed (85% for aviation covered by ETS and 15% for residual flights) are based on a preliminary estimation by the Norwegian Ministry of the Environment and the Norwegian Climate and Pollution Agency.

The excise duty for petroleum activities on the continental shelf has not been included in the maps due to data restrictions.

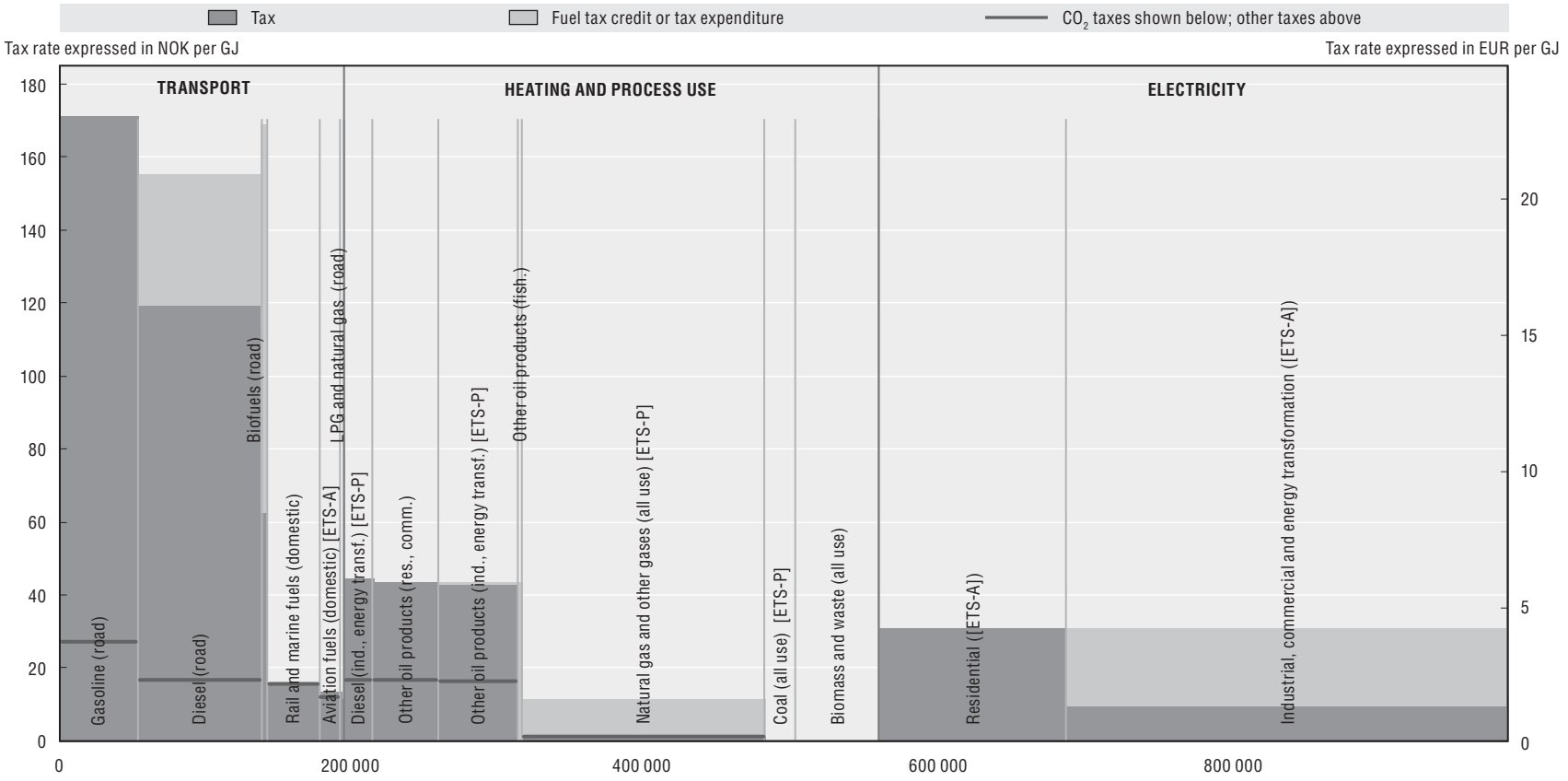
Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Norwegian Customs and Excise (2012), *Excise Duty on Mineral Products,* etc. *2012*, Circular No. 11/2012 S. Available at: *www.toll.no/templates_TAD/Article.aspx?id=219622&epslanguage=en*.

Norwegian Customs and Excise (2012), *The road use duty on fuels 2012*, Circular No. 13/2012 S. Available at: *www.toll.no/templates_TAD/Article.aspx?id=219623&epslanguage=en*.

Figure 24.2. **Taxation of energy in Norway on an energy content basis**

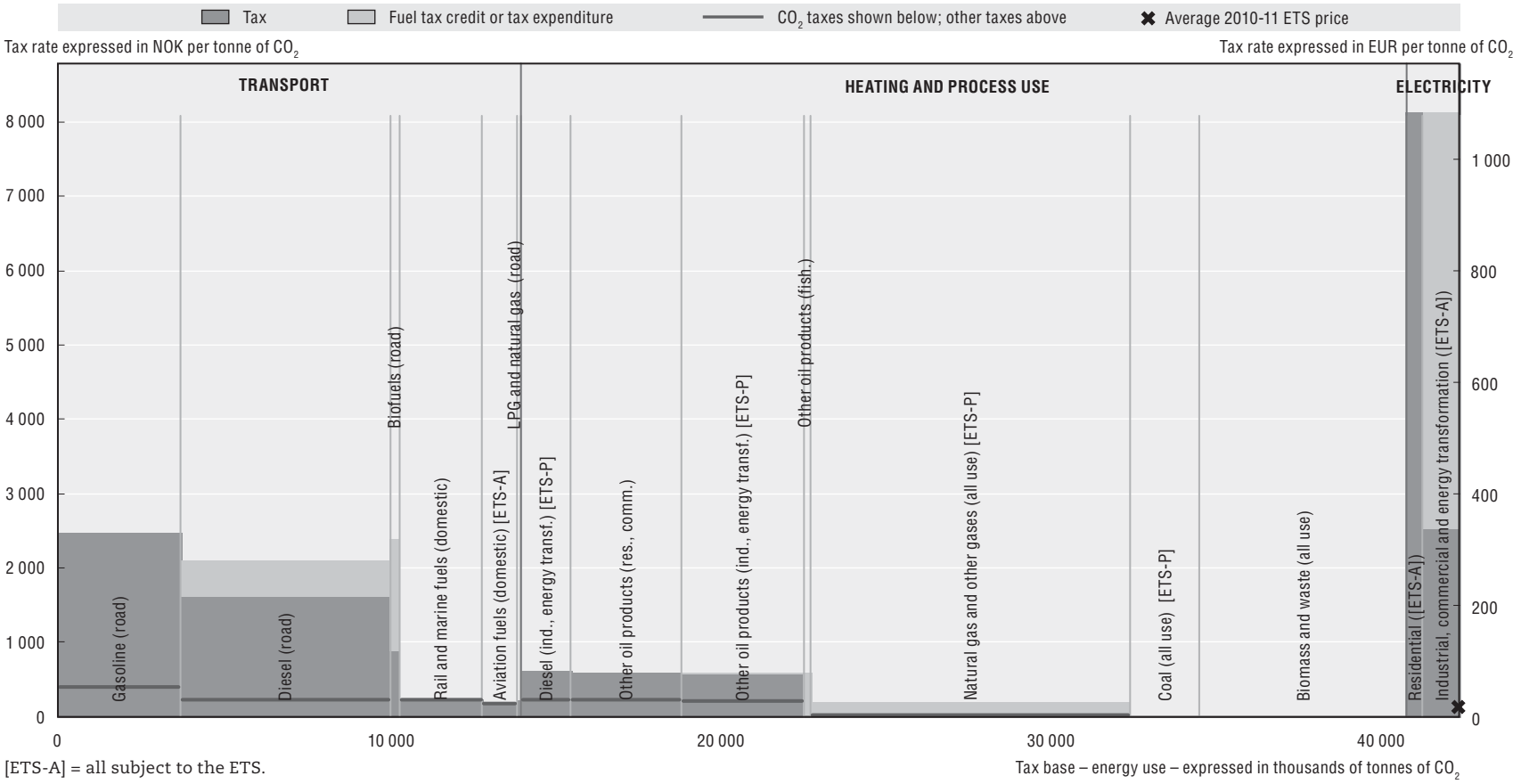


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766909

Figure 24.3. **Taxation of energy in Norway on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766928

Poland

Figures 25.1 and 25.2 map the use and taxation of energy in Poland on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In Poland, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). Energy taxes apply to gasoline, diesel, heavy fuel oil, kerosene, and LPG on a volume or mass basis. Higher tax rates apply to these fuels are higher when they are used for transport or industrial purposes, with reduced rates applying to the use of these fuels for heating. The use of LPG for heating is not taxed. Natural gas, coal, biomass, waste and renewable energy sources are not taxed.

The consumption of electricity is taxed at a flat rate of PLN 20 per MWh regardless of user, although electricity used in transport is exempt.

In addition to these taxes, a low-rate tax applies (at PLN 0.26 per 1 000 tonnes of carbon) to CO_2 emissions.

Energy use and taxation in Poland

As can be seen from the maps, transport represents 20% of all energy use and 16% of carbon emissions from all energy use. Fuels used for transport are generally subject to higher tax rates than fuels used for other purposes. Within the transport category, natural gas, biomass and waste are not taxed and account for 6% of energy use and emissions from the category. Gasoline, which accounts for 27% of energy use and 26% of the carbon emissions from transport use, is taxed at the highest rate of any fuel and use. A further 56% of energy used and 58% of emissions in the transport category arise from diesel use, which is taxed at a lower rate than gasoline. Transport fuelled by LPG is taxed a lower rate than either gasoline or diesel and accounts for 12% of energy use and 10% of emissions from this category.

The heating and process category accounts for 42% of energy use and 41% of emissions. In the heating and process category, the use of oil products for process purposes is generally taxed at a higher rate than those used for heating. Diesel for process use by the industrial sector is taxed at the same rate as diesel used as propellant, and accounts for approximately 7% of energy used in, and 6% emissions from, heating and process use. A lower tax rate applies to diesel used for heating purposes (2% of energy use and emissions from the heating and process category). Other oil products are taxed when used for industrial purposes (8% of heating and process energy and 6% of emissions). The majority of fuels used for process and heating use are not taxed, including coal (40% of energy and 46% of CO_2 emissions from heating and process use), natural gas (19% and 27% respectively) and renewables, biomass and waste (14% and 20%).

Energy used to generate electricity accounts for 38% of all energy use and 43% of emissions from energy use. In the maps, the consumption tax rate has been adjusted for the respective production efficiencies and carbon intensities of each fuel. This means that natural gas, which has a comparatively low amount of carbon per unit of energy, faces the highest effective tax rate, whereas coal faces a lower effective tax rate.

Reported tax expenditures and rebates

Poland reports a tax expenditure in relation to rebates of the diesel fuel tax for diesel used in farming, subject to some restrictions around the number of litres per hectare eligible for the refund. The rate is set annually by the Minister of Agriculture and Rural Development. No figures are reported, for this expenditure and due to the difficulty of establishing the correct benchmark, this measure is not shown on the graph.

Key assumptions and caveats

Some small categories have been combined into larger categories and a weighted average tax rate used. This is the case for "Other oil products (ind., energy transf.)" which includes all oil products used by industry other than diesel.

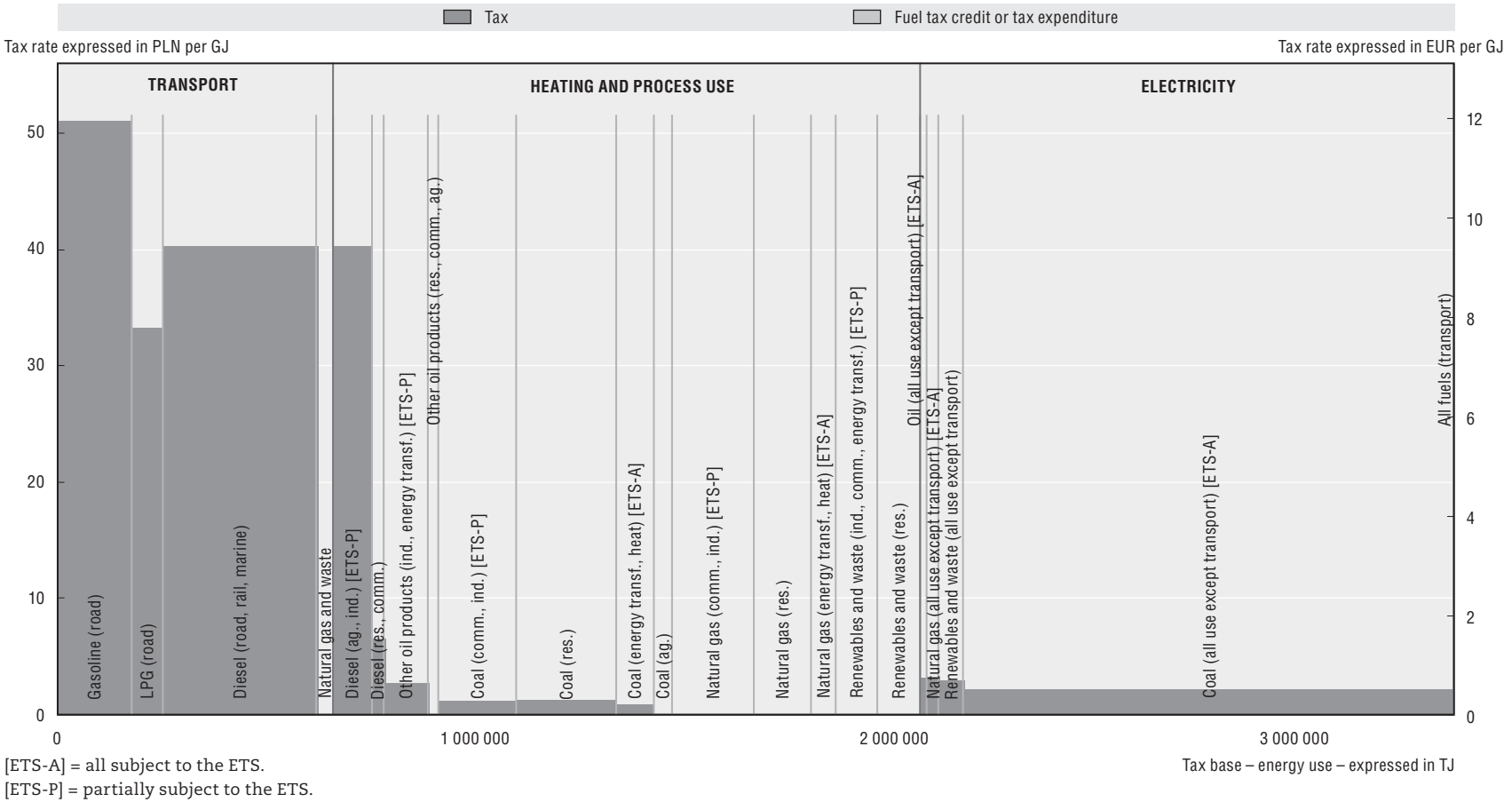
The tax on CO_2 has not been included on the graph; in part due to uncertainties regarding its application. However, as it is set at a very low rate, it would not be easily distinguishable from the scale of the maps.

We have assumed that fuels used by the industrial sector are primarily for process use, whereas fuels used by the commercial and residential sectors are primarily for heating use. The graph is constructed on this basis.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials.

Figure 25.1. **Taxation of energy in Poland on an energy content basis**

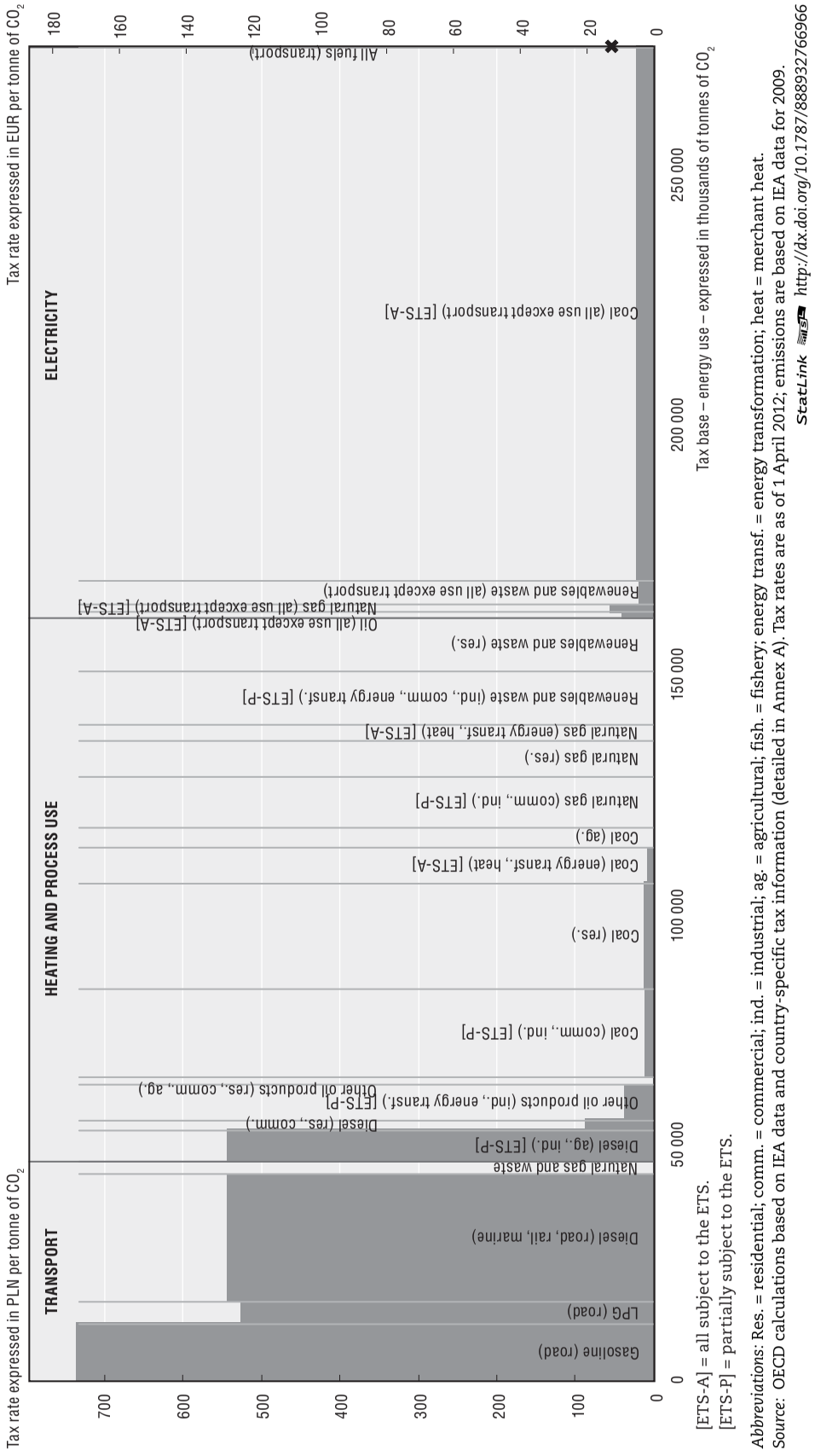


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766947

Figure 25.2. **Taxation of energy in Poland on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766966

Portugal

Figures 26.1 and 26.2 map the use and taxation of energy in Portugal on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In Portugal, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). In transport the tax rates are above the minimum rates set by the Directive for gasoline, diesel and natural gas, and equal to the minimum rate for LPG. The tax rates for heating and process fuels are above the minimum rate for diesel, LPG and fuel oil and below for the remaining fuels.

Only some fuels used for heating are taxed, and consumption of fuel for process use is in many cases exempt. Exemptions from excise duties are also provided for fuels used in aviation, rail transport, navigation and fishing. A reduced rate is applied to diesel oil consumed in agriculture and industry.

Electricity consumption is taxed in Portugal, with the exception of electricity used in public transport. Fuels used to generate electricity are not taxed.

Energy use and taxation in Portugal

Diesel used in transport is taxed at a lower rate than motor gasoline, on a per litre, energy, and CO_2 content basis. The majority of energy use (66%) and CO_2 emissions (67%) in transport come from road-use diesel, with gasoline contributing most of the remaining share (23% and 22% of energy use and CO_2 emissions, respectively). Rail and marine fuels (all diesel), biofuels and aviation fuels – which are all tax exempt – account for around another 10% of energy use and CO_2 emissions in transport.

With respect to heating and process fuel, tax rates apply to a limited range of energy products. Diesel is taxed at the highest rate and, together with a small amount of kerosene, accounts for around 11% of energy use and 9% of CO_2 emissions from heating and process fuels. Diesel used in industry and agriculture is taxed at a reduced rate. Industries covered by the European Emission Trading System (ETS) are not subject to the excise duties on coal, petroleum coke, fuel oil and LPG consumed. The exempted fuels account for 7% of energy use and 8% of CO_2 emissions from heating and process fuels. Fuel oil and LPG not covered by the ETS are taxed, but at lower rates than diesel. Renewables and waste are untaxed and account for 33% of energy use and 44% of CO_2 emissions from heating and process fuels. Natural gas is also untaxed and accounts for a further 18% of energy use and 12% of CO_2 emissions. Similarly, all fuels used in merchant heat production and energy transformation – constituting an additional 18% of energy use and 15% of CO_2 emissions – are untaxed.

Electricity generation in Portugal is dominated by coal, natural gas, and to a lesser extent renewables (predominantly hydro). These energy sources make up 36%, 29%, and 20%, respectively, of energy used to generate electricity. In terms of CO_2, coal generates 52% of emissions while natural gas generates a further 25% of emissions. Renewables are taxed at the highest effective tax rate in terms of energy use due to their greater efficiency in generating electricity than the other energy sources. Natural gas is taxed at the highest

effective tax rate in terms of CO_2 emissions. As noted above, electricity used for public transportation is untaxed.

Reported tax expenditures

Portugal reports several tax expenditures associated with the energy taxes in the official accounts (*Conta Geral do Estado*) prepared each year by the *Ministério das Finanças e da Administração Pública*. Most of them are set out in the maps:

- *Navigation and rail*: Fuel consumption in navigation and rail is tax exempt. In both cases energy consumption is entirely represented by diesel, whose tax rate for transport use has been used as benchmark to compute the tax expenditure. The corresponding amount is shown in light grey in the column "Rail and marine fuels (domestic)".
- *Biofuels*: Biofuels are not taxed and their consumption in Portugal is limited to biodiesel. The tax expenditure has been calculated using the tax rate of diesel as a benchmark. It is shown in the graph in light grey in the column "Biofuels (road)". This tax expenditure has a significant weight, as can be seen from the graph.
- *Diesel oil used in agriculture and industry*: A reduced rate is applied to diesel consumed in agriculture and stationary engines in industry. The graph shows a tax expenditure in the column "Diesel and kerosene (ind., ag.)", computed adopting as the benchmark the tax rate on diesel used as heating fuel. This is the largest tax expenditure reported by Portugal.
- *Fuel use in ETS sectors*: Coal, petroleum coke, fuel oil and LPG are exempt when used in industrial sectors covered by the European ETS. This exemption has not been shown on the maps but the interrelationship of the ETS with other taxes has been noted.

An exemption was previously in force for diesel oil for heating purposes, but it was removed in March 2011.

Tax expenditures are not reported for the exemption of aviation fuel, and for the lower tax rates applied to LPG and natural gas in transport.

Key assumptions and caveats

In terms of assumptions:

- When a different tax rate is levied on the same fuel used for heating and process use, *i.e.* for diesel, all the industrial consumption has been treated as process fuel, while the entire amount consumed by commercial and public sectors has been treated as heating fuel.
- ETS covered sectors have been considered to be iron and steel, non-ferrous metals, non-metals and chemical and petrochemical sectors, as included in the *Extended World Energy Balances*.
- On the basis of the information from the *Extended World Energy Balances* it has not been possible to disaggregate the share of diesel used in stationary engines in industry, which benefit from a reduced tax rate. Assuming that the majority of diesel consumption in industry relates to this use, all diesel consumed in industry has been assumed to benefit from the reduced tax rate.
- Fuel oil with a lower sulphur content is taxed at a lower rate. The tax basis could not be disaggregated based on the information from the *Extended World Energy Balances*. All the fuel oil consumed by ETS sectors has been assumed to have a sulphur content equal or

lower than 1%, and then treated as exempt. On the contrary, the tax rate represented in the graph is related to fuel oil with a sulphur content higher than 1%.

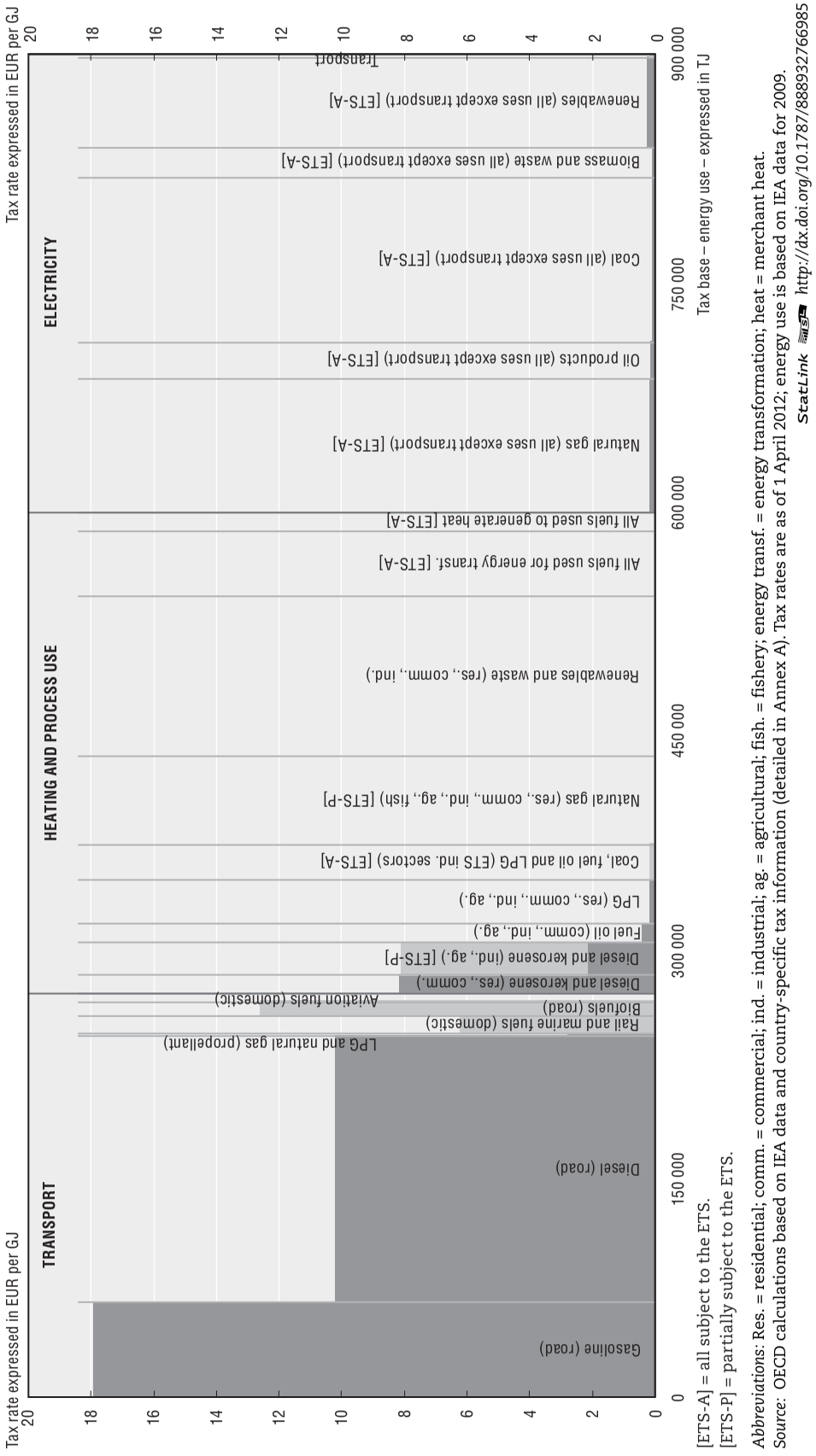
Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Portuguese Ministério das Finanças e da Administração Pública, Direcção-Geral do Orçamento (2009), *Conta Geral do Estado*. Available at: *www.dgo.pt/politicaorcamental/Paginas/Conta-Geral-do-Estado.aspx?Ano=2009*.

Portuguese Ministério das Finanças e da Administração Pública, Direcção-Geral do Orçamento (2010), *Conta Geral do Estado, www.dgo.pt/politicaorcamental/Paginas/Conta-Geral-do-Estado.aspx?Ano=2010*.

Figure 26.1. **Taxation of energy in Portugal on an energy content basis**



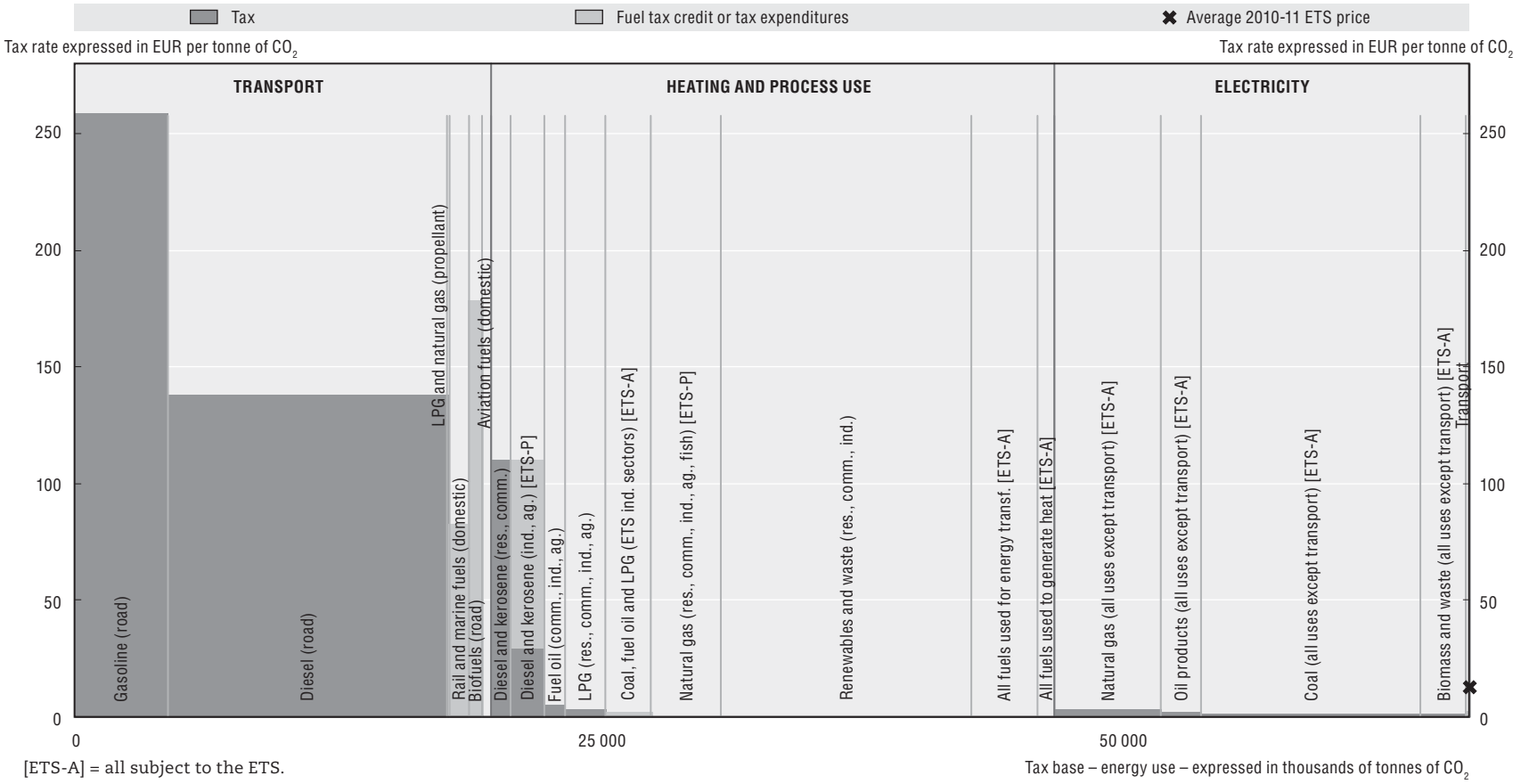
[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932766985

Figure 26.2. **Taxation of energy in Portugal on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932767004

Slovak Republic

Figures 27.2 and 27.3 map the use and taxation of energy in the Slovak Republic on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In the Slovak Republic, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). Tax rates are generally levied above the minimum level prescribed by the Directive. Coal used for residential heating and LPG used for residential or commercial heating are exempt from excise taxes, as are biofuels, biomass and waste.

Electricity is taxed at a single rate for all users, with the exception of residential users who are exempt from the electricity excise tax. Fuels used for the purpose of electricity generation are exempt from tax.

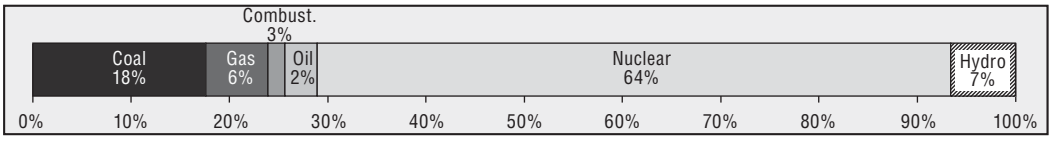
Energy use and taxation in the Slovak Republic

As can be seen from the maps of energy use and taxation that follow, gasoline and diesel dominate the transport category. Together they constitute 74% of energy used and 77% of CO_2 emissions produced in transportation. Natural gas contributes a further 18% and 15%, respectively, of energy used and CO_2 emissions. The remainder of the transport category is made up of biofuels and a small amount of LPG. Gasoline is taxed at the highest effective rate, with diesel also taxed at a relatively high level. LPG and natural gas are taxed at comparatively low rates, while, as noted above, biofuels are untaxed.

The heating and process use category is dominated by natural gas and coal. These account for 44% and 27%, respectively, of the heating and process energy use, and 29% and 31% of the CO_2 emissions in this category. Blast furnace gas also contributes significantly, particularly in terms of CO_2 where it contributes 18% of the emissions in this category. Only a small amount of diesel is used in this category, but it faces by far the highest effective tax rate. Natural gas is taxed at different rates according to user, with residential users facing a far lower rate than other users. Residential and commercial use of LPG is untaxed, although this cannot be seen in the maps due to the grouping of all LPG uses together (due to the small quantities of LPG used in this category). Blast furnace gas and other gas products, biofuels and waste, and coal used for residential purposes are all untaxed.

Electricity generation is dominated by the use of nuclear energy, which makes up 66% of energy used to generate electricity (see Figure 27.1). The predominance of (non-CO_2 producing) nuclear electricity generation results in the electricity category being far smaller in CO_2 terms than in energy terms.

Figure 27.1. **Fuels used to generate electricity in the Slovak Republic (TJs)**



Source: OECD calculations using 2009 IEA Energy Balance data (IEA, 2011a)

StatLink http://dx.doi.org/10.1787/888932767023

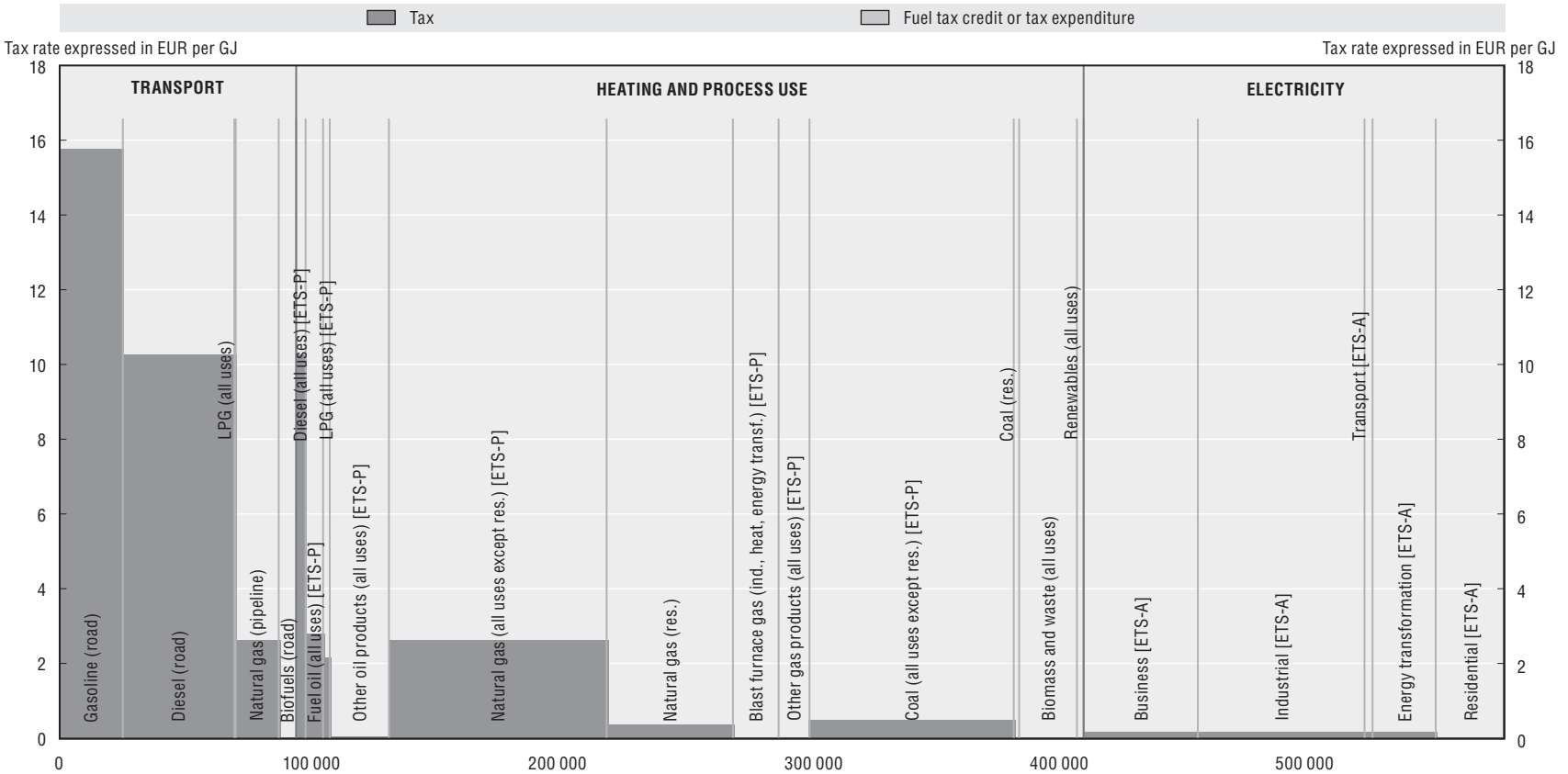
Reported tax expenditures and rebates

The Slovak Republic does not provide any fuel tax rebates, nor does it report any of its fuel tax rate discrepancies for various fuels and users as constituting tax expenditures.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials.

Figure 27.2. **Taxation of energy in the Slovak Republic on an energy content basis**

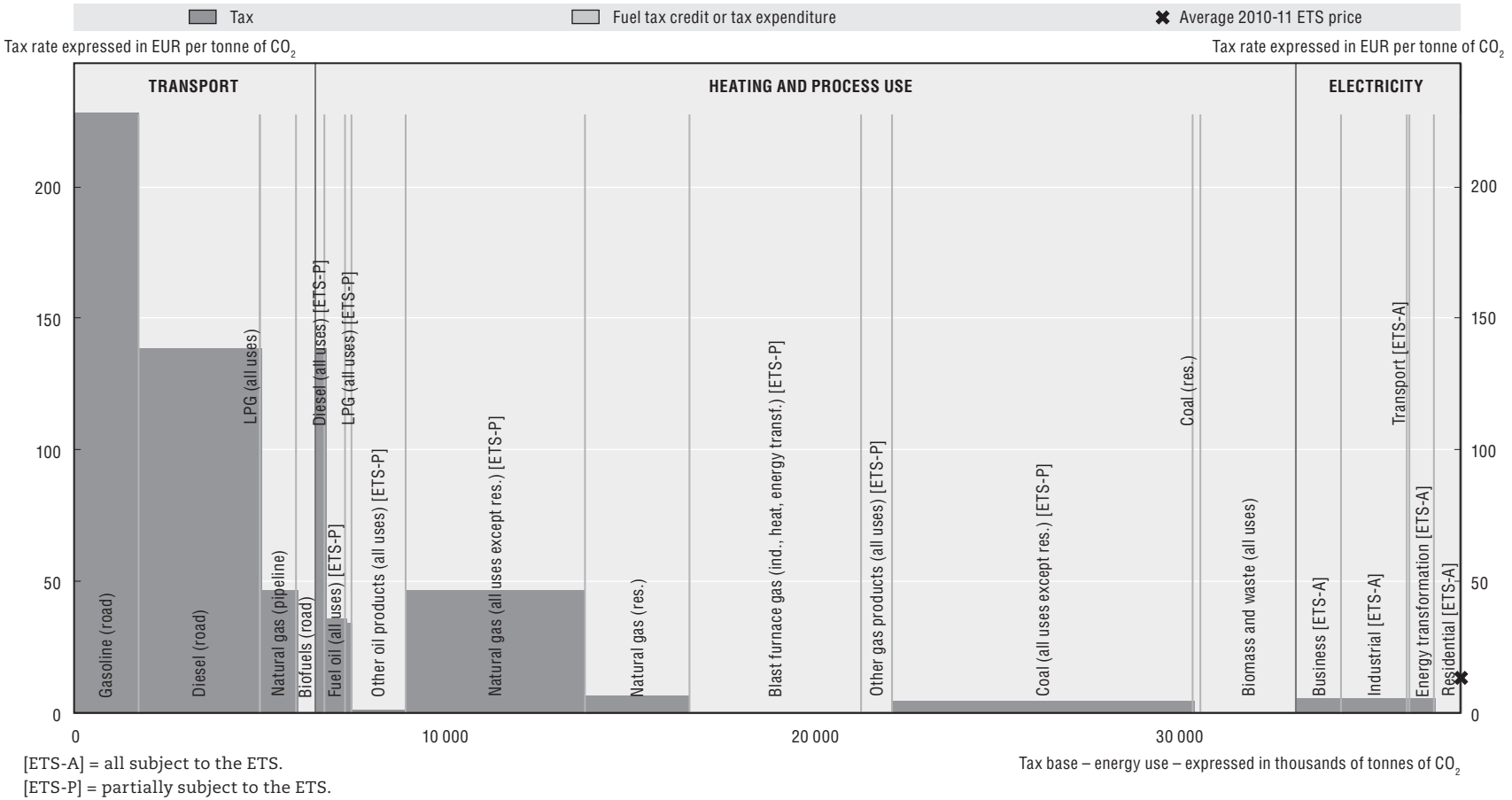


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932767042

Figure 27.3. **Taxation of energy in the Slovak Republic on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932767061

Slovenia

Figures 28.1 and 28.2 map the use and taxation of energy in Slovenia on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In Slovenia, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). The following energy products are exempted from energy excise taxes: energy products used for purposes other than transport or heating; used for commercial aviation and navigation; used for cogeneration of heat and electricity and production of electricity; used by producers in their production facilities for further processing or production of other non-excise products or other energy products and electricity; injected into furnaces for purposes of chemical reduction as an addition to coke; used for production of other non-metallic mineral products; dual use of energy products (as heating fuel and for purposes other than propulsion or heating); LPG used for heating; biofuels and biomass.

Additionally, a 70% refund is provided for excise taxes paid on gasoline and diesel used as a propellant in agriculture and forestry. A 50% refund is provided for excise taxes paid on energy products used as motor fuels for stationary working machines, motor rail track vehicles in railway transport, and cable cars. A partial refund is also provided for excise taxes paid on diesel used as a propellant for commercial transport of goods and passengers, lowering the effective excise tax rate to the minimum level under the EU Energy Taxation Directive (EUR 330 per 1 000 litres). A refund for biofuels added to fossil fuels is provided in proportion to the share of the added products, but no more than 5%.

Electricity is taxed at a single rate for all users. Excise duty shall not be payable on electricity if used for chemical reduction and electrolytic and metallurgical processes; in cases where electricity represents over 50% of the cost of products, and when generated in small hydroelectric power plants from renewable energy to power up to 2 MW and is used for the producers own needs. Fuels used for the purpose of electricity generation are exempt from tax.

Energy use and taxation in Slovenia

As can be seen from the maps of energy use and taxation that follow, gasoline and diesel together constitute almost all (98%) of both energy used and CO_2 emissions produced in transportation. LPG, aviation fuels and biofuels make up the remaining 2%. Gasoline is taxed at a higher effective rate than diesel (in terms of both energy and CO_2 content), with diesel for commercial road use taxed slightly less than diesel for non-commercial road use. The effective tax rate on LPG is around one-fifth of that on gasoline, while aviation fuels and biofuels are untaxed.

The heating and process use category is dominated by diesel, natural gas, and biomass and waste. These account for 30%, 32% and 21%, respectively, of the heating and process energy use, and 29%, 22% and 31% of the CO_2 emissions in this category. Diesel is taxed at differing rates according to user. Diesel for industrial use is taxed at the highest effective rate (both in terms of energy and CO_2 content). While this rate is lower than that applying to diesel used in the transport sector, it is more than twice the rates applying to diesel used

in agriculture, and diesel used for residential or commercial purposes. LPG is taxed at the next highest rate, with natural gas, coal and other oil products taxed at lower rates. Untaxed biomass and waste, fuels used for merchant heat production, and LPG used for residential purposes, result in 33% of energy use, and 43% of the CO_2 emissions, in this category being untaxed.

Electricity generation is dominated by nuclear energy and coal. These make up 46% and 37% of energy used to generate electricity. Meanwhile, coal makes up 92% of CO_2 emissions from electricity generation. As a result of the substantial use of nuclear energy (and renewables), the electricity category is substantially smaller in CO_2 terms than in energy terms. The highest effective tax rate (in terms of both energy and CO_2) falls on natural gas. This rate is around twice the rates applying to other energy products when measured in terms of CO_2, though only slightly higher in terms of energy. The higher rate is due to natural gas being more efficient than the other energy sources at producing electricity in terms of the energy required to produce a fixed amount of electricity, and in terms of the CO_2 emitted relative to the other non-renewable energy sources. This results in a higher effective tax rate because the tax on electricity consumption is effectively imposed on smaller amounts of energy and CO_2 than would otherwise be the case.

Reported tax expenditures and rebates

Slovenia reports a number of tax expenditures that can be identified in the maps:

- *Agriculture:* Slovenia provides a 70% refund of excise taxes paid on gasoline and diesel used as a propellant in agriculture. The standard excise rate for each fuel is used as the benchmark in the maps.
- *Aviation and marine fuels:* Slovenia provides an exemption from excise taxes for fuels used in commercial aviation and navigation. Neither of these tax expenditures is identifiable in the maps. This is because aviation fuels have been grouped together with biofuels (due to the small quantity used), and because there is no significant usage of marine fuels in Slovenia.
- *Diesel used as a propellant for commercial purposes:* Slovenia provides a partial refund for excise taxes paid on diesel used as a propellant for commercial transport of goods and passengers, lowering the effective excise tax rate to the minimum level under the EU Energy Taxation Directive (EUR 330 per 1 000 litres). The standard excise rate for diesel used as a propellant is used as the benchmark in the maps.
- *Stationary working machines:* Slovenia provides a 50% refund of excise duties paid on motor fuels for stationary working machines, machines in construction engineering and machine tools, motor rail track vehicles in railway transport, and cable cars. Diesel is the main fuel used in stationary working machines. The standard excise rate for diesel used as a propellant is used as the benchmark in the maps.

Key assumptions and caveats

In the maps, commercial use diesel is assumed to be used or heating purposes, while industrial use diesel is assumed to be used for one of the uses subject to the 50% refund for stationary working machines (see above).

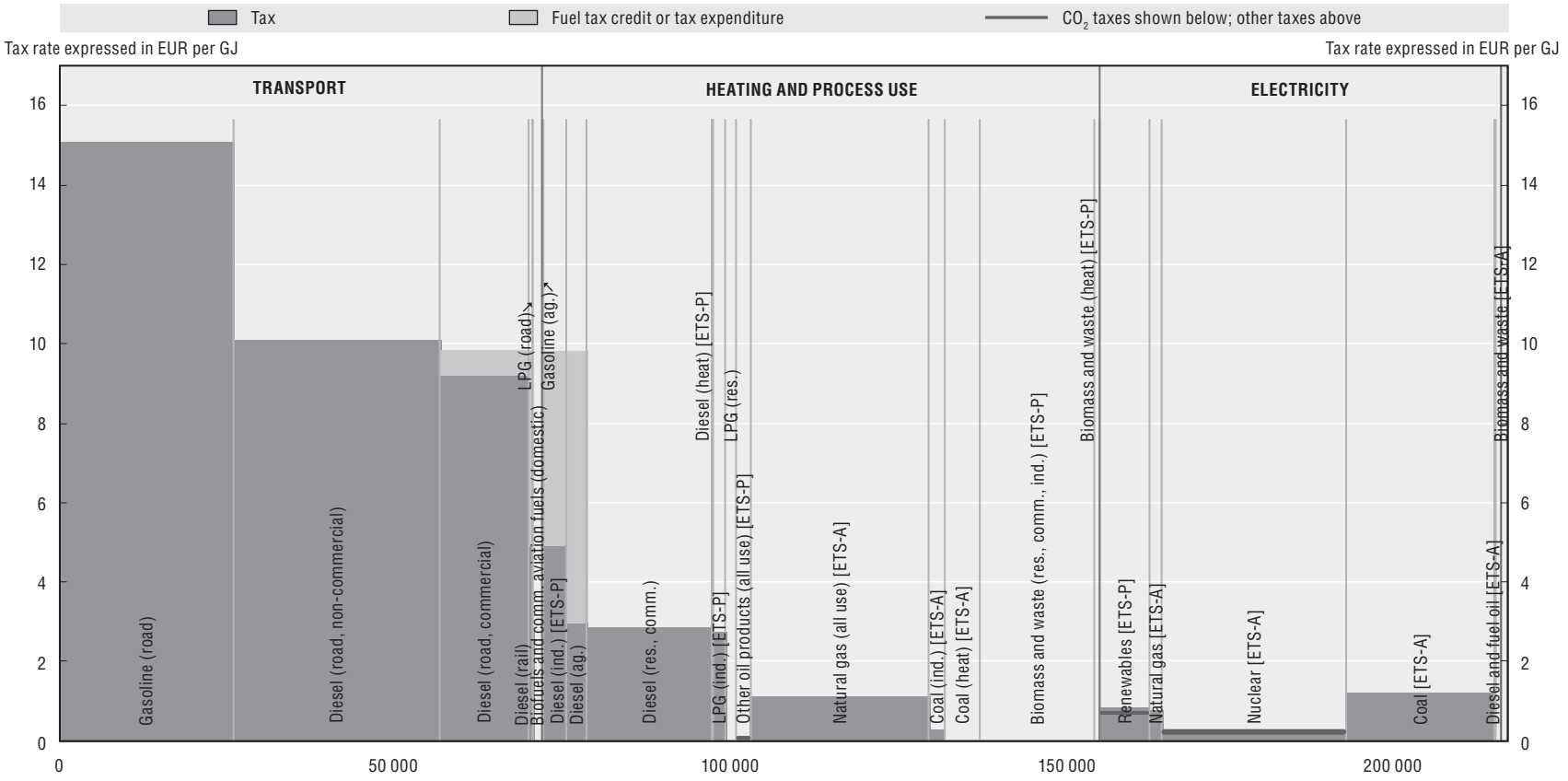
Note that, in 2010, a contribution for improving the efficiency of electricity consumption and a fuel-price supplement started to be charged on the use of fossil energy. These funds are used for programs aimed at achieving energy savings. Neither is included in the maps.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Slovenian Ministry of Finance, *Excise Duty Act*. Available at: *www.mf.gov.si/fileadmin/mf.gov.si/pageuploads/Davki_in_carine/Sprejeti_predpisi/Zakon_o_tro%C5%A1arinah/Excise_duty_act-unofficial_translation.pdf*.

Figure 28.1. **Taxation of energy in Slovenia on an energy content basis**

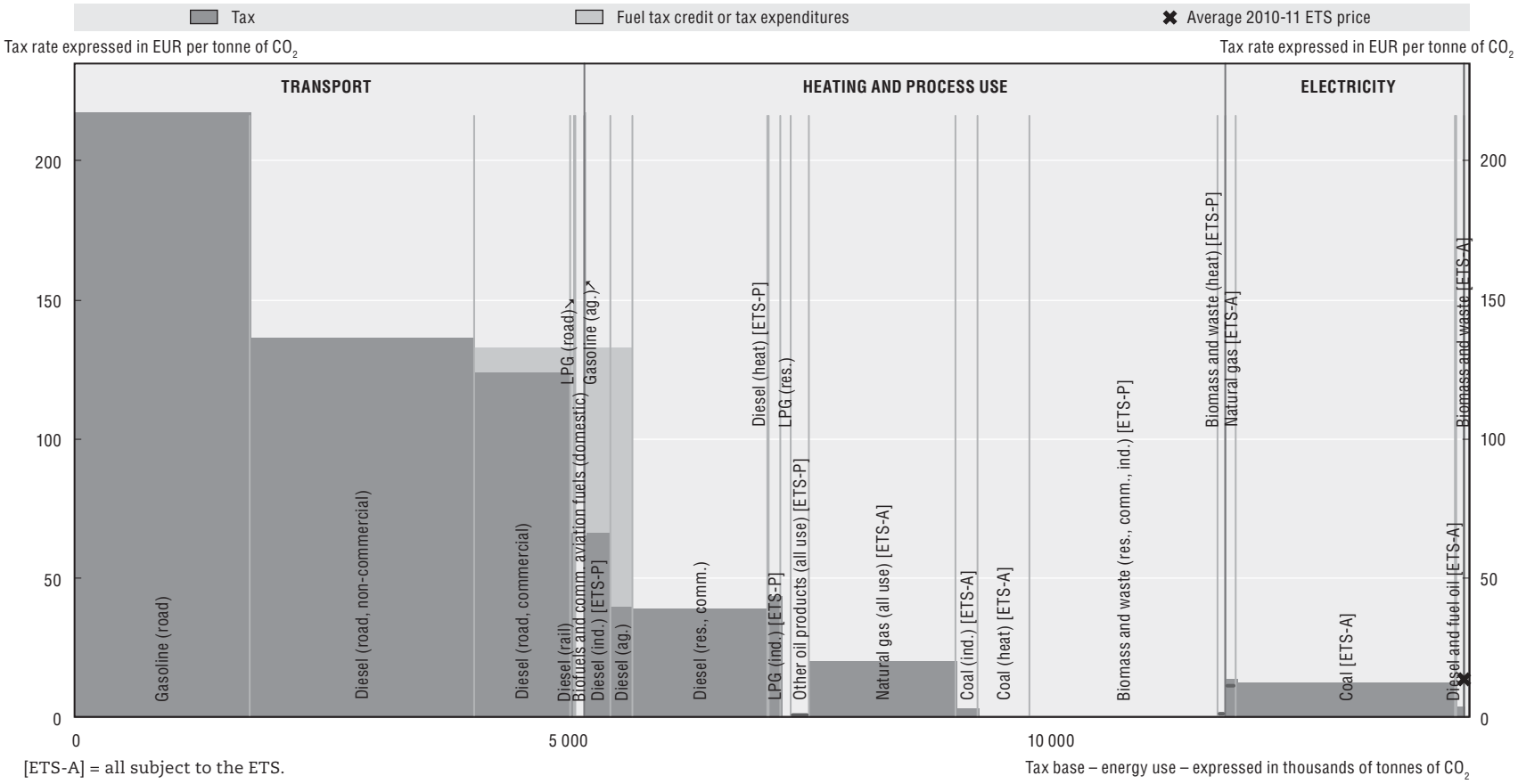


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932767080

Figure 28.2. **Taxation of energy in Slovenia on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932767099

Spain

Figures 29.2 and 29.3 map the use and taxation of energy in Spain on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In Spain, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). For heavy fuel oil, coal and coke and electricity the tax rate is equal to the minimum tax rate set by the Directive, and for LPG and natural gas it is lower.

A sales tax expressed in volume terms, called *Impuesto sobre las Ventas Minoristas de Determinados Hidrocarburos*, is also applied in Spain at the national level. A tax rate of EUR 0.024 per litre applies to gasoline, kerosene and diesel used as transport and process fuels. Diesel used as a heating fuel is taxed at a lower rate of EUR 0.006 per litre. A tax rate of EUR 0.001 per litre applies to heavy fuel oil used both as a heating or process fuel. With respect to the energy products sold within their territories, regions can increase these tax rates up to twice their original level.

The sale tax described above was introduced in 2001 in order to raise additional revenue at regional level which can be used to provide better public services, according to the "*corresponsabilidad fiscal*" approach. In the future, this tax may be abolished and replaced by regional differentiations in the harmonised excise duty.

Exemptions from the excise duties are provided for the fuels used in aviation, navigation and rail transport. Process use of fuels is generally taxed whereas use as heating use of fuels is in many cases exempt. A refund is applied to diesel consumed in agriculture and fishing.

Biomass, waste and renewable energy are not taxed when used to produce heat or electricity. Fuels used to generate electricity and heat are not taxed, and the consumption of electricity is taxed for non-industrial users.

Energy use and taxation in Spain

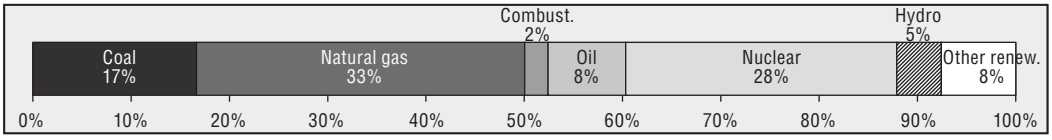
In line with the level of the minimum tax rates introduced by the EU Directive, diesel used in transport is taxed at a lower rate than motor gasoline, both on a per litre and CO_2 content basis. Around two-thirds of energy used in transport (68%) and the resulting CO_2 emissions (69%) are from the use of diesel. Gasoline, on which the highest tax rate is levied, accounts for another 18% of energy use and 17% of CO_2 emissions in the transport category. The remainder of the transport category is made up of untaxed rail and marine fuels, aviation fuels, and biofuels, together with very small amounts of LPG and natural gas which are taxed at lower rates than diesel and gasoline. Spain plans to remove the exemption for biofuels in 2012.

With respect to heating and process fuel, tax rates are differentiated by use. Process use is always taxed, whereas heating use of LPG and natural gas is exempt. Natural gas accounts for 36% of heating and process energy use and 28% of the resulting CO_2 emissions. Around one-third of the natural gas tax base is exempt from the excise duty. Diesel, which is taxed at the highest rate, accounts for around 15% of both heating and

process energy use and CO_2 emissions. Diesel used in agriculture and fishing faces a slightly lower tax rate than diesel used for residential, commercial and industrial purposes. All fuels used for energy transformation are untaxed, as are renewable and waste. Together with natural gas used for residential and commercial purposes, this results in 43% of energy use, and 45% of CO_2 emissions being untaxed.

Electricity consumption is taxed in Spain and the maps show the lower rate applying to industrial users over non-industrial users. The main energy sources used to generate electricity in Spain are natural gas and nuclear energy (see Figure 29.1), followed by coal and renewables (hydro, solar and wind). Due to the significant use of nuclear energy and renewables, the electricity category is proportionately smaller in CO_2 terms than in energy terms.

Figure 29.1. **Fuels used to generate electricity in Spain (TJs)**



Source: OECD calculations using 2009 IEA Energy Balance data (IEA, 2011a)

StatLink http://dx.doi.org/10.1787/888932767118

Reported tax expenditures

Spain's official budget documents report tax expenditures by aggregating them by the fuel (*Proyecto de Presupuestos Generales del Estado*) or by the type of measure (*Presupuestos generales del estado*) to which they are related, and distinguish between exemptions and refunds.

Several tax expenditures reported by Spain can be identified in the maps:

- *Aviation fuel*: Spain estimates a tax expenditure corresponding to the exemption for aviation fuel used by domestic commercial flights. The tax on kerosene used in aviation for leisure purposes has been used as the benchmark in order to compute the value shown in the graph. This exemption can be seen in the column marked "Aviation fuels (domestic)". Together with "rail and marine fuels (domestic)", this represents the majority of tax expenditures from tax exemptions reported by Spain.
- *Rail and marine*: Spain exempts fuels used in navigation and railways. These are primarily diesel with minimal use of fuel oil in rail transport. The relevant tax expenditure is shown in the column "Rail and marine fuels (domestic)". The tax rate of diesel for propellant use and the tax rate of fuel oil have been used as benchmarks in its computation. This tax expenditure constitutes almost the entire tax expenditure on diesel reported by Spain.
- *Biofuels*: In Spain, biofuels are tax exempt. The tax expenditure has been calculated using the tax rate of gasoline and diesel as the benchmarks respectively for ethanol and biodiesel. It is shown in the maps in light grey in the column "Biofuels (road)".
- *Diesel oil in agriculture and fishing*: In Spain, a refund rate is applied to diesel used in agriculture and fishing. The corresponding tax expenditure has been computed using the tax rate for diesel used as a heating and process fuel. If compared to other tax expenditures reported by Spain, this amount is not very significant, as is shown in the graph.

Tax expenditures are not reported for the exemption of natural gas consumed by residential and other users or for the lower tax rate applied to electricity in industry. More generally, the lower taxation of diesel with respect to gasoline in transport and the differential treatment of fuels for heating or process use are not considered to be tax expenditures.

Key assumptions and caveats

Key assumptions include:

- When a different tax rate is levied on process and use, *i.e.* natural gas and LPG, all the industrial consumption has been treated as process fuel use, while the entire amount consumed by the commercial and public sectors as heating fuel use.
- In Spain the electricity tax must equate to 4.864% of the price of the electricity supplied to a given consumer. The tax rates shown in the graph amount to EUR 0.5 per MWh and EUR 1 per MWh for industrial and other users respectively. They represent a minimum level for the tax rate. The *ad valorem* tax rate could not be represented due to lack of data.
- The sales tax has been added to the excise duty and only the national rate has been taken into account.

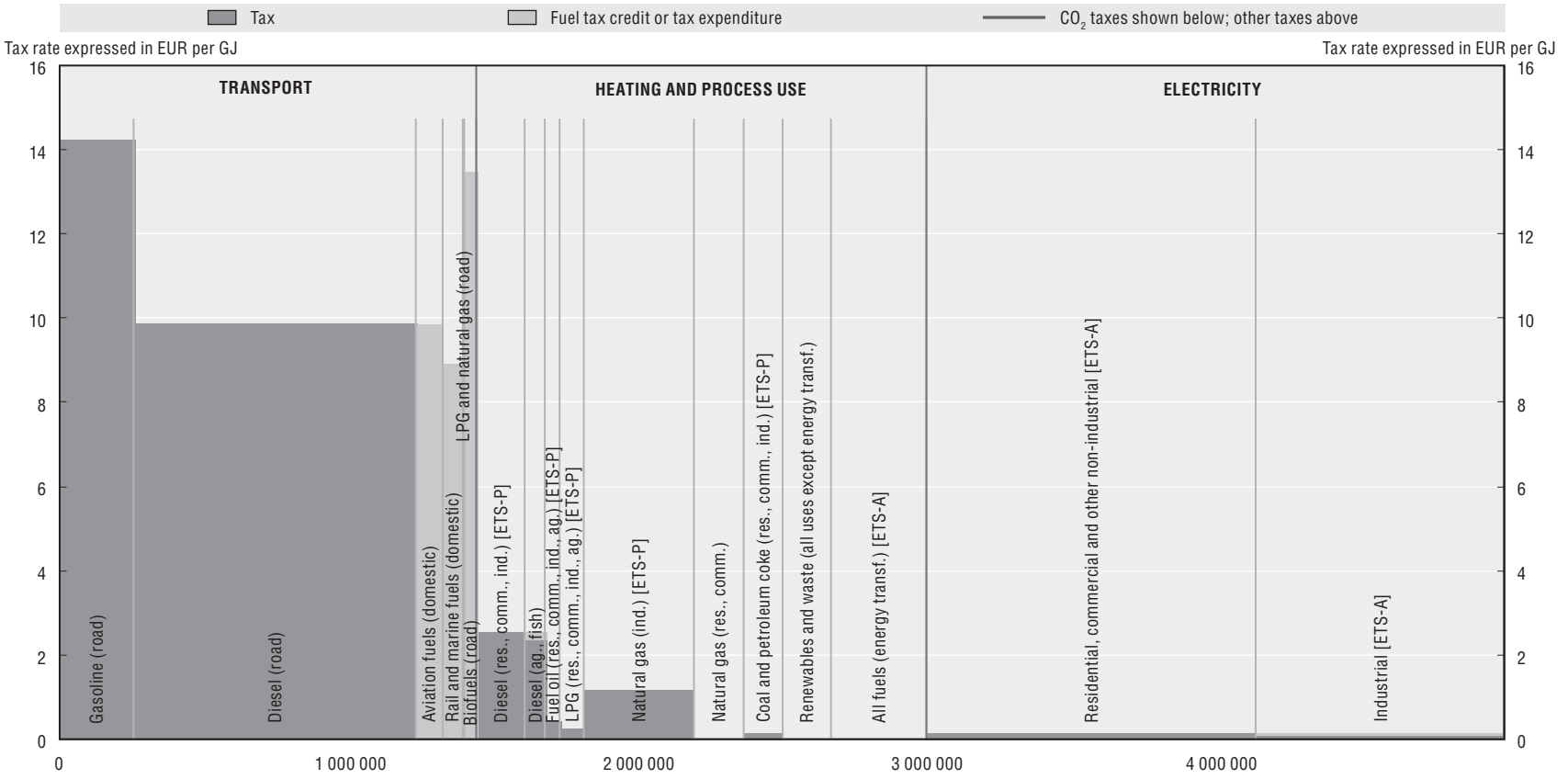
Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Spanish Ministerio de Economía y Hacienda (2010), *Presupuestos Generales del Estado*. Available at: *www.sgpg.pap.meh.es/Presup/PGE2010Ley/MaestroDocumentos/PGE-ROM/doc/1/2/1/5/N_10_E_R_2_101_1_5_1_1.PDF*.

Spanish Ministerio de Economía y Hacienda (2009), *Proyecto de Presupuestos Generales del Estado*. Available at: *www.sgpg.pap.meh.es/Presup/PGE2010Proyecto/MaestroDocumentos/PGE-ROM/doc/3/2/5/N_10_A_A_1B_C9_1.PDF*.

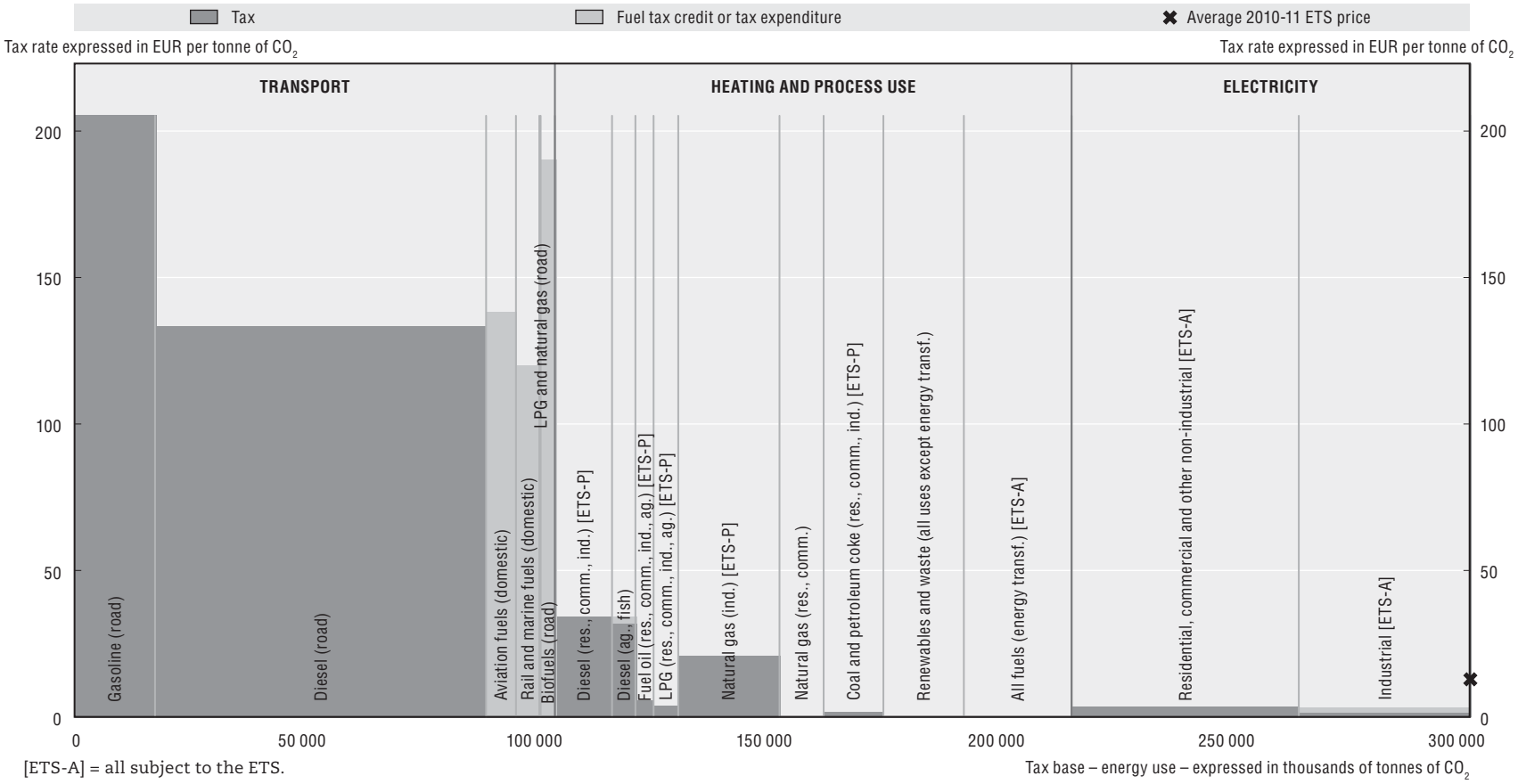
Figure 29.2. **Taxation of energy in Spain on an energy content basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932767137

Figure 29.3. **Taxation of energy in Spain on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932767156

Sweden

Figures 30.2 and 30.3 map the use and taxation of energy in Sweden on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In Sweden, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). Sweden's energy taxes are based on two components: an energy content component and a CO_2 emissions component. In the attached graph, the energy content component has been converted to the common basis of carbon emissions and both components have been aggregated to show both on a single diagram. While this approach is not able to illustrate the full thinking behind the Swedish approach, it allows Sweden's energy tax system to be presented on a uniform basis with those of other countries.

Under the energy content component, tax is applied to certain fuels used for transport and heating purposes according to their energy content. Within the transport category, gasoline and diesel are taxed, with a reduced rate applying to diesel. Exemptions apply to domestic aviation, rail and marine transport, and other transport fuels such as LPG.

Heating oil, natural gas, LPG and coal used for heating are also taxed under the energy component. Heating oil is taxed most heavily on an energy content basis, with lower rates applied to the other fuels. Biofuels and fuels for industrial use are not taxed under this component.

The energy component applies to the consumption of electricity on a per MWH basis. Electricity consumed by households is taxed at SEK 283 per MWH, except in Northern Sweden, where the rate is set at SEK 187 per MWH. A reduced rate is applied to electricity consumed by industry (at SEK 50 per MWH).

The CO_2 tax is structured to complement the EU's Emission Trading System. Consequently, the CO_2 tax does not apply to fossil fuel combustion at plants that are above the 20 MWh threshold and therefore covered by emission trading; the tax only applies to smaller plants. Reductions in the standard rate or refunds apply to fuels used by certain industries (including the agriculture and fishing industries, and some industries outside the EU ETS) and to LPG and natural gas used for road transport. Domestic aviation and navigation are exempt. As the consumption of electricity does not generate CO_2 emissions, consumption of electricity is not taxed under this component.

Energy use and taxation in Sweden

Figures 30.2 and 30.3 shows both components of Sweden's energy taxes (in a single map). The level of the CO_2 component is shown by the lines across the graph.

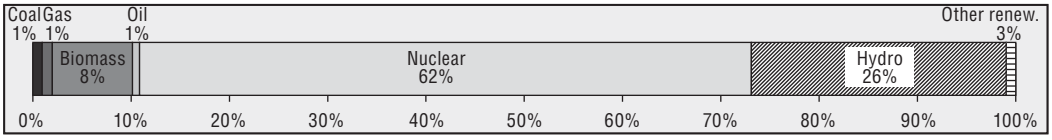
As is evident from the maps, gasoline is taxed more heavily than diesel in the transport sector primarily due to the higher energy component applying to gasoline. Gasoline (at 45%) and diesel (at 43%) account for the vast majority of energy and emissions in the transport category. Renewables are more lightly taxed and account for a further 6% of energy and 5% of emissions. The remainder of emissions from transport uses (for

example, from domestic aviation and navigation) are not taxed under either the energy component or the carbon dioxide component.

In the heating and process use category, biomass and gas (other than natural gas) are untaxed, and account for approximately 62% of energy use and emissions from this category. The remainder of fuels used, including natural gas, coal, and oil products are taxed at lower rates on a carbon emissions basis than fuels used in transport.

Electricity accounts for around 47% of total energy use and 10% of total carbon emissions from energy use. As shown in the map, approximately 24% of energy and emissions relating to electricity are used to generate electricity for household consumption; industrial and commercial consumption is taxed at a lower rate. Although the CO_2 component of Sweden's fuel taxation does not apply to the consumption of electricity, the energy component does apply as discussed above. In energy terms, this means that electricity is taxed at lower rates than transport fuels. However, in the CO_2 map, the highest rates shown are those for electricity. The reason the rate is high when converted to a carbon emission basis is that the graph looks through electricity consumed by end-users to the fuels used to produce it. In Sweden, electricity is largely produced from hydro or nuclear sources with only a minimal amount being produced from oil and coal. As a result, carbon emissions per unit of energy in Sweden are very low. Correspondingly, when the energy content component of the tax is applied to the carbon emissions from the fuels used to produce electricity, the total tax rate per tonne of CO_2 emitted is high. The energy used to produce electricity in Sweden is shown in Figure 30.1.

Figure 30.1. **Fuels used to generate electricity in Sweden (TJs)**



Source: OECD calculations using 2009 IEA Energy Balance data (IEA, 2011a)

StatLink http://dx.doi.org/10.1787/888932767175

Reported tax expenditures

In the official estimates of tax expenditures (Swedish Government, 2012), the starting point for establishing the benchmark against which energy tax expenditures are measured is that all energy use should be subject to the same tax rate per unit of energy content. Two types of differentiation are made: *i)* a higher benchmark rate is applied for electricity, to reflect the fact that one energy unit of electricity represents more than one energy unit of basic fuels, due to the energy loss in electricity generation; and *ii)* a higher benchmark rate is applied for transport fuels than for heating and process fuels, to reflect the additional externalities associated with road transport (wear and tear on roads, noise and traffic accidents). For the CO_2 tax expenditures, no differentiation is made in the official tax expenditure estimates: the standard CO_2 tax rate is the benchmark.

As the graph combines these two tax components, these official benchmarks cannot be applied as such and illustrated in the graph. Therefore, the two benchmarks have been added in a similar way to the tax rates. This shows that when aggregated, the benchmarks for transport are at very similar rates per tonne of CO_2, as are those for heating and fuel use, but at a lower rate. The difference between these reflects the fact that part of the

benchmark is based on energy rather than the CO_2 component. No expenditure is reported in respect of biomass or other gases.

Key assumptions and caveats

Several caveats apply to the map:

- Some categories have been combined into larger categories to allow the graph to be more easily read. Where this has occurred a weighted tax rate based on the CO_2 emissions generated by each fuel has been used. An example of this is the "All oil fuels (res., comm.)" category in the "Heating and Process Fuel Use" category where due to the small size of emissions from fuel oil, LPG and diesel from residential and commercial use, these have been included in a single category.
- The use of fuels by industries subject to the EU ETS has not been shown on this graph due to data restrictions. These industries are subject to the energy component of Sweden's tax system but are not taxed under the CO_2 component. Because these industries are subject to the ETS, Sweden does not report tax expenditures under the CO_2 component in relation to these industries. The graph indicates sectors that are substantially or fully subject to the ETS (with "[ETS-A]") and those that are partially subject to the ETS (with "[ETS-P]"). Fuels used in sectors considered partially subject to the ETS include diesel, heavy fuel oil, and natural gas used by industry. Those considered substantially or fully subject to the ETS are coal used by industry and the production of electricity.
- Where a different tax rate is levied on process and heating use, industrial use has been treated as process use, and commercial use has been treated as heating use.
- Although not shown on the graph, while the tax on diesel fuel is lower than on gasoline for road use, vehicles powered by diesel are subject to a higher annual vehicle tax than vehicles powered by gasoline for road use.

Following legislation passed in December 2009, Sweden is now in the process of reducing tax expenditures in its energy and CO_2 taxes. The tax rate for diesel will rise to SEK 173 per MWh in 2013. Currently, industry and agriculture pay 30% of the standard tax rate on heating fuels, which will increase to 60% as of 2015. In relation to the CO_2 component, the tax refunds granted for diesel used as propellant in agricultural and forestry will decrease in 2013 and will further decrease in 2015.

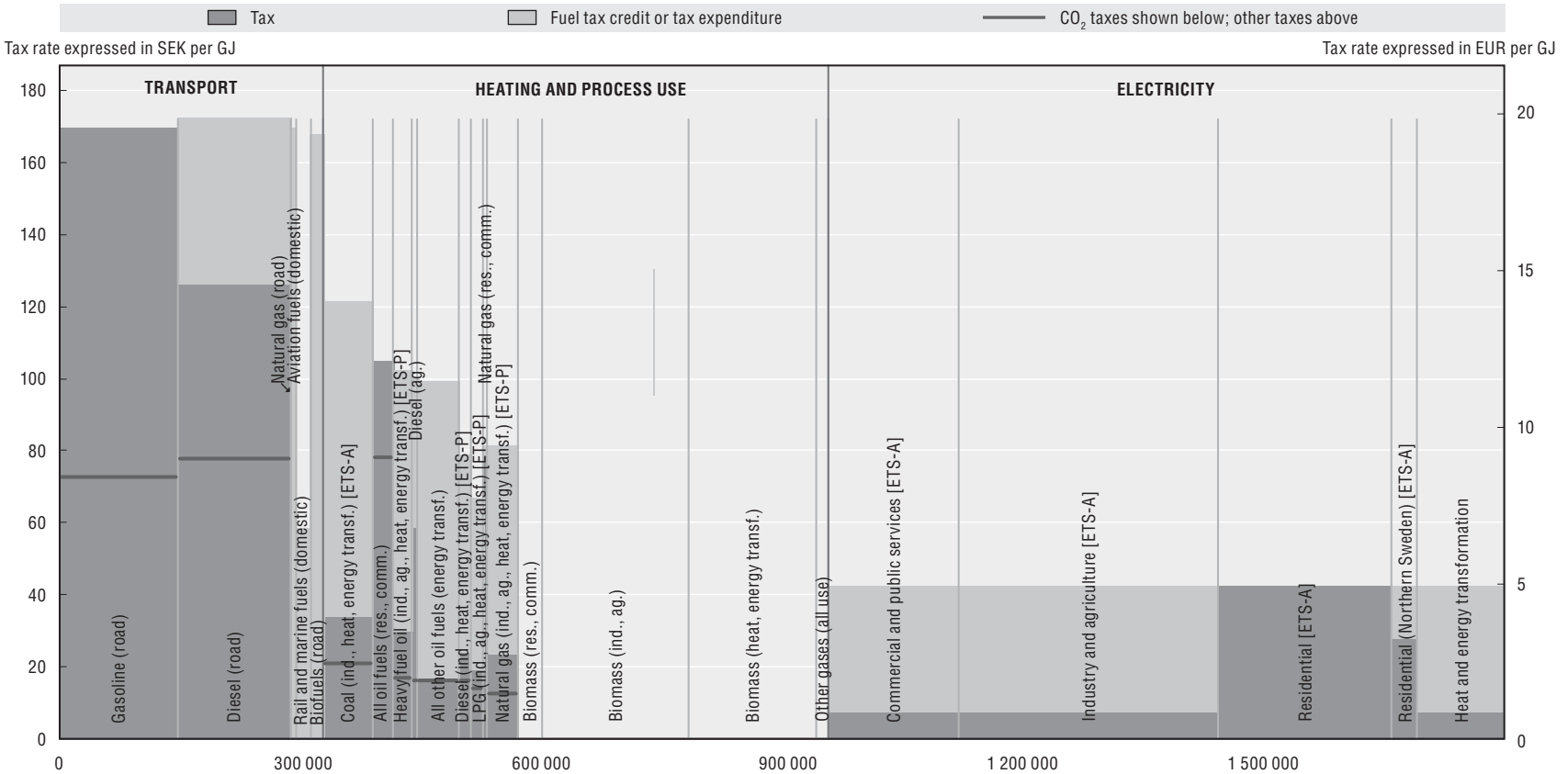
Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Government of Sweden (2012), *Redovisning av skatteutgifter*. Available at: *www.regeringen.se/content/1/c6/19/05/28/c426c21e.pdf*.

Statistics Sweden (2010), *Miljörelaterade skatter, subventioner och utsläppsrätter*. Available at: *www.scb.se/Pages/PublishingCalendarViewInfo____259923.aspx?PublObjId=15909*.

Figure 30.2. **Taxation of energy in Sweden on an energy content basis**

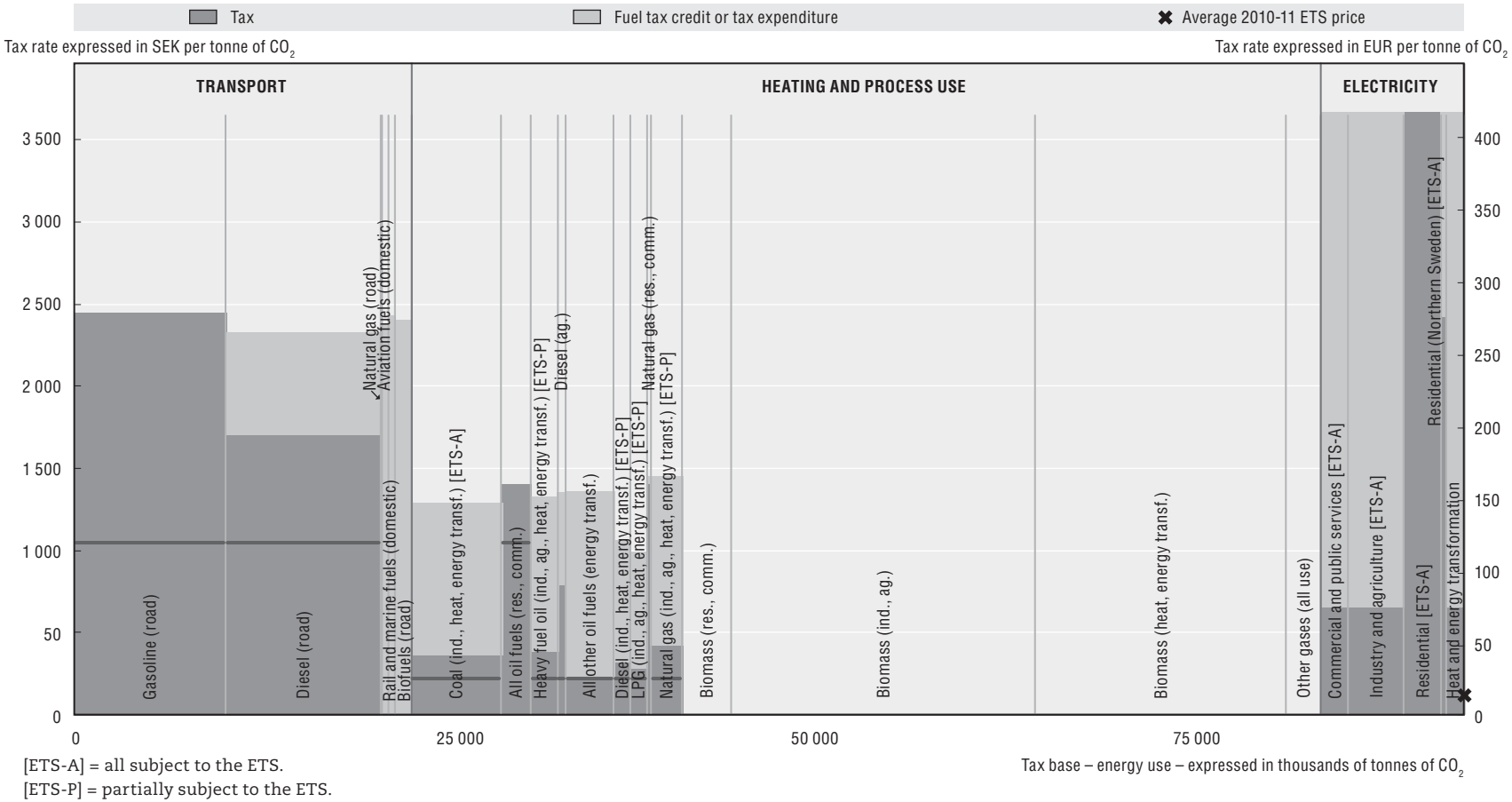


[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932767194

Figure 30.3. **Taxation of energy in Sweden on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932767213

Switzerland

Figures 31.1 and 31.2 map the use and taxation of energy in Switzerland on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In Switzerland taxation on energy products is levied through three different components: petroleum tax, petroleum surtax and CO_2 tax. One-half of the revenues from the petroleum tax and all of the surtax revenues are earmarked to provide transport infrastructure. The relevant rates of tax are set out in the following table:

Table 30.1. **Components of energy taxation in Switzerland (in CHF per unit)**

	Unit	Petroleum tax	Petroleum surtax	CO_2 tax	**Total**
Gasoline (road)	1 litre	0.4312	0.300	-	**0.7312**
Diesel (road)	1 litre	0.4587	0.300	-	**0.7587**
Light fuel oil (heating)	1 litre	0.0030	-	0.0955	**0.0985**
Diesel (heating)	1 litre	0.0030	-	0.0955	**0.0985**
Heavy fuel oil (heating)	1 kg	0.0036	-	0.1142	**0.1178**
Natural gas (road); gaseous	1 kg	0.1125	0.1097	-	**0.2222**
Natural gas (heating); liquefied	1 litre	0.0009	-	0.0415	**0.0424**
Natural gas (heating); gaseous	1 kg	0.0021	-	0.0921	**0.0942**
LPG (road)	1 litre	0.0883	0.1267	-	**0.215**
LPG (odorised, for heating)	1 litre	0.0011	-	0.0546	**0.0557**
Lignite	1 kg	-	-	0.0752	**0.0752**
Coal (other than lignite)	1 kg	-	-	0.0951	**0.0951**
Coal (coke)	1 kg	-	-	0.1021	**0.1021**
Petroleum coke	1 kg	-	-	0.1184	**0.1184**

According to the *Loi sur l'imposition des huiles minérales* the petroleum tax and surtax apply to oil products and natural gas, but not to coal and coke. The rates of the petroleum tax are generally higher for transport use than for heating and process use, and the revenue from this are earmarked for transport infrastructure. Biofuels are relieved from the petroleum tax and surtax if they comply with ecological and social minimum criteria; otherwise, they are taxed at the normal rate. LPG and natural gas used as road fuel are taxed at reduced rates since 2008. Fuel used for rail, navigation and domestic aviation is subject to the petroleum tax and surtax, though domestic commercial airline traffic is exempt in certain cases (*e.g.*, if it facilitates connection with international flights). The petroleum surtax applies only to engine fuels.

Switzerland also levies a performance-related heavy vehicle fee (HFV) at the federal level on the basis of total weight, emission level and the kilometres driven in Switzerland since 2001. It must be paid for all vehicles and trailers which have a total weight of more than 3.5 tonnes, are used for the carriage of goods, are licensed in Switzerland or abroad, and drive on Switzerland's public road network. While this tax has some correlation with fuel use, like similar taxes in other countries, it is not included in the maps since it is not levied directly on fuel use.

The CO_2 tax is levied on heat and process fuels, but not on transport fuels. It was introduced in January 2008. Starting from January 2010 its rate is equal to CHF 36 per tonne of CO_2. Fuels used by oil refineries to produce process heat are within the scope of the CO_2 tax; but full relief is provided from this tax and the petroleum tax

Final electricity consumption is subject to a grid levy of CHF 0.009 per kWh, the purpose of which is to finance system services (CHF 0.0045 per kWh) and the feed-in tariffs (also of the order of CHF 0.0045 per kWh) encouraging the generation of power from renewable sources. Fossil fuels (natural gas and light fuel oil) used to generate electricity and heat are also subject to the CO_2-tax but these energy sources play a minor role in the electricity generation mix, most electricity coming from hydraulic and nuclear sources.

Energy use and taxation in Switzerland

As illustrated along the horizontal axis of the carbon content map, gasoline accounts for roughly 58% of total CO_2 emissions (and 69% of energy) produced by transport fuels, and diesel, for about 42% (39% of energy). The tax rate per litre under the petroleum tax is somewhat higher for diesel than for gasoline, which may be consistent with the higher energy and carbon content of diesel relative to gasoline. The surtax applies at a common per-litre rate to both fuels. The CO_2 tax is not levied on fossil fuels used in transport. The maps illustrate that when the petroleum tax and surtax are considered together, however, the effective tax rate on gasoline is still somewhat higher than the rate on diesel, both per unit of energy and per unit of CO_2 emissions. Nonetheless, the gap is much smaller than in many other countries examined. LPG, natural gas and biofuels account for a minor portion of CO_2 emissions in transport, collectively equal to less than 1% of both energy and carbon emissions. Another roughly 1% of transport energy use and emissions is associated with fuels consumed in domestic aviation, rail and shipping.

The maps illustrate that with respect to heating and process fuel use, the largest share of CO_2 emissions comes from diesel, accounting for 45% of energy use and 47% of emissions from heating and process use. In Switzerland, the fuel included in this category is represented by light heating fuel oil, mainly used in the residential and commercial sector (41% of emissions). Other oil products account for another 3% of energy use and 5% of emissions: of this amount, only the share associated with LPG (1%) is taxed, whereas refinery gas and other oil products used in energy transformation are exempt from tax. Natural gas is the second fuel in terms of importance in the heating and process fuel category, both in energy and carbon content terms, and it is taxed at a lower rate than diesel both on an energy and a carbon content basis. It accounts for 28% of energy and 21% of CO_2 emissions in the category. Again, consumption by residential and commercial use forms the major share (12% of emissions), with industrial use accounting for a lower proportion (6%). The remainder of the tax base is taxed at reduced rates, being exempt from the CO_2 tax for energy intensive industries (around 2% of emissions) or not being subject to the petroleum surtax.

The use of renewable energy sources and waste as heating and process fuel is not taxed (except in the case of biofuels (*e.g.* biodiesel, bioethanol, biogas) not reaching the ecological and social minimum standards). Renewables and waste consumed by the industrial, commercial and agricultural sectors account for 15% of energy use and 12% of CO_2 emissions in the heating and process use category. Industrial use of waste as an energy source is mostly responsible for this share: it is the highest component in this category,

followed by solid biomass. Solid biomass used in the residential sector accounts for 7% of energy and 8% of emissions in this category. This energy source is used in the residential sector to a greater extent than in industrial, commercial and agricultural sectors all together. Coal accounts for 2% of energy use and CO_2 emissions from heating and process use and is taxed at a lower rate than other fuels, since only the CO_2 tax is levied on its consumption. Energy sources used to produce heat are represented mainly by waste, which is not taxed. Heat is produced using natural gas, biomass and diesel, with the first and the last fuels being subject to the CO_2 tax.

Fossil fuels used to generate electricity are also taxed, and the consumption of electricity is untaxed. In Switzerland, however, 92% of electricity is produced from nuclear and hydroelectric sources, which are untaxed. Waste also has some importance. Natural gas is the main fossil fuel consumed in the Swiss electricity mix, and together with oil products (in particular, diesel oil, fuel oil and LPG) accounts for 8% of the total energy used in electricity generation.

Reported tax expenditures and rebates

Useful information on tax expenditures is provided in the Liste des allégements fiscaux accordés par la confederation (*www.estv2.admin.ch/f/steuerverguenstigungen/tabelle_4_uebrige_steuern_und_abgaben_ezv_f.htm*) and in a report published by the Département fédéral des finances in 2011 (*www.estv.admin.ch/themen/01230/index.html?lang=fr&download=NHzLpZeg7t,lnp6I0NTU0 2l2 Z6ln1ae2IZn4Z2qZpnO2Yuq2Z6gpJCDeHx5fWym162epYbg2c_JjKbNoKSn6A--.*)

As shown in the table at the beginning of this country chapter, the total tax rate levied on energy products is often the sum of more than one component. When a product is exempt from one component or taxed at a reduced rate the benchmark has been considered to be equal to the sum of the overall (standard) tax rates of the various components.

In Switzerland reduced rates are applied to:

- *Natural gas and diesel used by energy intensive industries:* Energy-intensive companies exposed to international competition (i.e. in the iron and steel, cement, paper and pulp, chemicals and petrochemicals sectors) can be exempted from the CO_2 tax if they commit to legally binding CO_2 reduction targets. Since the use of natural gas and diesel by energy-intensive industries is relatively small, the two fuels have been combined into a single category. The tax expenditure has been computed considering the individual tax rates and benchmarks. By contrast, the tax rate shown for the combined category is the weighted average of the rates applying to each category (by consumption size).
- *Natural gas used by agriculture:* Natural gas which is used as fuel in agriculture and fishery are eligible for reduced tax rates. This includes partial refunding of the mineral oil tax and total refunding of the surtax. In 2009, no natural gas was used in agriculture. natural gas consumed in agriculture and fishing is exempt from the petroleum surtax. The tax expenditure is shown in the graph in light grey.
- Other reduced rates apply to licensed transport, forestry, stationary electricity generation and natural stone mining. These are not identified in the maps.

Key assumptions and caveats

In terms of assumptions:

- Only federal tax rates have been included.
- Almost all biofuels used in Switzerland comply with the ecological and social minimum standards and therefore benefit from the tax relief on the mineral oil tax and surchargepay the mineral oil tax and surtax, so they have all been shown as taxed at these rates in the text.
- Concerning the exemption from the CO_2 tax for some energy-intensive industries, all diesel consumption in paper, pulp and printing sector has been treated as exempt from the CO_2 tax, according to the information provided through bilateral consultation. Since according to the same information more than half of the diesel consumption in the chemical and petrochemical sector can be considered as exempt, for computable reasons all diesel consumption has been assumed to be exempt. This results in some overestimation of the tax expenditure in the map.
- The tax rate shown for coal is a weighted average (by the consumption values) for different coal types; the CO_2 tax rate is the one associated with the most widely used coal in Switzerland, namely bituminous coal.
- For energy products used to produce heat, the CO_2 tax applied to natural gas is shown, since this fuel has the highest share in heat production.
- Since nuclear energy has a carbon content equal to zero, it does not appear in the CO_2 map when electricity is disaggregated by fuel.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

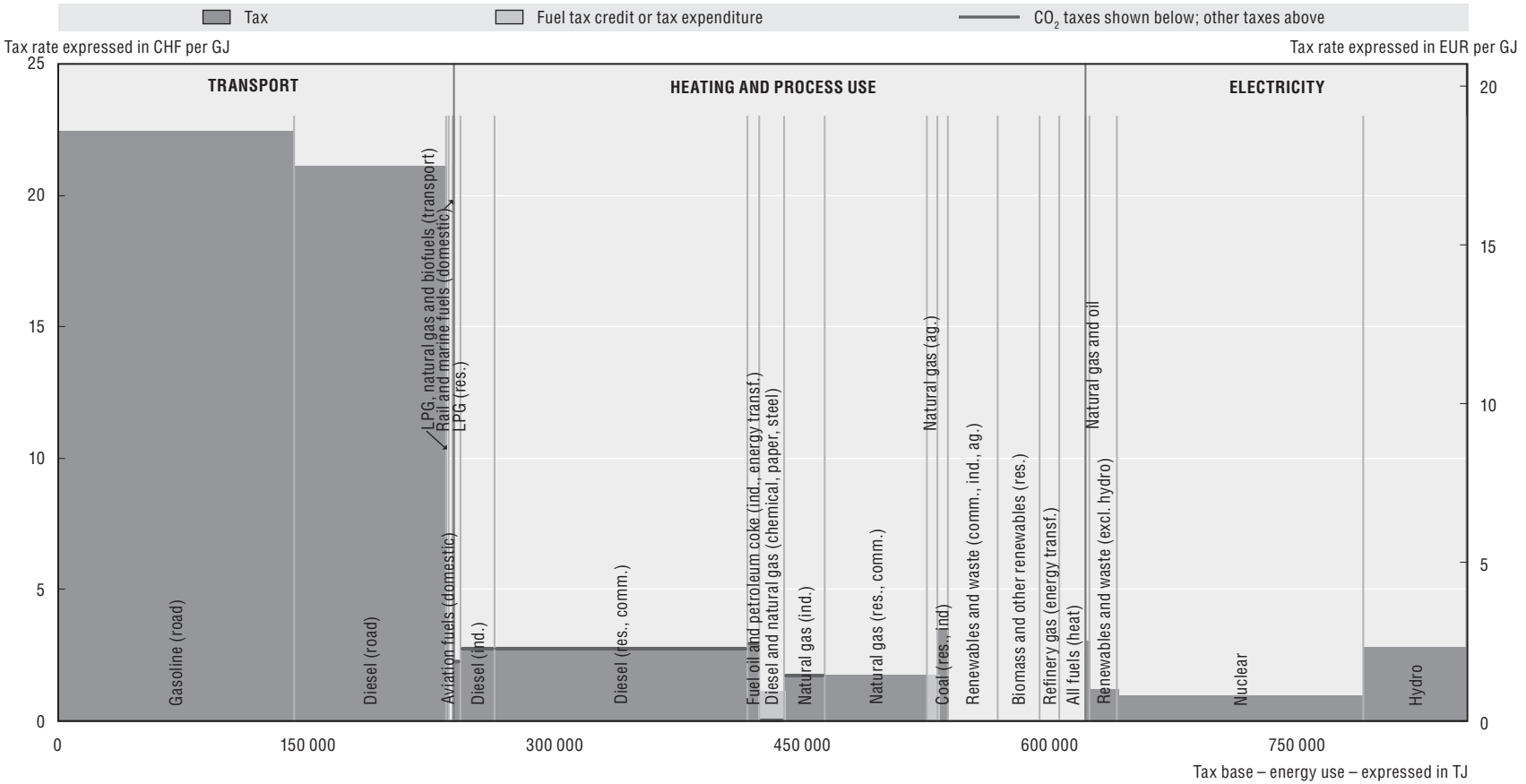
Administration Fédérale des Douanes, *www.ezv.admin.ch/index.html?lang=fr*.

Département Fédéral des finances (2011), *Quels sont les allégements fiscaux accordés par la Confédération ?* Available at: *www.estv.admin.ch/themen/01230/index.html?lang=fr&download=NHzLpZeg7t,lnp6I0NTU042l2Z6ln1ae2IZn4Z2qZpnO2Yuq2Z6gpJCDeHx5fWym162epYbg2c_JjKbNoKSn6A--*.

Département Fédéral des Finances (2012), *Liste des allégements fiscaux accordés par la confédération*. Available at: *www.estv2.admin.ch/f/steuerverguenstigungen/tabelle_4_uebrige_steuern_und_abgaben_ezv_f.htm*

Government of Switzerland, Loi sur l'imposition des huiles minérales.

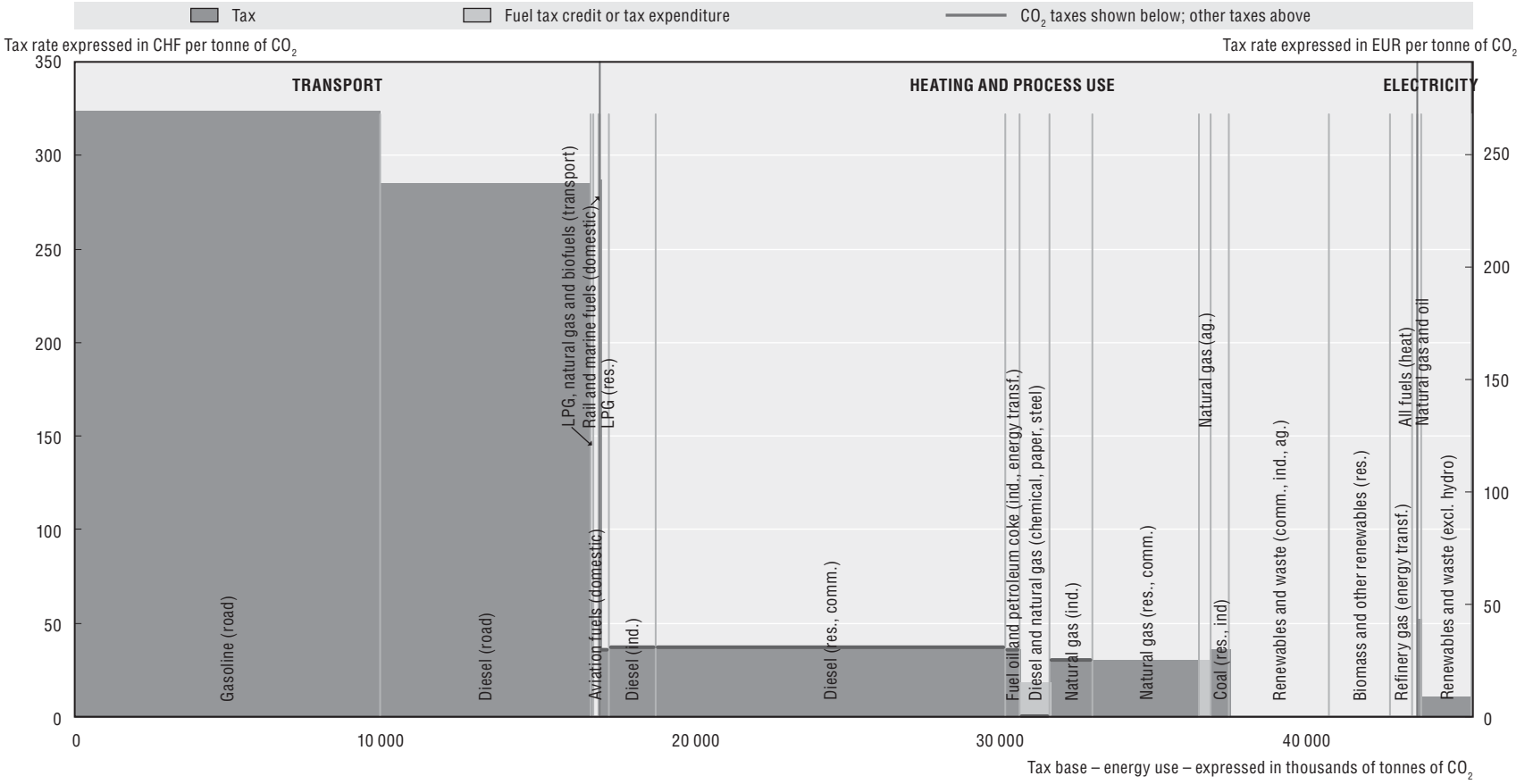
Figure 31.1. **Taxation of energy in Switzerland on an energy content basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932767232

Figure 31.2. **Taxation of energy in Switzerland on a carbon emission basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

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Turkey

Figures 32.2 and 32.3 map the use and taxation of energy in Turkey on the basis of energy content and carbon content, respectively.

Structure of energy taxation

Energy-related taxes in Turkey are levied mainly on the transport sector. Although not explicitly imposed for an environment-related objective, gasoline and diesel tax rates are differentiated according to the composition of the fuel – octane rating for gasoline and sulphur content for diesel. As in many countries, the per litre tax rate on gasoline is higher than that on diesel, and biodiesel has further a tax advantage relative to diesel. The current level of the gasoline excise (TRY 1.89 per litre in the case of an octane number less than 95) is the highest among OECD countries (Table 32.1). Lower tax rates are levied on LPG (TRY 1.28 per kilogram) and natural gas (TRY 0.69 per standard cubic meter). As a consequence, there has been a significant increase in LPG consumption by Turkish cars in recent years. Domestic aviation is currently exempted from energy taxation. A tax rate is set on marine transport fuels (TRY 0.224 per kilogram), but several exemptions are in force.

Besides fuel taxation, a highly differentiated motor vehicle tax and a special consumption tax on other transport vehicles are applied.

In the heating and process use category, energy taxation is, in principle, not differentiated among user sectors. LPG and natural gas excise rates are set at a lower level

Table 32.1. **Energy tax rates in Turkey as of 1 April 2012 (Turkish Lira)**

Transport			
Petrol	Octane higher than 98	2.0135	litre
Petrol	Octane lower than 98	1.8915	litre
Diesel	Below 0.05% sulphur	1.3045	litre
Diesel	Between 0.05% and 2% sulphur	1.2345	litre
Biodiesel (road)		0.91	litre
LPG (road)		1.278	kg
Natural gas (road)		0.6964	Standard m^3
Aviation		0	
Marine fuels		0.224	kg
Heating and process			
LPG		1.21	kg
Fuel oil (a)	Sulphur content less than 1%	0.237	kg
Fuel oil (b)	Sulphur content between 1% and 2%	0.476	kg
Fuel oil (c)	Sulphur content between 2% and 2.8%	0.224	kg
Propane		1.21	kg
Buthane		1.21	kg
Natural gas		0.023	Standard m^3
Petroleum gas		0	
Petroleum coke		0	
Electricity			
Electricity (household)		17.74205	MW
Electricity (non-household)		7.5421	MW

than with respect to road use. This is especially true in the case of natural gas (TRY 0.023 per standard cubic meter). Other gases and coal are exempted from taxation.

An excise tax is levied on the use of natural gas in electricity production, while the use of diesel, coal and fuel oil for that purpose is not taxed. A tax is levied on electricity consumption, with a higher rate for residential use (TRY 17.74 per MW) than industrial and commercial use (TRY 7.54 per MW).

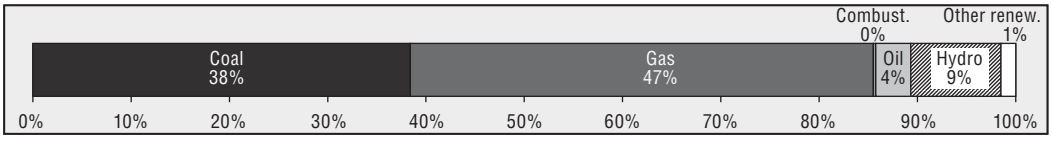
Energy use and taxation in Turkey

From the maps of energy use and taxation, it can be seen that although most energy-related tax revenue comes from transport fuels, the transport sector represents a smaller proportion of energy use – about 15% – than in most other OECD countries. Diesel, taxed at lower rate than gasoline, represents more than 50% of total energy consumption in the sector. Gasoline, subject to the highest tax rate among OECD countries, accounts for only 16%, overtaken by LPG and natural gas, which receive a more favourable tax treatment. Aviation, marine and rails are taxed on average at a much lower level, due to the exemption for aviation fuel and to the lower rate for the shipping industry.

Within the heating and process category, natural gas share accounts for about 30% of energy use in this category and is taxed. Coal usage has a similar share in energy content, but it is untaxed. The emission map, however, shows that coal represents more than 40% of the category's CO_2 emissions and above 20% of total CO_2 emissions from energy. Lignite, which is among Turkey's most important energy resources, is still widely used by households for heating. Diesel and other oil products are taxed at a higher taxation, and represent around 20% of energy use for heating and process purposes. Renewables and waste account for about 14% of both energy use and emissions from heating and process use.

As shown in the figure below, electricity production is based mostly on coal and natural gas; they account for about 85% of energy use for power generation. Hydro and other renewables account for about 10% of energy use in electricity generation. Natural gas (which accounts for about 46% of the energy used to generate electricity and about 36% of the carbon emissions from this use) is taxed, while coal (which accounts for about 38% of energy use and 55% of emissions) is not taxed.

Figure 32.1. **Fuels used to generate electricity in Turkey (TJs)**



Source: OECD calculations using 2009 IEA Energy Balance data (IEA, 2011a)

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Electricity is also subject to a consumption tax in Turkey. Both levels of taxation (where applicable) have been taken into account in the maps. The maps show electricity by fuel used for generation (natural gas *vs.* other fuels), with this then further broken down by users. Electricity used for residential purposes is taxed at a higher rate than energy used for commercial purposes. However, as the proportion of electricity generated by natural gas is taxed at two levels, the effective rate on electricity generated by natural gas is higher than

electricity generated by other fuels. A stepwise schedule is the result of this combined taxation by fuel and by user.

Reported tax expenditures and rebate

Domestic consumption of aviation and jet fuel is exempt from excise taxes.

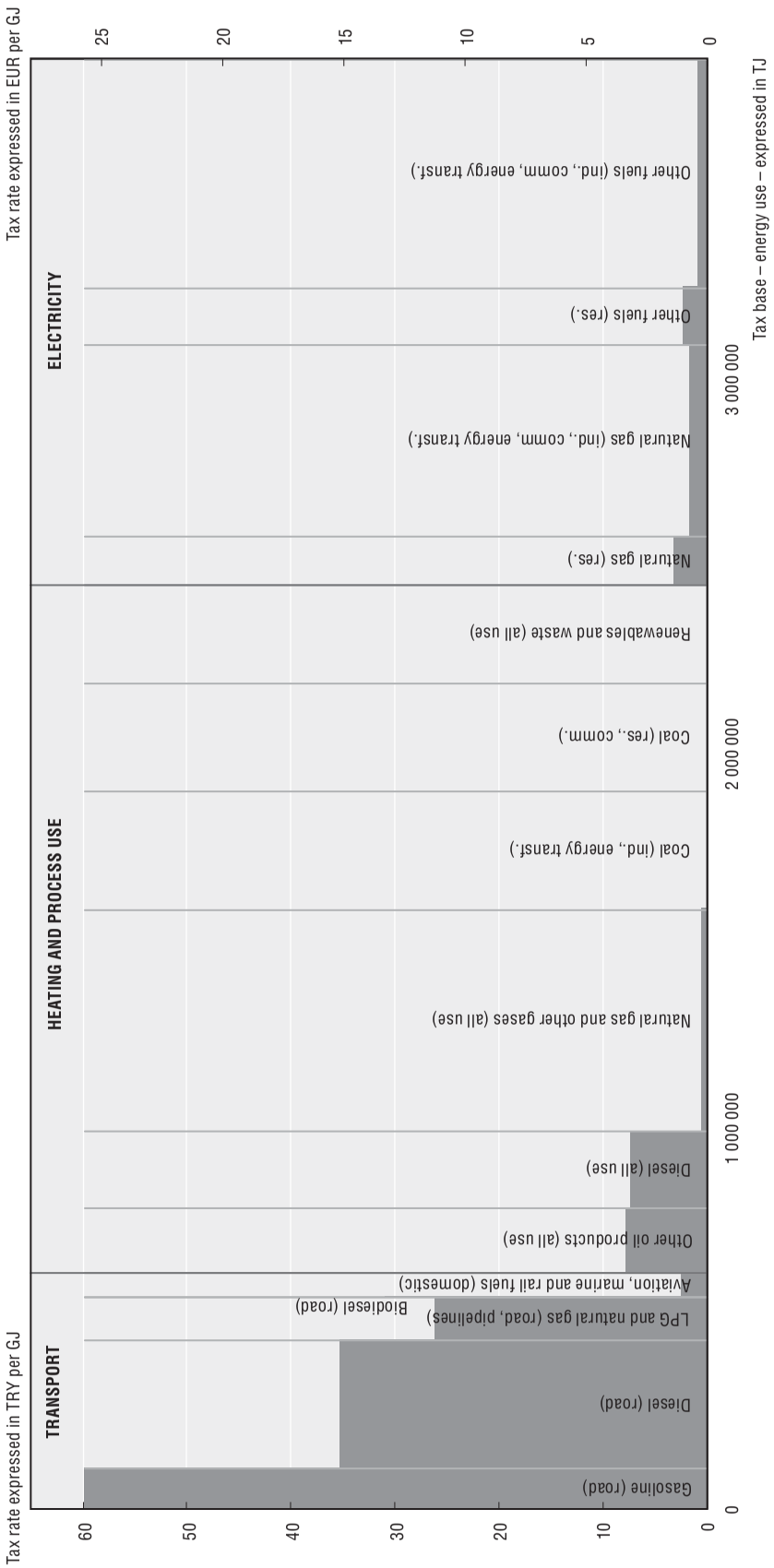
Key assumptions and caveats

For petrol, diesel and fuel oil, we calculated an un-weighted average of tax rates set with regard to sulphur and octane level.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials.

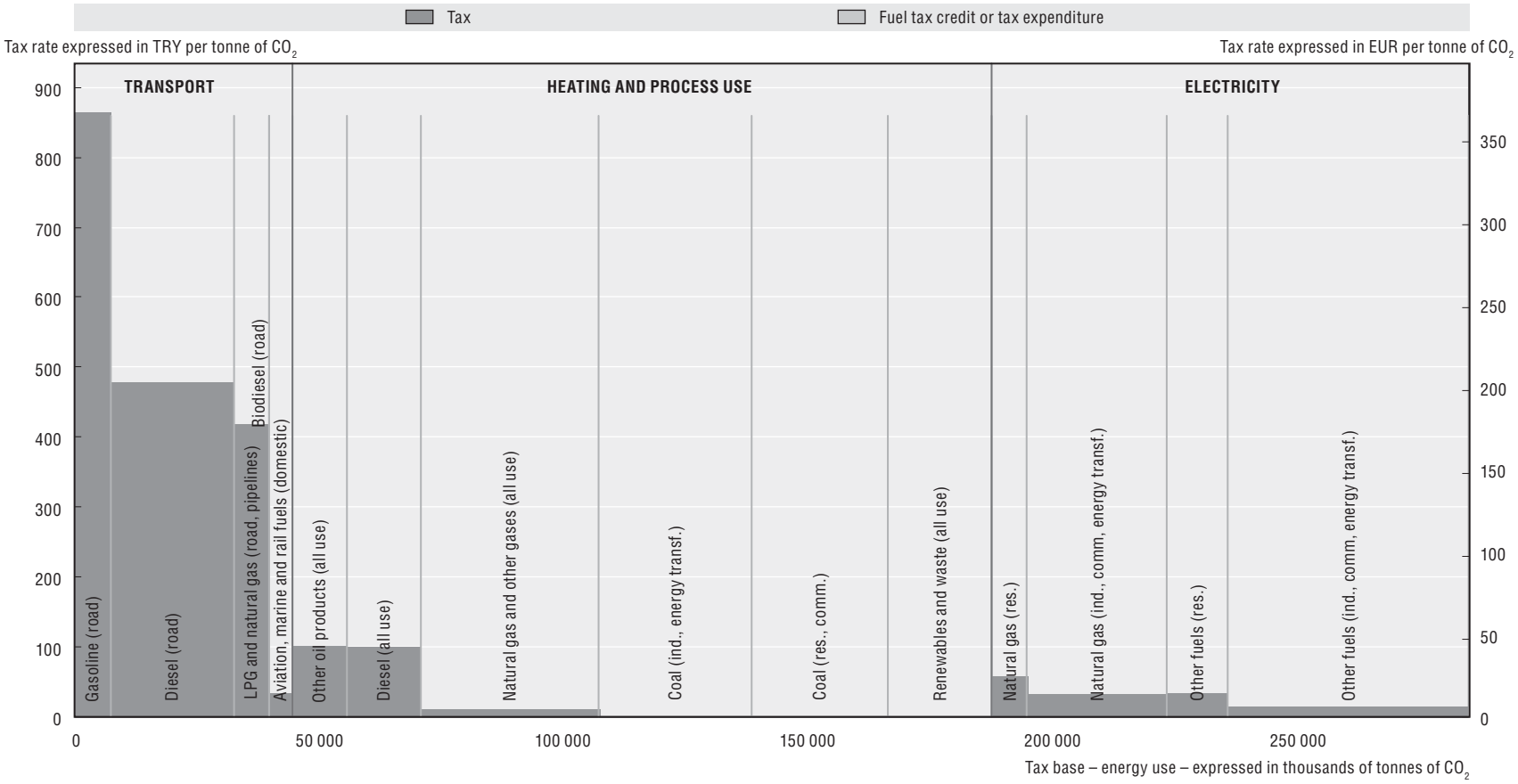
Figure 32.2. **Taxation of energy in Turkey on an energy content basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932767289

Figure 32.3. **Taxation of energy in Turkey on a carbon emission basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

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United Kingdom

Figures 33.2 and 33.3 map the use and taxation of energy in the United Kingdom on the basis of energy content and carbon content, respectively.

Structure of energy taxation

In the United Kingdom, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (see Box 5 for more detail). The taxation of energy use comprises two different taxes: fuel duty rates, which apply to oil products and biofuels; and the climate change levy, which applies to the consumption by business and the public sector of electricity, natural gas, liquefied petroleum gases and solid fuels (*e.g.* coal).

Duty tax rates of GBP 0.5795 per litre apply to unleaded motor gasoline, heavy oil, biodiesel and bioethanol. A rebate applies to these duties when the fuel is for non-road use, which reduces the net rate to GBP 0.1070 or GBP 0.1114 per litre, depending on the type of fuel. Light oil products are taxed at a higher rate of GBP 0.6767 per litre; and aviation, natural gas and road fuel gas other than natural gas at lower rates (GBP 0.3770 per litre, GBP 0.2470 per kilogram, and GBP 0.3161 per kilogram, respectively). All duty rates are due to increase on 1 January 2013.

The climate change levy applies to electricity, gas, liquefied petroleum gases, and other taxable commodities, such as coal, consumed by business and the public sector. The rates on each product will increase from 1 April 2013. The rates that apply in 2012-13 are set out below:

Table 33.1. **The climate change levy in the United Kingdom**

Commodity (business and public sector use)	Rate in 2012-13
Electricity	GBP 0.00509 per kilowatt hour
Natural gas	GBP 0.00177 per kilowatt hour
Natural gas in Northern Ireland[1]	GBP 0.00062 per kilowatt hour
Liquid petroleum gas (LPG)	GBP 0.01137 per kilogram
Solid fuels	GBP 0.01387 per kilogram

1. This rate will be removed from 1 November 2013 and the main rate for natural gas will apply in Northern Ireland.

The Climate Change Levy does not apply to taxable commodities used for domestic or charitable consumption.

Energy use and taxation in the United Kingdom

As can be seen from the maps, the transport category used 27% of energy and accounts for 23% of emissions from energy use in the United Kingdom in 2009, based on the IEA data on energy use used for the maps.[1] In the transport category, although gasoline and diesel for road use are taxed at the same rate per litre, the higher CO_2 emissions per litre of diesel means that diesel is more lightly taxed on a CO_2 basis. On a CO_2 basis, gasoline is taxed more highly than other fuels for transport or heating and process use. Gasoline represented 40% of energy and 39% of emissions in the transport category, and diesel 50% and 42%, respectively. Smaller contributions to carbon emissions came from: domestic aviation fuel and biofuels, which are taxed at lower rates; diesel used for rail transport,

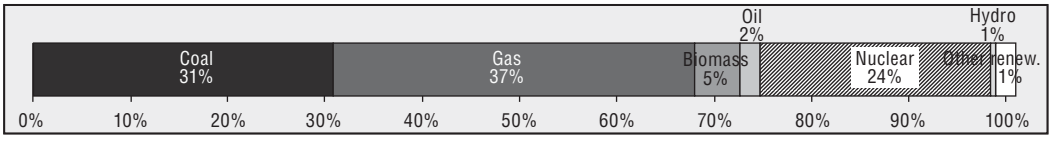
which pays a partially rebated tax; and domestic navigation, which is exempt. The maps show rebates in this category only for diesel used for rail transport.

The heating and process category accounted for 40% of energy use and emissions from energy use. In the heating and process use category, the fuel duty paid is partially rebated on the basis that the fuels are used off-road. The rebate that applies to residual fuel, kerosene, and diesel is shown on the graph in light grey, with the net tax paid shown in dark grey. Together, these fuels account for approximately 11% of energy use and 13% of carbon emissions in the heating and process fuel use category. The largest amount of carbon emissions from heating and process use derive from natural gas for either personal or business use. Business and public sector use of natural gas is taxed under the climate change levy; residential use is not. Coal, coke, and LPG, are subject to the climate change levy.; Electricity from renewable sources or other gasesgas for heating or process are not subject to the levy.

The electricity sector accounted for 33% of energy and 37% of carbon emission from energy use. The consumption of electricity in the United Kingdom is taxed in some circumstances. Consumption of electricity by businesses (including the industrial and commercial sectors) is taxed under the climate change levy. Business electricity represented 59% of electricity use in the United Kingdom. When adjusted under the standard approach used in this paper to reflect the primary energy used to produce electricity, rather than the electricity consumed, the tax applying on the consumption of electricity can be seen as an effective tax on the fuels used to generate the electricity. Because the amount of energy used to generate electricity is greater the energy value of the electricity produced, this means that the effective tax rate on energy used to generate electricity is lower than the rate applying to the electricity produced. This lower rate is shown on the maps.

Although not shown on the map, fuels used to produce electricity are not currently subject to the Climate Change Levy (by way of exemption) and duty paid on oils is rebated in full when they are used to generate electricity. Because of data constraints, this rebate is not shown on the main map below. (From 1 April 2013 the United Kingdom will be introducing the carbon price floor and gas, coal and LPG used in electricity generation will become liable to the Climate Change Levy, and the fuel duty on oils will no longer be fully rebated.) Energy used to produce electricity is set out below.

Figure 33.1. **Fuels used to generate electricity in the United Kingdom (TJs)**



Source: OECD calculations using 2009 IEA Energy Balance data (IEA, 2011a).

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Reported tax expenditures and rebates

The United Kingdom reports a tax expenditure in relation to the reduced rate of excise for diesel but estimates of the revenue forgone are not available. The rebates that apply under the fuel duty regime, including the rebate for diesel, can be seen in the maps as the light grey areas on the graphs in the areas marked "All fuels (rail)", "Heavy fuel oil

and kerosene (ind., comm., ag.)" and "Diesel (ind., comm., res.)".[2] The benchmark for the rebate is assumed to be the tax rate that would apply to each fuel in the absence of the rebate.

When the rebate is mapped against fuel use, the largest amount of expenditure seems to arise from the rebates applied to residual fuel and kerosene for heating and process use, with diesel for heating and process use also comprising a large component of the cost. There is an exemption under the climate change levy for taxable commodities used in trail based transport (chiefly electricity) and diesel used in rail transport is charged at the lower "red diesel" rate.

Tax expenditures are not reported for the non-taxation of natural gas and electricity for residential use or of biomass and waste used as heating or process fuel. Tax expenditures are also not reported in respect of the tax rates applying to different transportation fuels (gasoline *vs.* diesel *vs.* aviation fuel) and different heating and process fuels used in business (natural gas *vs.* coal *vs.* LPG).

Key assumptions and caveats

Some smaller categories have been combined into larger categories to make the graph easier to read. Where this has occurred a weighted tax rate based on the CO_2 emissions generated by each fuel has been used. Examples include "Heavy fuel oil and kerosene (ind., comm., ag.)" which includes kerosene and residual fuel oil used for heating and process use; and "Biodiesel and bioethanol" which includes all biofuels used for transport.

A few elements of the tax structure are not shown on the maps. In particular:

- Full rebates applying to oils in particular industrial sectors are not shown on the map due either to their small size or the difficulty of correctly applying the tax rate to the tax base information from the 2009 IEA Energy Balances (IEA, 2011a).
- LPG used for transport has not been shown on the graph due to the very small amount of use for this purpose- in 2009, it accounted for less than 0.06% of total fuel use in the United Kingdom.
- Tax features related to vehicles, including the vehicle excise duty, company car tax, and capital allowances for vehicles, are not shown as these are not directly linked to energy use. However, vehicle taxation in the United Kingdom varies based on vehicles' carbon dioxide emissions so that lower emitting vehicles are subject to lower tax rates.
- The Road Transport Fuel Obligation is also not included. This applies to fuel suppliers who do not include a prescribed amount of biofuels in fuel sold for road use.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

Department for Energy and Climate Change (2011), *Total Energy Statistics*. Available at: *www.decc.gov.uk/en/content/cms/statistics/energy_stats/source/total/total.aspx*.

Department for Energy and Climate Change (2011), *Commodity Balances*. Available at: *www.decc.gov.uk/assets/decc/Statistics/source/oil/dukes3_2-3_4.xls*.

Government of the United Kingdom of Great Britain and Northern Ireland, *Hydrocarbon Oil Duties Act 1979*. Available at: *www.legislation.gov.uk*.

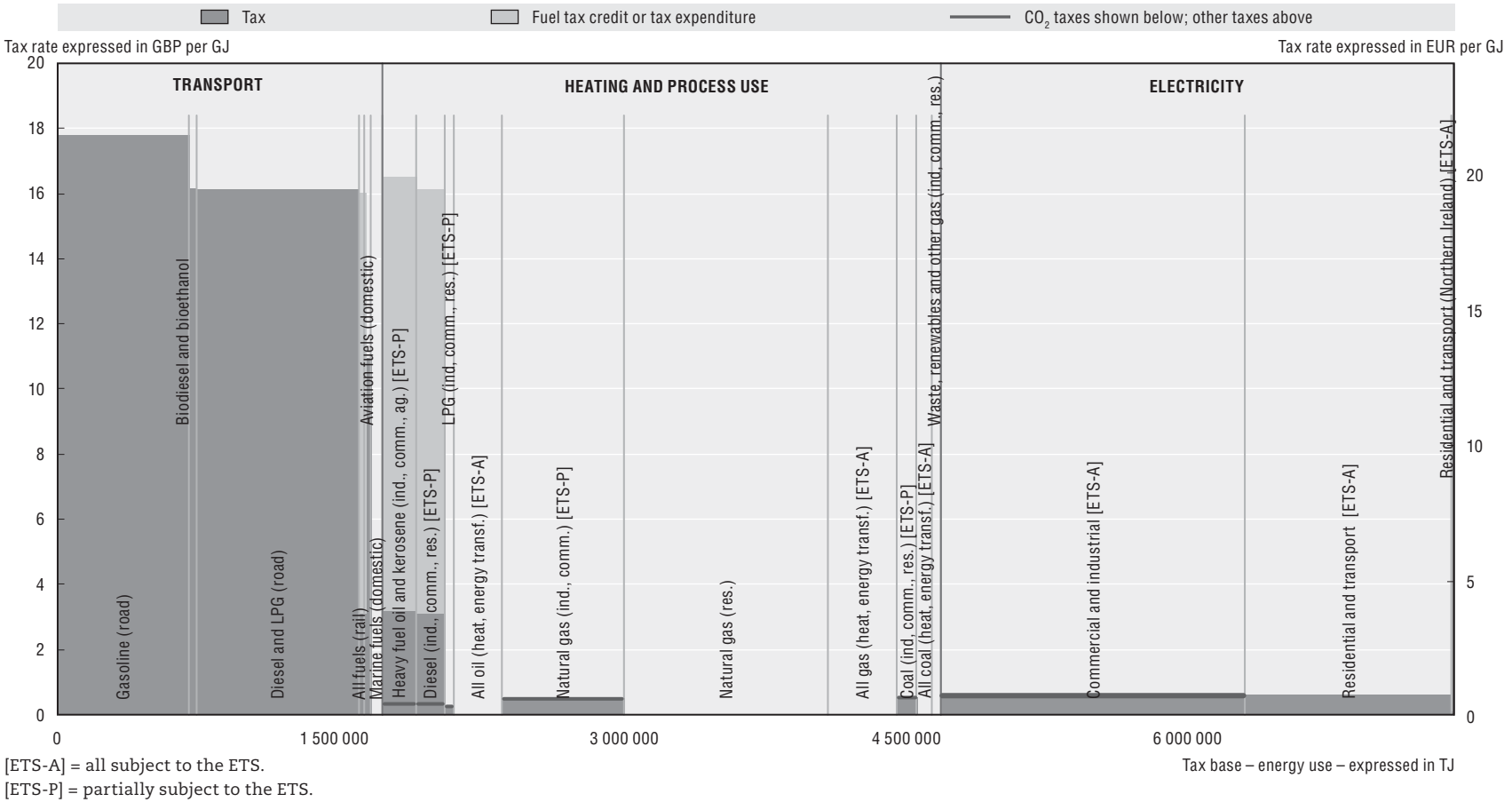
HM Revenue and Customs (2012a), *Climate Change Levy*. Available at: *www.hmrc.gov.uk/climate-change-levy/index.htm*.

HM Revenue and Customs (2012b), *Excise and environmental tax rates*. Available at: *http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?_nfpb=true&_pageLabel=pageExcise_RatesCodesTools*.

Notes

1. The percentages of energy use cited in this section have been calculated by the OECD using 2009 IEA Energy Balances data (IEA, 2011a). See Section 3.1 of the report and Annex A for further information.
2. The fuel oil and kerosene category is approximately 69% kerosene, with the remainder being fuel oil. The tax rate and benchmark rate shown on the graph are the weighted average of the rates applying to each fuel. The categories were aggregated to improve graph readability.

Figure 33.2. **Taxation of energy in the United Kingdom on an energy content basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009.

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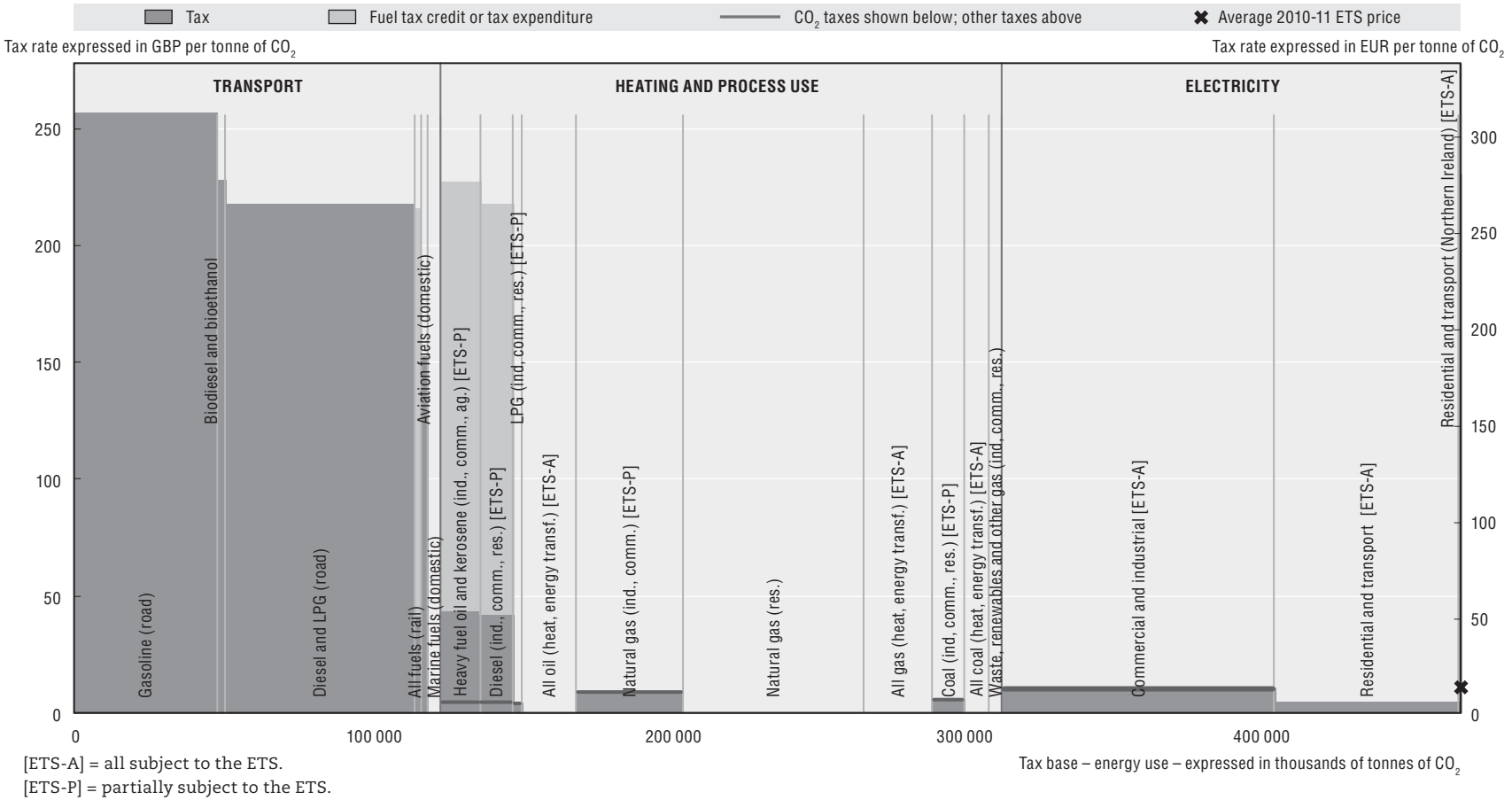
Figure 33.3. **Taxation of energy in the United Kingdom on a carbon emission basis**



[ETS-A] = all subject to the ETS.
[ETS-P] = partially subject to the ETS.

Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.
Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009.

StatLink http://dx.doi.org/10.1787/888932767365

United States

Figures 34.1 and 34.2 map the use and taxation of energy in the United States on the basis of energy content and carbon content, respectively. In addition to showing the tax base and tax rates at the federal level, to illustrate the important role of state taxation, combined federal and state tax rates are shown for selected large states (California, Pennsylvania and Texas).

Structure of energy taxation

In the United States, excise duties are levied on automotive fuels and fuels used in non-commercial domestic marine navigation. The other energy products are subject only to certain sale taxes levied at the state level, as a percentage of price. The rationale for taxing automotive fuels at the federal level is often presented as the raising of revenue to finance the national highway system and its maintenance.[1] According to this rationale, energy taxation is not explicitly aimed to internalise other externalities associated with fuel use, such as air emissions. For this reason, the exemption of non-road uses of energy products may not be considered to be a tax expenditure.[2]

Fuels used in rail transport, or in commercial domestic navigation outside of specified inland or intra-coastal waterways are not subject to excise duties. The approach of taxing only fuels used in transport implies that fuels used in heating and industrial processes are not taxed, and neither are fuels used to generate electricity. Electricity consumption is not taxed at the federal level in the United States, but it is taxed in some states.

Regarding biofuels, alcohol fuel blended with gasoline is taxed at the gasoline rate, and biodiesel and renewable diesel blended with diesel are taxed at the diesel rate. At the federal level, the Volumetric Ethanol Excise Tax Credit (VEETC) equal to USD 0.45 per gallon for ethanol blended with gasoline expired in December 2011. The USD 0.50 per gallon tax credit for biodiesel and renewable diesel also expired in December 2011.

Excise taxes on transport fuels are also levied at the state level and are added to the federal tax rate. Excise taxes are shown on an illustrative basis for three states, chosen for their significance in terms of population (California and Texas) and level of energy taxes (Pennsylvania). Different states tax transport fuels in a different way, as shown in the table below, which lists rates in both USD per gallon and USD per tonne of CO_2. Various exemptions also exist at the state level, such as the exemption for aviation fuel in Texas.

Table 34.1. **Illustrative US state excise tax rates**

	USD per gallon			USD per tonne of CO_2		
	CA	PA	TX	CA	PA	TX
Unleaded motor gasoline	0.353	0.3	0.2	40.55	34.46	22.97
Diesel	0.18	0.381	0.2	17.87	37.83	19.86
Liquefied Petroleum Gas (LPG)	0.06	0.228	0.15	9.86	37.47	24.65
Liquefied Natural Gas (LNG)	0.06	0.18		0.09	0.28	
Biofuels – ethanol	0.18	0.208	0.2	30.86	35.66	34.29
Biofuels – biodiesel	0.18	0.381	0.16	20.17	42.68	17.93
Non-commercial aviation – jet kerosene	0.02	0.02		2.33	2.33	
Commercial aviation – jet kerosene	0.02	0.02		2.33	2.33	
Non-commercial aviation – gasoline	0.18	0.053		20.68	6.09	
Electricity		0.01			0.02	

Energy use and taxation in the United States

Emissions from transport fuels represent about one-third of both energy use and the resulting CO_2 emissions in the United States. This is roughly the share on which a fuel excise tax is levied. Another third of CO_2 emissions comes from coal used to generate electricity, though this only equates to around 20% of total energy use. Natural gas used as heating and process fuel also has a substantial relative weight, making up 17% of total energy use and 13% of total CO_2 emissions.

As can be seen from the maps of energy use and taxation that follow, gasoline dominates the transport category – making up 63% of energy used in transportation and 62% of the CO_2 emissions produced in transportation. Diesel makes up an additional 19% of energy use and 20% of CO_2 emissions from transportation. Unlike most other countries examined, the federal tax rate on diesel in the United States is higher in terms of both energy and CO_2 content than the rate on gasoline. The remainder of the transport category is made up of aviation fuel and small quantities of biofuels, natural gas and LPG. The tax rate is lower for commercial aviation fuel than for non-commercial aviation fuel. Rail and marine fuel use – representing about 2% of both energy use and CO_2 emissions in transport – is exempt.

The heating and process use category is dominated by natural gas, which accounts for 62% of the heating and process energy use, and 53% of the resulting CO_2 emissions. The rest of this category is distributed relatively evenly amongst other fuels. No fuels used in the heating and process use category are subject to excise tax.

Coal, together with renewables and waste, make up 80% of energy used to generate electricity. However, as renewables produce no CO_2, coal is responsible for 79% of the total CO_2 emissions from electricity generation. As noted above, electricity consumption is not taxed at the federal level in the United States, while it is taxed in some states. For example, a low rate is levied in Pennsylvania, as shown in the maps.

Reported tax expenditures

The United States does not report any federal tax expenditures in respect of taxes on final energy consumption.

Energy products used in agriculture as motor fuel are exempt from the federal tax on transport fuels. This exemption may not be considered a tax expenditure since the fuels are employed for off-road use.

Some states have specific rebates and exemptions. Tax expenditures for selected states are set out in the *Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels* (OECD, 2013).

Key assumptions and caveats

While state tax bases are not shown in the graphs, the State Energy Data System (SEDS) provides state data which could potentially be used to produce graphs at the state level.

On an illustrative basis, the combined level of federal and state taxes is shown for California (CA), Pennsylvania (PA) and Texas (TX).

Key assumptions include:

- Non-commercial aviation has been assumed to account for 25% of total energy consumption in aviation.
- The federal tax rate shown in the maps for "Biofuels (road)" is based on a weighted average of the consumption of ethanol and biodiesel. At the state level, only the ethanol rate is shown, since relative consumption levels by state were not available. However, biodiesel represents only 7% of total biofuels consumption in United States according to 2009 IEA Energy Balances data (IEA, 2011a).
- The tax rate shown for electricity in Pennsylvania has been computed following the standard adjustment procedure for electricity and converted in carbon content terms, using national-level information.

Sources

Information on tax rates and bases, tax expenditures, energy use, and conversion rates were obtained from the sources detailed in Annex A and from consultation with national officials. In addition, the following country-specific sources were used:

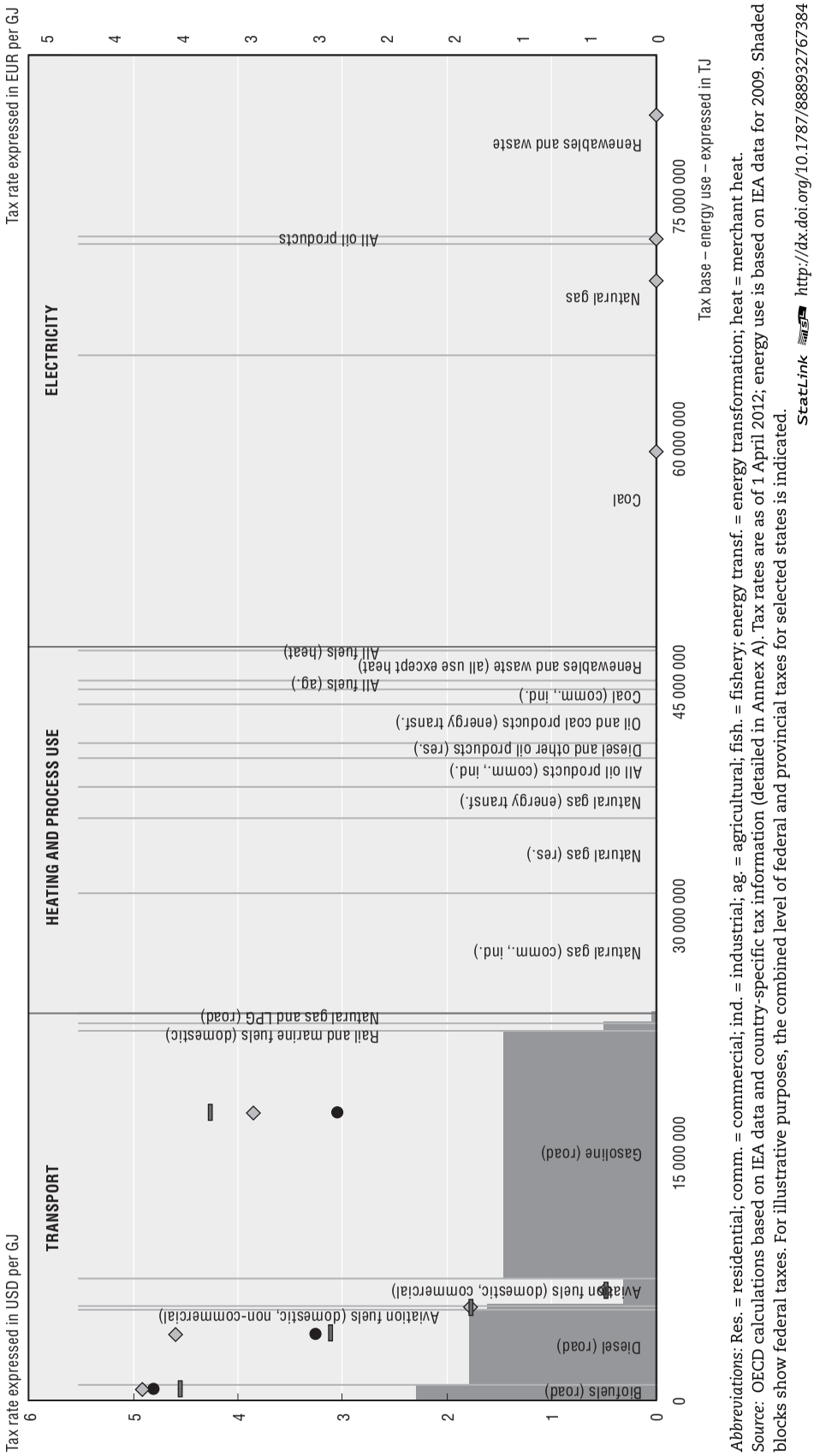
United States Defence Logistics Agency (2011), *Compilation of United States Fuel Taxes, Inspection Fees and Environmental Taxes and Fees*. Available at: *www.desc.dla.mil/DCM/Files/Tax%20Compilation%202011-09.pdf*.

United States Department of Transportation, Federal Highway Administration (2010), *Highway Statistics 2009 – Federal excise tax rates on motor fuels and lubricating oil*. Available at: *www.fhwa.dot.gov/policyinformation/statistics/2009/*.

Notes

1. Similarly, tax revenue from fuel used in non-commercial domestic marine navigation is transferred to the Sport Fish Restoration and Boating Trust Fund.
2. In any case, the US tax expenditure budget only covers federal income tax expenditures; excise taxes are not covered.

Figure 34.1. **Taxation of energy in the United States on an energy content basis**

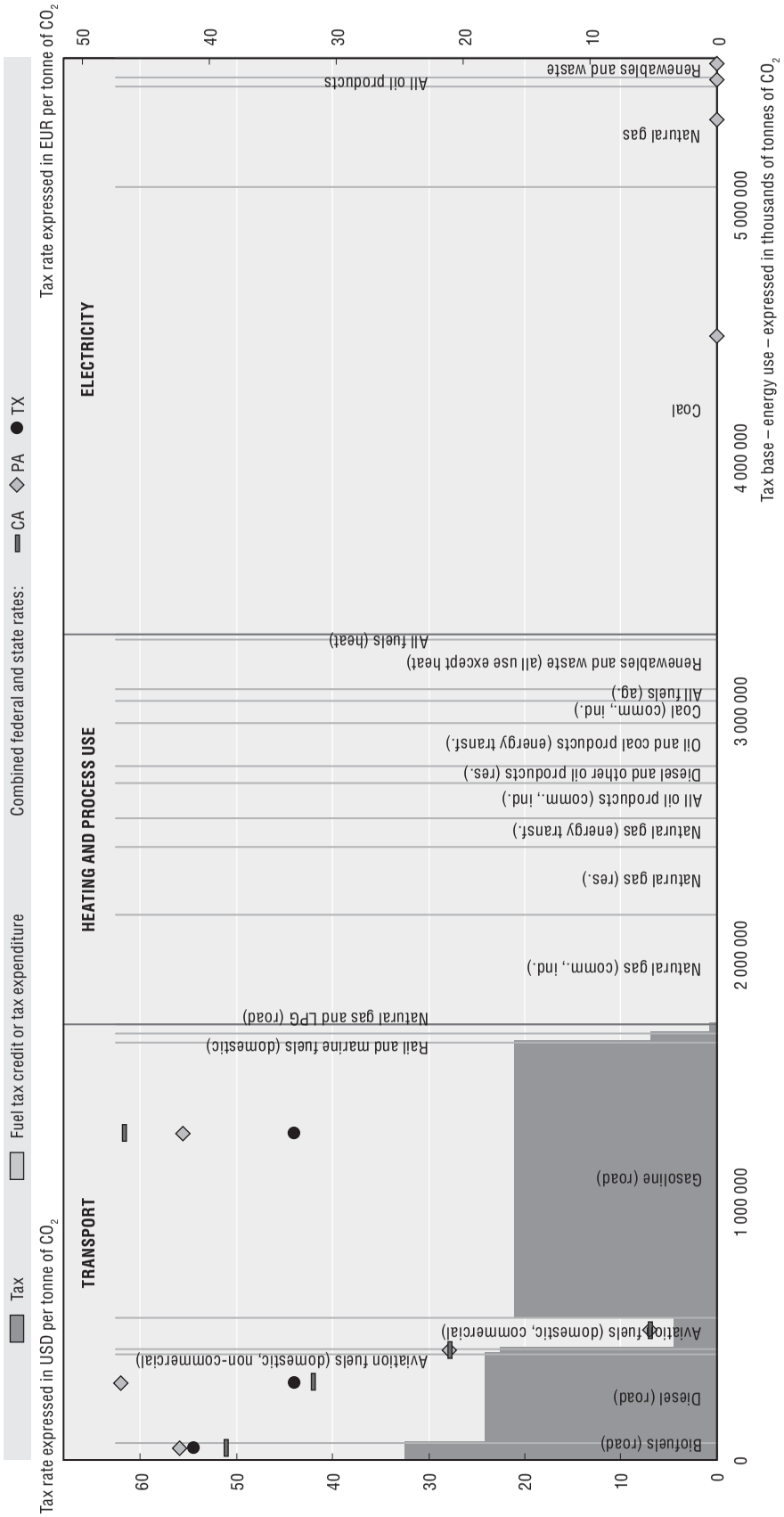


Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; energy use is based on IEA data for 2009. Shaded blocks show federal taxes. For illustrative purposes, the combined level of federal and provincial taxes for selected states is indicated.

StatLink http://dx.doi.org/10.1787/888932767384

Figure 34.2. **Taxation of energy in the United States on a carbon emission basis**



Abbreviations: Res. = residential; comm. = commercial; ind. = industrial; ag. = agricultural; fish. = fishery; energy transf. = energy transformation; heat = merchant heat.

Source: OECD calculations based on IEA data and country-specific tax information (detailed in Annex A). Tax rates are as of 1 April 2012; emissions are based on IEA data for 2009. Shaded blocks show federal taxes. For illustrative purposes, the combined level of federal and provincial taxes for selected states is indicated.

StatLink http://dx.doi.org/10.1787/888932767403

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IEA (2011c), *Oil information (2010 edition)*, OECD, Paris.

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ANNEX A

Methodology and data sources

The maps show the composition of energy use in each country covered and the effective rate of tax on various segments of energy use. Both energy use and tax rates are shown alternately in terms of energy content and carbon content.

This annex provides a detailed overview of the methodology, assumptions, and data sources underlying the maps. Details specific to a particular country are found in the relevant country chapter.

Tax base – energy use

The tax base presented on the horizontal axis of the maps includes all energy use within a country including: the use of energy by end-use residential and business consumers; the use of energy in the generation of electricity (shown in the electricity category) and of heat for sale; and the net energy that is used to transform energy into other forms, or to distribute energy. Given the focus on consumption within each country, imports of energy are included (with the exception of fuels used to produce electricity, detailed below) whereas exports of energy to other countries are excluded. Fuel used in international aviation and international maritime shipping is similarly excluded.

Energy consumption is divided into three main categories: transport fuel use, heating and process fuel use and electricity. Each of these categories has then been disaggregated into a number of subcategories reflecting how tax bases are defined in the particular national tax system. The subcategories therefore differ from country to country and may reflect, variously, the nature of the fuel, the use of the fuel or the user of the fuel.

Within the main categories, transport is relatively straightforward, with a few major fuels (motor gasoline and diesel) and some smaller items, like biofuels. Heating and process fuel use (comprised from IEA data on industrial, commercial and residential use) is more complex because the same fuels can be taxed very differently depending on whether they are used for industrial processes or for heating and, in some countries, depending on household location or size. The heating and process fuel use category also includes the net energy used to transform energy from one form to another – *e.g.,* in oil refineries, which transform crude oil into products like motor gasoline and diesel, or in merchant heating plants that burn fuel to produce heat for sale. Net energy use has been identified by calculating the difference (in terms of energy content or carbon emissions) between the energy that has been used by each type of energy transformation plant and the energy output by that plant as another fuel available for use by an end-use consumer. In the IEA data, fuels used by industry for transport off business premises (for example, for transit of

goods on public roads) are included in the transport sector, whereas fuels used as propellant on business premises are listed in the heating and process category.

Treatment of electricity

Electricity is a form of secondary energy that is generated using some other source of primary energy (*e.g.*, coal, natural gas or hydro). While relatively few countries tax fuel that is used to generate electricity, many countries have a tax on electricity consumption that may be analysed as an indirect tax on the fuels used to generate the electricity. Given the focus on fuel combustion, therefore, the paper includes electricity consumption but "looks through" to the underlying primary energy used to generate it (provided both the electricity use and the generation take place within the country). All fuels used to produce electricity for domestic consumption, including energy industry own use, are included.

The maps show the domestic consumption of electricity that has been produced domestically. They exclude both electricity generated abroad that is imported and electricity generated domestically which is exported. This is for two reasons:

- In the case of electricity imports, the IEA data does not indicate the producing country or the underlying primary energy source used to generate the electricity.
- Since the maps are based on consumption, it would not seem appropriate to attribute exported electricity to the exporting country.

Given that electricity is generally fungible on the grid, and the generation source of exported electricity cannot be readily identified, the fuels used to generate electricity for export have been assumed to be in the same proportion as for total domestic generation.

"Looking through" domestic electricity consumption to the domestic energy sources used to generate that electricity involves several adjustments. Since the graphs illustrate taxes on the consumption of electricity as an indirect tax on the energy used to produce that electricity, it is necessary to estimate the amount of fuel used to generate the electricity consumed by each user and the related CO_2 emissions.

The energy value of the primary fuel used to generate a unit of electricity for consumption by end users is larger than the energy value of that unit of electricity. This is because there are inefficiencies in converting primary fuels into electricity as well as substantial transmission losses in sending electricity from the place of generation to the place of consumption. Therefore, the energy value of electricity consumed is grossed up to show the energy value of all the primary energy used to generate the electricity.[1]

Given the fungibility of electricity, it is assumed that electricity consumed by each user reflects on a *pro rata* basis the national distribution of generation sources. This amounts to an assumption that all end users use the same mix of electricity. In a similar way to energy use, tax rates on electricity consumption expressed in terms of energy value are adjusted, but in a downward direction, taking into account that the effective tax rate on the fuels used to produce electricity is lower than the nominal tax rate on the energy value of electricity consumed because of energy losses in generation and transmission.

Table A1. **Approaches to electricity in maps of energy use**

	Electricity shown by user of electricity	Electricity shown by fuels used to generate electricity
Tax base	Energy or CO_2 value of the average mix of fuels used to generate the electricity consumed by each user	Energy or CO_2 value of each type of fuel used to generate electricity
Tax rate	Effective tax rate on fuels used to generate the electricity consumed by those users	Effective tax rate on each fuel used to generate electricity

After the adjustments, as with other types of energy, the electricity category in the maps is divided into sub-categories that reflect the way in which electricity is taxed in the particular country. Electricity is therefore shown in the maps in one of two ways, by user or by fuel.

Data sources

Information on energy consumed in each country – the potential tax base – was obtained from the *IEA Extended World Energy Balances* ("EWEB") (IEA, 2011a). Data for 2009, the most recently available data in spreadsheet form, is used essentially as a proxy for current consumption.

Supplementary information on energy use data for individual countries has been used where it is necessary to divide one of the categories in the EWEB to more accurately reflect a country's tax settings. This was necessary, for example, in cases where a country applies a lower tax rate in more remote or less developed areas of the country.

Tax rates

On the vertical axis, the maps show the rate of specific taxes on energy consumption (and related tax expenditures). The taxes covered are those (such as excises) that are levied selectively on some or all energy products on a physical basis such as volume or weight (which in some cases may be set to reflect energy or carbon content). Therefore, not included are taxes (and related tax expenditures) set by reference to the value of products or that apply to a very broad range of goods (such as value-added and retail sales taxes), royalties and other levies on the extraction or harnessing of energy resources (such as crude oil royalties and water "rentals" paid by hydroelectricity generators), and taxes that that may be related to energy use but that are not imposed directly on the fuel (such as vehicle taxes or road user charges). Tax expenditures on bases other than energy consumption (such as renewable energy production or investment in equipment used for that purpose) are similarly excluded.

Carbon taxes on fuel are generally included since such taxes are usually based explicitly or implicitly on the volume or weight of fuel consumed. This is possible since the CO_2 emissions associated with combustion of a given volume or weight of a particular fuel is roughly fixed, regardless of the combustion process used. By contrast, taxes aimed at emissions that are not fixed on a per-volume-of-fuel basis are not included, since the emissions vary according to the quality of the fuel and the combustion technology used. This includes, for example, taxes on directly measured emissions from fuel combustion such as those on NO_x, or SO_x emissions, and taxes based on the amount of sulphur (which produces SO_x) per fuel volume.

Tax rates, which are typically set in monetary units per physical quantity of fuel, are re-calculated as effective tax rates per gigajoule of energy (in the first map for each country) and per tonne of CO_2 emissions (in the second map). Tax rates are shown in local currency on the left-hand axis of the maps, and in euros (converted by reference to the average exchange rate over the 12 months ending August 2012). An alternative approach would convert the rates using a purchasing power parity exchanges rates, but ideally these would be based on a comparison of prices of a basket of energy products, since relative price levels for energy products may differ significantly from general price levels. The tax rate applying to each fuel is mapped on the graph as a shaded bar across the portion of

energy use or carbon emissions (the tax base) to which the particular rate applies. The shaded area is thus an approximation of the revenue raised by the tax – the rate multiplied by the base.

In some cases, due to scale issues, approximations were needed to allow the tax system to be shown on the graph. In particular, some minor variations in tax schedules were not included (such as exemptions for fuel for emergency vehicles) and tax bases that were very small have sometimes been included in other categories by taking a weighted average of the applicable tax rates (for example, fuel oil and diesel oil have sometimes been included within a single category). More information on such approximations can be found in the country-specific chapters.

Two of the countries examined, Chile and Mexico, have price stabilisation mechanisms that are used to control to varying extents the price of certain fossil fuels in the domestic economy. These mechanisms can be analysed as being equivalent to a tax on consumption in some cases, and to a subsidy to consumption in other cases. Given the importance of these policy mechanisms to the treatment of energy in these economies, an attempt is made to incorporate them into the maps.

For federal countries, given that the horizontal axis shows national energy use, the horizontal bars showing the tax rate applicable to a given range of energy use reflect only federal taxes. It would not be practical to accurately illustrate in a national graph taxation at the sub-national level (*e.g.*, by provinces and states). This is because each category along the horizontal access would in principle need to have a subdivision for each sub-national jurisdiction, or at least each jurisdiction that has a different tax rate. Nonetheless, in order to give some sense of the range in the levels of taxes levied by sub-national jurisdictions, for federal countries where this is relevant, the graph indicates the combined level of federal and sub national tax in selected sub-national jurisdictions.

An attempt has been made to note the interaction of tax systems with other policy instruments in the case of CO_2 emission trading. In particular, the graphs distinguish fuel consumers participating in the European Union Emission Trading System (EU ETS) by including the symbol "[ETS-A]" after the name of the category where all or most of it is covered by the ETS, and the symbol "[ETS-P]" if the category is only partially covered by the ETS.

Treatment of electricity

Taxes levied on electricity consumption have been mapped as effective taxes on the fuels used to generate the electricity. In cases where a common nominal tax rate is applied to all electricity consumption, the effective tax rate on each underlying energy source (*e.g.*, coal, natural gas, hydro) used to generate the electricity is shown. In cases where different rates of nominal electricity tax apply to consumption in different sectors (*e.g.*, residential, commercial, industrial), for each sector, the effective tax rate shown is that on the "average" basket of fuels used to generate electricity in the country. Effective carbon tax rates on electricity need to be interpreted carefully because of this assumption. If carbon energy is a small proportion of the generation mix, the effective tax rate on carbon thus calculated will be very high.

As described with reference to tax bases, in cases where tax rates on electricity consumption are shown in the maps, they have been adjusted downward to take into account that the effective tax rate on the energy value of fuels used in producing electricity

is lower than the nominal rate on the energy value of electricity consumed because of energy losses in generation and transmission.

Data sources

Tax rates are the rates in effect on 1 April 2012 unless otherwise indicated. Tax rate information (used to construct the vertical axes of the maps) was obtained from several sources. Key sources that were used for multiple countries include the *Database on Instruments Used for Environmental Policy and Natural Resources Management* (OECD/EEA), the *Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels* (OECD, 2013) and the *Excise Duty Tables* (European Commission, 2012). Country-specific sources are detailed in the country-specific chapters. Bilateral consultations were also an important source in obtaining or confirming tax rates.

Tax expenditures

In addition to showing taxes levied, the maps developed in this paper can also illustrate tax exemptions, refunds and credits, reduced rates and other tax expenditures that reduce the effective tax rate for some portion of the tax base. A tax expenditure is a measure that reduces the tax burden relative to some benchmark level that would otherwise apply under the "normal" rules of the particular country.

The maps included in the country sections show tax expenditures for the products and users where these are reported by the countries concerned. They also show tax rebates and tax credits which apply to energy products, whether or not these are identified as tax expenditures *per se*. This is important in order for the maps to show the net level of tax on each category of energy use. Where more than one benchmark is encompassed within a single category in the maps (*e.g.*, if the applicable tax bases are very small) a weighted average of the relevant benchmarks has been used.

Many countries estimate tax expenditures using the so-called revenue foregone method, which measures the tax expenditure as the rate of the tax concession multiplied by the relevant base or uptake. Such estimates do not take into account changes in behaviour that might occur if the measure were to be removed, which could affect the base of the tax expenditure and therefore the amount of revenue that would be raised by its removal. This is a specific implication of the fact that tax rates (the vertical axis) and tax bases (the horizontal axis) are not independent – changes in tax rates affect behaviour and therefore the size of tax bases.

In the energy use and taxation maps, the shaded area under the tax rate for any portion of the tax base is therefore an approximation of the revenue obtained from that particular tax base, or in the case of tax expenditures, the revenue foregone. These values, however, will generally differ somewhat from official estimates of tax revenues and tax expenditures – including the values in the *Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels* (OECD, 2013) – for a number of reasons:

- tax rates and tax expenditures in the maps are generally based on parameters as of 1 October 2011 or 1 April 2012, while energy use data is for calendar year 2009;
- inexact matching between actual tax bases and energy use data (in terms of fuels, uses or users) and the omission from the maps of measures with very small tax bases; and
- uncertainty in some cases about benchmarks used for tax expenditure estimates.

Data sources

The tax expenditures reported by countries and related benchmarks were obtained from national official budget data and government reports and from the *Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels* (OECD, 2013). Country-specific sources are detailed in the relevant country section. In many cases, the benchmark applied by governments in calculating the impact of various different exemptions or refunds, which is not always explicit in public documents, has been confirmed in bilateral consultations.

Conversion of tax bases and tax rates to energy content and CO_2 emissions

To show tax base and rate information on a single graph, both the tax rates and tax bases presented in the maps were first converted from their original units (tax rates, for example, are often based on volume or weight) to energy content measured in gigajoules and then to tonnes of CO_2 emissions.

Because of the differing energy and emission characteristics of different fuels, if the same tax rate is applied to two different fuels on a, for example, per litre basis, they would not generally have the same effective tax rate in energy or carbon content terms. If the policy aim is to tax two fuels consistently based on their energy or carbon content, a different nominal tax rate will be needed for the two fuels if the rate is set on a volume or mass basis.

In the electricity sector, the carbon content refers to the carbon content of the underlying primary energy sources used to generate the electricity.

Coverage of CO_2 emissions

Among greenhouse gases, account is only taken of CO_2 emissions, which constitute about 82% of total greenhouse gases emissions in OECD countries (IEA, 2009). Other greenhouse gas emissions have not been included for two reasons:

- The level of CO_2 emissions from fuel combustion is more or less fixed for a given quantity of each carbon fuel regardless of the combustion technology used. By contrast, the emissions factors for other greenhouse gases like methane (CH_4) and nitrous oxide (N_2O) change significantly depending on the technology used in the combustion process (IPCC, 2006). These two pollutants account for 15% of GHG emissions in the OECD area. The three remaining GHG gases (hydrofluorocarbons (HFC), perfluorocarbons (PFC) and sulphur hexafluoride (SF6)) are produced by specific industrial processes (*e.g.*, primary aluminium production for PFC) rather than by fuel combustion.
- Among the countries examined, where there is a component of energy taxes that reflects greenhouse gases, it is in fact related exclusively to CO_2 rather than to any of the greenhouse gases associated with energy combustion

The CO_2 emissions shown in this paper may differ from those provided in other data sources (such as country GHG inventories for the UNFCC for three main reasons:

- Firstly, consistent with the focus of this report on energy, only emissions relating to fuel combustion are shown; those from other sources, such as chemical reactions in industrial processes, landfills, agriculture land and livestock are not shown.
- Secondly, biofuels are treated as having a positive level of carbon emissions in these maps, as discussed below.

- Finally, the carbon emissions shown on the graphs are calculated using information on energy consumption for all the various fuels for each country from the International Energy Agency (IEA), converted to carbon emissions using standard conversion factors from the Intergovernmental Panel on Climate Change and the IEA as set out above.

The emissions figures, therefore, are essentially a "bottom-up" estimation of the carbon emissions from fuel use.

Emissions from biomass

There are three ways that CO_2 emissions from combustion of biomass (plants and trees) could potentially have been treated for the purposes of the maps:

- As with fossil fuels (coal, oil, natural gas), include direct human-made CO_2 emissions from biomass combustion, which would lead to positive emissions factors.
- Take into account the fact that plants and trees absorb CO_2 from the atmosphere as they grow, and emit CO_2 back into the atmosphere when they die – whether by human-made combustion or natural causes such as forest fires or decomposition – and relatively short life-cycle of plants and trees (years, decades or centuries) as compared with fossil fuels (millions of years). On this basis, the net effect of biomass production and consumption is sometimes considered to be "carbon neutral" as a general principle, leading to a zero emission factor.
- Estimate the emissions implied by particular types of biomass by following a life-cycle approach that examines the source of the biomass ("natural" vs. human-initiated crops), impacts of land use change, whether and how harvested biomass is replanted, etc. Under this approach, the carbon balance of biomass is neutral only if the original biomass is replanted in the same form after harvest, thus preserving its carbon absorption (sink) function. Depending on the particular source, this approach could potentially lead to positive or negative emission factors.

According to the debate in environmental economics (see, for example, Searchinger, 2010; Royal Society, 2008), considering biomass as automatically carbon neutral (the second option) is likely to be too simplistic. Assuming zero net emissions involves making assumptions about the lifecycle of biomass that may not be accurate. On the other hand, adopting a life-cycle approach (third option) to obtain an overall estimate of the carbon impact of biomass production from particular sources in particular countries is beyond the scope of this paper and would be very challenging to do even as a stand-alone project, given the heterogeneity of biomass sources and the limited information available.

For these reasons, in order to provide the most information, the first option was followed, so that the direct emissions produced by biomass combustion are shown, in the same way as with fossil energy. Users who are comfortable that a particular biomass source can be considered carbon neutral can choose to ignore those carbon values.

Data sources

Information from the Energy Balances of OECD countries (IEA, 2011a) and Oil Information (IEA, 2011c) was used to convert volume- or mass-based tax rates or consumption data to gigajoules.

The emission factors were taken from the Intergovernmental Panel on Climate Change's *Guidelines for National Greenhouse Gas Inventories* (IPCC, 2006) and applied to the corresponding energy products. The information used is consistent with the emission

factors listed by the IEA in its report *CO_2 Emissions from Fuel Combustion* (IEA, 2011e). In some cases a greater level of detail was available in the IPCC publication, and for this reason it has been used as the primary data source. The IPCC provides the data which allow the conversion from gigajoules to carbon content. Carbon content data have been converted to CO_2 by using the molecular weight ratio of CO_2 to C (44/12).

Note

1. This gross-up is based on the observed energy efficiency of electricity generation in the country in question as derived from the IEA energy balances. In the case of combined heat and power (also known as cogeneration) plants, which produce both electricity and heat using the same fuel, it is assumed that heat is a by-product and is 100% efficient. The energy value of the marketable heat output is subtracted from the energy value of fuel inputs. The remaining fuel use is attributed to electricity generation, from which an effective efficiency rate can be calculated.

ANNEX B

Effective tax rate overview by country

Note: Figures are based on energy consumption data for 2009 from IEA (2011a) and statutory tax rates as of 1 April 2012 (unless otherwise indicated).

	Fuel user	Oil products	Coal and peat	Natural gas	Biofuels and waste	Renewables and nuclear	All fuels	Oil products	Coal and peat	Natural gas	Biofuels and waste	All fuels
		EUR per GJ						*EUR per tonne CO_2*				
Australia (Rates as of 1 July 2012)	Road	7.7	0.0	0.0	0.5	0.0	7.6	109.1	0.0	0.0	6.8	108.0
	Non-road	1.5	0.0	0.0	0.0	0.0	1.4	21.0	0.0	0.0	0.0	18.9
	Total transport	*6.9*	*0.0*	*0.0*	*0.5*	*0.0*	*6.7*	*97.1*	*0.0*	*0.0*	*6.8*	*94.8*
	Residential and commercial	1.3	0.0	0.0	0.0	0.0	0.2	18.2	0.0	0.0	0.0	2.7
	Industrial and energy transformation	1.0	0.0	0.0	0.0	0.0	0.3	13.5	0.0	0.0	0.0	3.7
	Total heating and process	*1.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.3*	*13.9*	*0.0*	*0.0*	*0.0*	*3.5*
	Electricity	1.0	0.0	0.0	0.0	0.0	0.0	12.7	0.0	0.0	0.0	0.1
	Total	**5.3**	**0.0**	**0.0**	**0.0**	**0.0**	**1.6**	**74.8**	**0.0**	**0.0**	**0.2**	**19.6**
Austria	Road	12.9	0.0	1.7	0.0	0.0	12.0	176.8	0.0	29.5	0.0	165.1
	Non-road	1.0	0.0	1.7	0.0	0.0	1.3	13.7	0.0	29.5	0.0	20.3
	Total transport	*12.6*	*0.0*	*1.7*	*0.0*	*0.0*	*11.5*	*172.5*	*0.0*	*29.5*	*0.0*	*158.9*
	Residential and commercial	3.3	1.7	1.7	0.0	0.0	1.6	45.3	16.7	29.5	0.0	20.4
	Industrial and energy transformation	3.5	0.5	1.1	0.0	0.0	1.2	49.3	3.7	16.6	0.0	13.1
	Total heating and process	*3.4*	*0.5*	*1.3*	*0.0*	*0.0*	*1.3*	*47.4*	*4.2*	*20.2*	*0.0*	*15.5*
	Electricity	0.0	2.0	2.6	1.3	3.3	2.6	0.4	47.1	55.8	28.2	41.3
	Total	**9.4**	**1.0**	**1.6**	**0.2**	**3.1**	**4.4**	**129.8**	**16.7**	**26.6**	**4.1**	**57.9**
Belgium	Road	12.8	0.0	0.0	0.0	0.0	12.4	174.8	0.0	0.0	0.0	169.3
	Non-road	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total transport	*12.5*	*0.0*	*0.0*	*0.0*	*0.0*	*12.1*	*170.6*	*0.0*	*0.0*	*0.0*	*165.4*
	Residential and commercial	0.5	0.0	0.3	0.0	0.0	0.4	6.9	0.0	4.9	0.0	5.4
	Industrial and energy transformation	0.1	0.1	0.1	0.0	0.0	0.1	0.8	1.2	1.2	0.0	0.9
	Total heating and process	*0.2*	*0.1*	*0.2*	*0.0*	*0.0*	*0.2*	*3.4*	*1.0*	*3.1*	*0.0*	*2.8*
	Electricity	0.4	0.4	0.6	0.3	0.4	0.4	10.9	21.3	7.9	15.4	14.0
	Total	**6.4**	**0.2**	**0.3**	**0.2**	**0.4**	**2.5**	**86.9**	**10.9**	**4.4**	**7.8**	**45.6**
Canada (federal)	Road	1.9	0.0	0.0	3.6	0.0	1.9	27.0	0.0	0.0	50.2	27.4
	Non-road	0.8	0.0	0.0	0.0	0.0	0.6	11.6	0.0	0.0	0.0	9.2
	Total transport	*1.7*	*0.0*	*0.0*	*3.6*	*0.0*	*1.7*	*24.5*	*0.0*	*0.0*	*50.2*	*23.9*
	Residential and commercial	0.6	0.0	0.0	0.0	0.0	0.2	8.7	0.0	0.0	0.0	2.7
	Industrial and energy transformation	0.2	0.0	0.0	0.0	0.0	0.1	3.1	0.0	0.0	0.0	0.8
	Total heating and process	*0.4*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*5.2*	*0.0*	*0.0*	*0.0*	*1.4*
	Electricity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	**1.2**	**0.0**	**0.0**	**0.2**	**0.0**	**0.4**	**17.4**	**0.0**	**0.0**	**2.3**	**7.7**

	Fuel user	Oil products	Coal and peat	Natural gas	Biofuels and waste	Renewables and nuclear	All fuels	Oil products	Coal and peat	Natural gas	Biofuels and waste	All fuels
		EUR per GJ						*EUR per tonne CO_2*				
Chile	Road	5.8	0.0	3.0	0.0	0.0	5.8	81.2	0.0	53.9	0.0	81.1
	Non-road	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total transport	*5.1*	*0.0*	*3.0*	*0.0*	*0.0*	*5.1*	*71.0*	*0.0*	*53.9*	*0.0*	*71.0*
	Residential and commercial	-0.1	0.0	0.0	0.0	0.0	0.0	-1.3	0.0	0.0	0.0	-0.3
	Industrial and energy transformation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total heating and process	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-0.2*	*0.0*	*0.0*	*0.0*	*-0.1*
	Electricity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	**2.1**	**0.0**	**0.0**	**0.0**	**0.0**	**1.2**	**29.3**	**0.0**	**0.8**	**0.0**	**15.7**
Czech Republic	Road	13.3	0.0	0.4	0.0	0.0	12.8	184.0	0.0	6.7	0.0	177.8
	Non-road	8.8	0.3	0.4	0.0	0.0	6.0	119.5	3.3	6.7	0.0	88.5
	Total transport	*13.2*	*0.3*	*0.4*	*0.0*	*0.0*	*12.6*	*182.5*	*3.3*	*6.7*	*0.0*	*175.0*
	Residential and commercial	0.4	0.3	0.1	0.0	0.0	0.1	5.9	3.4	2.3	0.0	1.7
	Industrial and energy transformation	1.6	0.2	0.3	0.0	0.0	0.4	22.1	1.7	6.0	0.0	4.2
	Total heating and process	*1.6*	*0.2*	*0.2*	*0.0*	*0.0*	*0.3*	*21.9*	*1.8*	*4.1*	*0.0*	*3.5*
	Electricity	0.1	0.1	0.1	0.0	0.0	0.1	0.9	1.1	2.2	0.0	1.1
	Total	**11.2**	**0.1**	**0.2**	**0.0**	**0.0**	**2.3**	**155.0**	**1.4**	**4.1**	**0.0**	**31.6**
Denmark	Road	14.7	0.0	0.0	0.0	0.0	14.7	204.4	0.0	0.0	0.0	204.0
	Non-road	9.9	0.0	0.0	0.0	0.0	9.9	134.2	0.0	0.0	0.0	134.2
	Total transport	*14.3*	*0.0*	*0.0*	*0.0*	*0.0*	*14.3*	*198.6*	*0.0*	*0.0*	*0.0*	*198.2*
	Residential and commercial	9.9	0.4	9.3	0.0	0.0	5.7	135.5	8.9	165.0	0.0	69.5
	Industrial and energy transformation	2.3	1.4	0.9	0.0	0.0	1.2	31.3	14.5	16.1	0.0	15.0
	Total heating and process	*4.0*	*1.3*	*3.2*	*0.0*	*0.0*	*2.3*	*54.8*	*14.5*	*57.0*	*0.0*	*29.8*
	Electricity	5.2	5.2	6.9	5.8	10.5	6.1	64.4	81.9	48.6	89.2	78.4
	Total	**10.6**	**4.0**	**3.8**	**0.9**	**9.9**	**6.3**	**145.6**	**61.2**	**55.5**	**13.1**	**81.7**
Estonia	Road	11.9	0.0	0.0	0.0	0.0	11.9	165.3	0.0	0.0	0.0	165.3
	Non-road	11.0	0.0	0.0	0.0	0.0	11.0	148.2	0.0	0.0	0.0	148.2
	Total transport	*11.8*	*0.0*	*0.0*	*0.0*	*0.0*	*11.8*	*164.2*	*0.0*	*0.0*	*0.0*	*164.2*
	Residential and commercial	2.9	0.1	0.7	0.0	0.0	0.3	39.6	0.9	12.5	0.0	3.2
	Industrial and energy transformation	2.3	0.2	0.0	0.0	0.0	0.4	30.5	1.7	0.0	0.0	4.2
	Total heating and process	*2.4*	*0.2*	*0.1*	*0.0*	*0.0*	*0.3*	*32.3*	*1.6*	*2.1*	*0.0*	*3.9*
	Electricity	0.4	0.4	0.6	0.9	1.2	0.4	5.8	4.0	11.1	8.1	4.1
	Total	**9.5**	**0.3**	**0.1**	**0.0**	**1.2**	**2.3**	**131.1**	**3.3**	**2.3**	**0.3**	**25.7**

	Fuel user	Oil products	Coal and peat	Natural gas	Biofuels and waste	Renewables and nuclear	All fuels	Oil products	Coal and peat	Natural gas	Biofuels and waste	All fuels
		EUR per GJ						*EUR per tonne CO_2*				
Finland	Road	16.1	0.0	2.5	15.5	0.0	16.0	223.0	0.0	44.3	218.3	222.7
	Non-road	9.6	0.0	2.5	0.0	0.0	9.4	131.6	0.0	44.3	0.0	129.8
	Total transport	*15.5*	*0.0*	*2.5*	*15.5*	*0.0*	*15.5*	*215.5*	*0.0*	*44.3*	*218.3*	*215.1*
	Residential and commercial	4.5	0.5	2.5	0.0	0.0	1.9	60.0	5.0	44.3	0.0	19.4
	Industrial and energy transformation	1.2	7.9	2.5	0.0	0.0	2.4	23.6	74.3	44.3	0.0	30.4
	Total heating and process	*1.8*	*7.9*	*2.5*	*0.0*	*0.0*	*2.3*	*32.6*	*73.8*	*44.3*	*0.0*	*28.3*
	Electricity	1.6	1.5	2.4	1.9	1.3	1.5	28.3	41.4	20.8	41.3	38.6
	Total	**7.9**	**4.8**	**2.4**	**0.6**	**1.3**	**3.9**	**126.1**	**58.4**	**32.2**	**11.0**	**60.2**
France	Road	13.3	0.0	0.0	13.5	0.0	13.3	182.0	0.0	0.0	190.8	182.3
	Non-road	0.2	0.0	0.0	0.0	0.0	0.2	2.2	0.0	0.0	0.0	2.2
	Total transport	*12.7*	*0.0*	*0.0*	*13.5*	*0.0*	*12.7*	*174.2*	*0.0*	*0.0*	*190.8*	*174.7*
	Residential and commercial	1.6	0.3	0.1	0.0	0.0	0.5	22.6	3.5	1.6	0.0	7.5
	Industrial and energy transformation	0.7	0.2	0.2	0.0	0.0	0.4	10.0	2.2	4.4	0.0	5.5
	Total heating and process	*1.1*	*0.2*	*0.2*	*0.0*	*0.0*	*0.5*	*15.7*	*2.2*	*2.7*	*0.0*	*6.5*
	Electricity	0.1	0.1	0.1	0.1	0.1	0.1	8.6	13.8	6.4	10.9	11.4
	Total	**8.0**	**0.1**	**0.1**	**2.2**	**0.1**	**2.5**	**110.0**	**7.6**	**3.1**	**23.1**	**61.1**
Germany	Road	16.0	0.0	0.0	19.2	0.0	16.1	222.4	0.0	0.0	271.4	224.6
	Non-road	0.9	0.0	0.0	0.0	0.0	0.9	12.1	0.0	0.0	0.0	12.1
	Total transport	*15.3*	*0.0*	*0.0*	*19.2*	*0.0*	*15.4*	*212.1*	*0.0*	*0.0*	*271.4*	*214.8*
	Residential and commercial	1.9	0.3	1.5	0.0	0.0	1.5	25.5	3.4	27.2	0.0	22.4
	Industrial and energy transformation	0.3	0.2	1.0	0.1	0.0	0.6	4.6	2.7	18.0	0.8	7.6
	Total heating and process	*1.3*	*0.2*	*1.3*	*0.1*	*0.0*	*1.1*	*18.6*	*2.7*	*23.5*	*0.4*	*14.9*
	Electricity	1.8	1.6	2.6	1.1	1.8	1.7	21.1	29.3	15.6	26.7	27.7
	Total	**9.5**	**1.3**	**1.5**	**2.8**	**1.7**	**4.0**	**131.4**	**22.5**	**22.3**	**35.0**	**58.3**
Greece	Road	16.9	0.0	0.0	13.8	0.0	16.9	237.9	0.0	0.0	195.0	237.1
	Non-road	5.2	0.0	0.0	0.0	0.0	5.2	69.1	0.0	0.0	0.0	69.0
	Total transport	*15.2*	*0.0*	*0.0*	*13.8*	*0.0*	*15.2*	*212.1*	*0.0*	*0.0*	*195.0*	*211.7*
	Residential and commercial	2.3	0.3	1.5	0.0	0.0	1.7	30.9	3.0	26.7	0.0	23.0
	Industrial and energy transformation	1.8	0.3	1.5	0.0	0.0	1.5	23.5	3.1	26.7	0.0	20.0
	Total heating and process	*2.0*	*0.3*	*1.5*	*0.0*	*0.0*	*1.6*	*26.7*	*3.1*	*26.7*	*0.0*	*21.4*
	Electricity	3.1	0.2	1.8	0.7	0.0	0.9	41.9	2.4	33.0	11.0	10.4
	Total	**9.1**	**0.2**	**1.7**	**1.1**	**0.0**	**5.3**	**124.4**	**2.4**	**30.7**	**10.7**	**68.0**

	Fuel user	Oil products	Coal and peat	Natural gas	Biofuels and waste	Renewables and nuclear	All fuels	Oil products	Coal and peat	Natural gas	Biofuels and waste	All fuels
		EUR per GJ						*EUR per tonne CO_2*				
Hungary	Road	10.4	0.0	0.0	0.0	0.0	10.0	144.4	0.0	0.0	0.0	138.8
	Non-road	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total transport	*10.3*	*0.0*	*0.0*	*0.0*	*0.0*	*9.9*	*142.1*	*0.0*	*0.0*	*0.0*	*136.7*
	Residential and commercial	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	1.8	0.0	1.3
	Industrial and energy transformation	1.0	0.1	0.1	0.0	0.0	0.3	13.1	1.4	2.3	0.0	4.0
	Total heating and process	*0.8*	*0.1*	*0.1*	*0.0*	*0.0*	*0.2*	*11.6*	*1.3*	*2.0*	*0.0*	*2.5*
	Electricity	0.1	0.0	0.1	0.0	0.0	0.1	1.0	1.4	0.7	1.4	1.2
	Total	**8.4**	**0.1**	**0.1**	**0.0**	**0.0**	**2.1**	**115.7**	**1.3**	**1.8**	**0.5**	**35.4**
Iceland	Road	12.0	0.0	0.0	0.0	0.0	12.0	169.3	0.0	0.0	0.0	169.2
	Non-road	0.2	0.0	0.0	0.0	0.0	0.2	2.6	0.0	0.0	0.0	2.6
	Total transport	*11.0*	*0.0*	*0.0*	*0.0*	*0.0*	*11.0*	*153.8*	*0.0*	*0.0*	*0.0*	*153.7*
	Residential and commercial	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Industrial and energy transformation	0.7	0.0	0.0	0.0	0.0	0.2	9.3	0.0	0.0	0.0	6.7
	Total heating and process	*0.7*	*0.0*	*0.0*	*0.0*	*0.0*	*0.2*	*9.2*	*0.0*	*0.0*	*0.0*	*6.6*
	Electricity	0.0	0.0	0.0	0.0	0.1	0.1	2 982.1	0.0	0.0	3 656.8	3 129.3
	Total	**6.1**	**0.0**	**0.0**	**0.0**	**0.1**	**0.7**	**88.8**	**0.0**	**0.0**	**657.3**	**76.0**
Ireland	Road	15.3	0.0	0.0	18.4	0.0	15.3	211.8	0.0	0.0	260.2	212.7
	Non-road	5.9	0.0	0.0	0.0	0.0	5.9	79.5	0.0	0.0	0.0	79.5
	Total transport	*15.1*	*0.0*	*0.0*	*18.4*	*0.0*	*15.1*	*208.6*	*0.0*	*0.0*	*260.2*	*209.5*
	Residential and commercial	2.1	0.0	1.1	0.0	0.0	1.5	28.4	0.0	20.3	0.0	20.4
	Industrial and energy transformation	7.4	0.1	1.1	0.0	0.0	4.4	98.8	1.0	20.3	0.0	59.7
	Total heating and process	*4.2*	*0.0*	*1.1*	*0.0*	*0.0*	*2.6*	*56.9*	*0.3*	*20.3*	*0.0*	*36.0*
	Electricity	0.0	0.2	0.2	0.0	0.0	0.2	0.0	1.7	3.2	0.0	2.3
	Total	**10.3**	**0.1**	**0.5**	**4.4**	**0.0**	**5.4**	**140.7**	**1.3**	**9.6**	**46.3**	**77.1**
Israel	Road	16.9	0.0	0.0	0.0	0.0	16.9	236.3	0.0	0.0	0.0	236.3
	Non-road	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total transport	*16.9*	*0.0*	*0.0*	*0.0*	*0.0*	*16.9*	*236.3*	*0.0*	*0.0*	*0.0*	*236.3*
	Residential and commercial	6.5	0.0	0.0	0.0	0.0	3.2	98.4	0.0	0.0	0.0	97.7
	Industrial and energy transformation	1.5	0.0	0.1	0.0	0.0	1.3	19.3	0.0	1.1	0.0	17.4
	Total heating and process	*3.3*	*0.0*	*0.1*	*0.0*	*0.0*	*2.2*	*45.6*	*0.0*	*1.1*	*0.0*	*42.2*
	Electricity	2.1	0.4	0.1	0.0	0.0	0.4	27.2	3.9	1.1	0.0	4.3
	Total	**12.0**	**0.4**	**0.1**	**0.0**	**0.0**	**5.4**	**166.3**	**3.9**	**1.1**	**0.0**	**73.3**

	Fuel user	Oil products	Coal and peat	Natural gas	Biofuels and waste	Renewables and nuclear	All fuels	Oil products	Coal and peat	Natural gas	Biofuels and waste	All fuels
		EUR per GJ						*EUR per tonne CO_2*				
Italy	Road	17.7	0.0	0.1	21.5	0.0	17.6	245.8	0.0	1.5	303.8	244.5
	Non-road	0.2	0.0	0.0	0.0	0.0	0.2	2.1	0.0	0.0	0.0	2.1
	Total transport	*16.8*	*0.0*	*0.1*	*21.5*	*0.0*	*16.7*	*232.5*	*0.0*	*1.5*	*303.8*	*231.8*
	Residential and commercial	8.1	0.0	0.1	0.0	0.0	1.2	116.0	0.0	1.9	0.0	20.2
	Industrial and energy transformation	1.7	0.1	0.3	0.0	0.0	0.9	22.5	0.8	5.4	0.0	12.8
	Total heating and process	*3.4*	*0.1*	*0.2*	*0.0*	*0.0*	*1.1*	*45.1*	*0.8*	*3.1*	*0.0*	*16.4*
	Electricity	0.0	1.0	1.2	1.9	1.9	1.2	0.5	12.4	21.1	18.6	15.0
	Total	**11.1**	**0.9**	**0.6**	**4.4**	**1.8**	**5.0**	**152.4**	**10.2**	**9.8**	**44.6**	**75.9**
Japan	Road	13.3	0.0	0.0	0.0	0.0	13.3	188.2	0.0	0.0	0.0	188.2
	Non-road	4.1	0.0	0.0	0.0	0.0	4.1	56.0	0.0	0.0	0.0	56.0
	Total transport	*12.5*	*0.0*	*0.0*	*0.0*	*0.0*	*12.5*	*175.7*	*0.0*	*0.0*	*0.0*	*175.7*
	Residential and commercial	0.5	0.3	0.3	0.0	0.0	0.4	6.6	2.9	2.9	0.0	5.1
	Industrial and energy transformation	0.2	0.2	0.1	0.0	0.0	0.2	2.9	1.8	0.8	0.0	2.0
	Total heating and process	*0.3*	*0.2*	*0.2*	*0.0*	*0.0*	*0.3*	*4.5*	*1.8*	*2.3*	*0.0*	*2.9*
	Electricity	0.4	0.7	0.8	0.5	1.0	0.8	5.7	6.5	13.4	4.3	8.2
	Total	**6.1**	**0.5**	**0.5**	**0.3**	**1.0**	**2.6**	**84.6**	**4.4**	**8.9**	**2.6**	**37.4**
Korea	Road	11.2	0.0	0.7	0.0	0.0	10.8	159.2	0.0	11.9	0.0	154.1
	Non-road	4.4	0.0	0.0	0.0	0.0	4.4	58.4	0.0	0.0	0.0	58.4
	Total transport	*10.9*	*0.0*	*0.7*	*0.0*	*0.0*	*10.5*	*154.0*	*0.0*	*11.9*	*0.0*	*149.3*
	Residential and commercial	1.4	0.0	0.7	0.0	0.0	0.9	20.1	0.0	11.9	0.0	13.5
	Industrial and energy transformation	0.5	0.0	0.7	0.0	0.0	0.3	6.7	0.0	11.9	0.0	3.4
	Total heating and process	*0.7*	*0.0*	*0.7*	*0.0*	*0.0*	*0.5*	*10.2*	*0.0*	*11.9*	*0.0*	*5.9*
	Electricity	0.1	0.0	0.7	0.0	0.0	0.1	1.8	0.0	11.9	0.0	1.4
	Total	**5.8**	**0.0**	**0.7**	**0.0**	**0.0**	**1.8**	**81.5**	**0.0**	**11.9**	**0.0**	**26.5**
Luxembourg	Road	10.3	0.0	0.0	0.0	0.0	10.1	140.5	0.0	0.0	0.0	137.7
	Non-road	9.3	0.0	0.0	0.0	0.0	9.3	125.9	0.0	0.0	0.0	125.9
	Total transport	*10.3*	*0.0*	*0.0*	*0.0*	*0.0*	*10.1*	*140.4*	*0.0*	*0.0*	*0.0*	*137.7*
	Residential and commercial	0.3	0.0	0.3	0.0	0.0	0.3	3.8	0.0	5.3	0.0	4.4
	Industrial and energy transformation	0.5	0.0	0.2	0.0	0.0	0.1	7.2	0.0	2.7	0.0	2.0
	Total heating and process	*0.3*	*0.0*	*0.2*	*0.0*	*0.0*	*0.2*	*4.1*	*0.0*	*4.3*	*0.0*	*3.5*
	Electricity	0.0	0.0	0.1	0.0	0.2	0.1	2.1	0.0	1.6	2.6	1.7
	Total	**9.0**	**0.0**	**0.2**	**0.0**	**0.2**	**6.6**	**123.5**	**0.0**	**4.0**	**0.3**	**93.6**
Mexico	Road	0.6	0.0	0.0	0.0	0.0	0.6	8.2	0.0	0.0	0.0	8.2
	Non-road	0.4	0.0	0.0	0.0	0.0	0.4	6.0	0.0	0.0	0.0	6.0
	Total transport	*0.6*	*0.0*	*0.0*	*0.0*	*0.0*	*0.6*	*8.1*	*0.0*	*0.0*	*0.0*	*8.1*
	Residential and commercial	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
	Industrial and energy transformation	0.1	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.4
	Total heating and process	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.6*	*0.0*	*0.0*	*0.0*	*0.3*
	Electricity	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.1
	Total	**0.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.2**	**4.7**	**0.0**	**0.0**	**0.0**	**2.8**

	Fuel user	Oil products	Coal and peat	Natural gas	Biofuels and waste	Renewables and nuclear	All fuels	Oil products	Coal and peat	Natural gas	Biofuels and waste	All fuels
		EUR per GJ						*EUR per tonne CO_2*				
Netherlands	Road	15.9	0.0	0.0	22.2	0.0	16.1	221.4	0.0	0.0	314.2	224.4
	Non-road	5.8	0.0	0.0	0.0	0.0	5.8	78.4	0.0	0.0	0.0	78.4
	Total transport	*15.7*	*0.0*	*0.0*	*22.2*	*0.0*	*15.9*	*218.4*	*0.0*	*0.0*	*314.2*	*221.5*
	Residential and commercial	7.0	0.5	3.8	0.0	0.0	3.8	97.0	5.5	67.0	0.0	65.2
	Industrial and energy transformation	0.8	0.1	1.1	0.0	0.0	0.9	12.0	0.9	19.9	0.0	13.0
	Total heating and process	*1.2*	*0.1*	*2.6*	*0.0*	*0.0*	*2.1*	*18.8*	*0.9*	*45.6*	*0.0*	*32.6*
	Electricity	6.1	5.7	7.4	3.7	6.4	6.4	59.7	124.9	56.6	101.7	91.5
	Total	**10.2**	**3.9**	**3.9**	**4.9**	**6.3**	**5.9**	**146.9**	**82.8**	**48.7**	**92.4**	**88.0**
New Zealand	Road	6.6	0.0	0.0	0.0	0.0	6.6	92.2	0.0	0.0	0.0	92.2
	Non-road	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2
	Total transport	*5.9*	*0.0*	*0.0*	*0.0*	*0.0*	*5.9*	*82.6*	*0.0*	*0.0*	*0.0*	*82.5*
	Residential and commercial	0.6	0.0	0.0	0.0	0.0	0.1	9.0	0.0	0.0	0.0	2.0
	Industrial and energy transformation	0.2	0.0	0.0	0.0	0.0	0.1	2.6	0.0	0.0	0.0	0.7
	Total heating and process	*0.2*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*3.3*	*0.0*	*0.0*	*0.0*	*0.9*
	Electricity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	**4.6**	**0.0**	**0.0**	**0.0**	**0.0**	**1.6**	**65.4**	**0.0**	**0.0**	**0.0**	**31.3**
Norway	Road	18.3	0.0	1.5	8.2	0.0	18.0	253.5	0.0	26.5	115.9	249.6
	Non-road	1.5	0.0	1.5	0.0	0.0	1.5	20.8	0.0	26.5	0.0	21.0
	Total transport	*14.0*	*0.0*	*1.5*	*8.2*	*0.0*	*13.7*	*192.7*	*0.0*	*26.5*	*115.9*	*189.7*
	Residential and commercial	4.7	0.0	1.5	0.0	0.0	1.8	63.6	0.0	26.5	0.0	18.4
	Industrial and energy transformation	2.7	0.0	0.2	0.0	0.0	1.0	38.0	0.4	3.1	0.0	14.1
	Total heating and process	*3.0*	*0.0*	*0.2*	*0.0*	*0.0*	*1.1*	*41.7*	*0.4*	*3.3*	*0.0*	*14.8*
	Electricity	1.8	0.9	1.2	1.2	2.1	2.1	577.3	1 530.3	437.1	819.8	548.3
	Total	**9.6**	**0.0**	**0.3**	**0.5**	**2.1**	**4.0**	**133.8**	**67.5**	**58.1**	**24.7**	**93.3**
Poland	Road	9.9	0.0	0.0	0.0	0.0	9.5	139.4	0.0	0.0	0.0	133.3
	Non-road	9.4	0.0	0.0	0.0	0.0	3.0	127.5	0.0	0.0	0.0	48.1
	Total transport	*9.9*	*0.0*	*0.0*	*0.0*	*0.0*	*9.3*	*139.2*	*0.0*	*0.0*	*0.0*	*131.4*
	Residential and commercial	0.8	0.3	0.0	0.0	0.0	0.2	12.0	3.2	0.0	0.0	2.4
	Industrial and energy transformation	4.7	0.1	0.0	0.0	0.0	1.0	64.9	1.1	0.0	0.0	11.2
	Total heating and process	*3.9*	*0.2*	*0.0*	*0.0*	*0.0*	*0.7*	*54.1*	*1.8*	*0.0*	*0.0*	*7.9*
	Electricity	0.7	0.5	0.7	0.5	1.3	0.5	9.5	5.2	13.2	4.6	5.3
	Total	**8.0**	**0.4**	**0.0**	**0.1**	**1.2**	**2.2**	**112.4**	**3.8**	**0.9**	**0.8**	**25.5**
Portugal	Road	12.2	0.0	2.8	0.0	0.0	11.7	167.3	0.0	50.6	0.0	161.2
	Non-road	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total transport	*11.5*	*0.0*	*2.8*	*0.0*	*0.0*	*11.1*	*157.4*	*0.0*	*50.6*	*0.0*	*152.0*
	Residential and commercial	2.6	0.0	0.0	0.0	0.0	1.0	39.0	0.0	0.0	0.0	11.5
	Industrial and energy transformation	0.5	0.0	0.0	0.0	0.0	0.2	6.6	0.1	0.0	0.0	3.0
	Total heating and process	*1.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.5*	*14.8*	*0.1*	*0.0*	*0.0*	*5.9*
	Electricity	0.1	0.1	0.2	0.1	0.3	0.2	1.6	1.1	2.7	1.0	1.6
	Total	**7.3**	**0.1**	**0.1**	**0.0**	**0.2**	**3.5**	**99.3**	**1.1**	**1.6**	**0.2**	**47.8**

	Fuel user	Oil products	Coal and peat	Natural gas	Biofuels and waste	Renewables and nuclear	All fuels	Oil products	Coal and peat	Natural gas	Biofuels and waste	All fuels
		EUR per GJ						*EUR per tonne CO_2*				
Slovak Republic	Road	12.2	0.0	0.0	0.0	0.0	11.1	168.9	0.0	0.0	0.0	153.8
	Non-road	4.0	0.0	2.6	0.0	0.0	2.6	62.7	0.0	46.3	0.0	46.4
	Total transport	*12.2*	*0.0*	*2.6*	*0.0*	*0.0*	*9.5*	*168.9*	*0.0*	*46.3*	*0.0*	*137.7*
	Residential and commercial	1.5	0.4	1.1	0.0	0.0	0.9	23.0	3.9	19.4	0.0	13.7
	Industrial and energy transformation	1.7	0.3	2.6	0.0	0.0	1.2	26.0	2.4	46.3	0.0	12.7
	Total heating and process	*1.7*	*0.3*	*1.8*	*0.0*	*0.0*	*1.1*	*25.9*	*2.7*	*31.7*	*0.0*	*12.9*
	Electricity	0.1	0.1	0.2	0.1	0.1	0.1	3.4	4.9	2.5	4.8	4.5
	Total	**8.3**	**0.3**	**1.8**	**0.0**	**0.1**	**2.2**	**117.3**	**3.1**	**31.7**	**0.6**	**33.6**
Slovenia	Road	11.7	0.0	0.0	0.0	0.0	11.5	162.2	0.0	0.0	0.0	159.4
	Non-road	4.5	0.0	0.0	0.0	0.0	4.5	61.2	0.0	0.0	0.0	61.2
	Total transport	*11.7*	*0.0*	*0.0*	*0.0*	*0.0*	*11.5*	*161.4*	*0.0*	*0.0*	*0.0*	*158.6*
	Residential and commercial	2.6	0.0	1.1	0.0	0.0	1.5	36.0	0.0	19.8	0.0	17.9
	Industrial and energy transformation	3.0	0.1	1.1	0.0	0.0	1.3	39.2	0.9	19.8	0.0	17.4
	Total heating and process	*2.7*	*0.1*	*1.1*	*0.0*	*0.0*	*1.4*	*37.2*	*0.9*	*19.8*	*0.0*	*17.7*
	Electricity	0.9	1.2	0.8	0.3	0.4	0.7	11.6	12.0	13.6	3.4	11.8
	Total	**8.9**	**0.9**	**1.1**	**0.0**	**0.4**	**4.6**	**122.7**	**9.2**	**19.4**	**0.1**	**68.3**
Spain	Road	10.8	0.0	0.0	0.0	0.0	10.4	147.5	0.0	0.0	0.0	142.4
	Non-road	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	20.5	0.0	0.2
	Total transport	*9.5*	*0.0*	*1.2*	*0.0*	*0.0*	*9.2*	*130.5*	*0.0*	*20.5*	*0.0*	*126.4*
	Residential and commercial	1.6	0.1	0.0	0.0	0.0	0.7	22.5	1.0	0.0	0.0	9.3
	Industrial and energy transformation	0.7	0.1	0.9	0.0	0.0	0.7	8.8	3.7	16.9	0.0	9.9
	Total heating and process	*0.9*	*0.1*	*0.7*	*0.0*	*0.0*	*0.7*	*12.6*	*3.4*	*12.4*	*0.0*	*9.7*
	Electricity	0.1	0.1	0.1	0.1	0.1	0.1	2.5	3.3	1.8	3.1	2.5
	Total	**6.2**	**0.1**	**0.4**	**0.0**	**0.1**	**2.9**	**84.6**	**3.3**	**6.9**	**0.5**	**47.8**
Sweden	Road	16.8	0.0	0.0	0.0	0.0	15.8	234.1	0.0	0.0	0.0	221.5
	Non-road	2.3	0.0	0.0	0.0	0.0	2.3	31.8	0.0	0.0	0.0	31.8
	Total transport	*16.2*	*0.0*	*0.0*	*0.0*	*0.0*	*15.3*	*226.1*	*0.0*	*0.0*	*0.0*	*214.3*
	Residential and commercial	11.8	0.0	8.9	0.0	0.0	5.6	158.6	0.0	157.8	0.0	63.9
	Industrial and energy transformation	1.8	3.1	2.7	0.0	0.0	0.9	25.4	29.4	47.3	0.0	9.8
	Total heating and process	*3.6*	*3.1*	*3.4*	*0.0*	*0.0*	*1.4*	*51.8*	*29.3*	*60.1*	*0.0*	*14.7*
	Electricity	1.4	1.8	3.0	2.1	1.9	1.9	111.7	239.3	81.5	158.6	165.5
	Total	**12.0**	**2.9**	**3.3**	**0.3**	**1.9**	**4.1**	**170.0**	**60.3**	**61.6**	**24.4**	**78.6**

	Fuel user	Oil products	Coal and peat	Natural gas	Biofuels and waste	Renewables and nuclear	All fuels	Oil products	Coal and peat	Natural gas	Biofuels and waste	All fuels
		EUR per GJ						*EUR per tonne CO_2*				
Switzerland	Road	18.1	0.0	3.3	0.0	0.0	18.1	254.5	0.0	59.3	0.0	253.8
	Non-road	5.0	0.0	0.0	0.0	0.0	5.0	69.4	0.0	0.0	0.0	69.4
	Total transport	*17.9*	*0.0*	*3.3*	*0.0*	*0.0*	*17.9*	*252.0*	*0.0*	*59.3*	*0.0*	*251.4*
	Residential and commercial	2.3	2.8	1.4	0.0	0.0	1.7	30.6	29.6	25.1	0.0	24.4
	Industrial and energy transformation	1.4	2.9	0.9	0.0	0.0	1.1	19.8	29.4	15.2	0.0	14.1
	Total heating and process	*2.0*	*2.9*	*1.2*	*0.0*	*0.0*	*1.5*	*27.9*	*29.4*	*21.1*	*0.0*	*21.0*
	Electricity	1.1	0.0	2.8	1.0	1.2	1.2	15.2	0.0	49.1	8.5	10.6
	Total	**10.6**	**2.9**	**1.2**	**0.3**	**1.2**	**6.1**	**147.3**	**29.4**	**21.8**	**2.0**	**107.3**
Turkey	Road	16.4	0.0	7.7	13.2	0.0	16.4	231.2	0.0	136.7	185.9	231.0
	Non-road	1.1	0.0	0.3	0.0	0.0	1.0	15.4	0.0	4.5	0.0	14.6
	Total transport	*14.9*	*0.0*	*1.6*	*13.2*	*0.0*	*14.7*	*209.3*	*0.0*	*27.7*	*185.9*	*207.5*
	Residential and commercial	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	4.5	0.0	1.0
	Industrial and energy transformation	2.1	0.0	0.3	0.0	0.0	0.7	29.2	0.0	4.5	0.0	9.5
	Total heating and process	*1.7*	*0.0*	*0.3*	*0.0*	*0.0*	*0.4*	*24.2*	*0.0*	*4.5*	*0.0*	*5.4*
	Electricity	0.0	0.4	1.4	0.4	0.4	0.8	0.5	4.6	24.6	3.7	11.8
	Total	**9.4**	**0.2**	**0.9**	**0.0**	**0.3**	**2.9**	**132.5**	**2.2**	**15.4**	**0.2**	**38.9**
United Kingdom	Road	20.3	0.0	0.0	19.5	0.0	20.3	282.7	0.0	0.0	275.0	282.5
	Non-road	0.9	0.0	0.0	0.0	0.0	0.9	12.0	0.0	0.0	0.0	12.0
	Total transport	*18.9*	*0.0*	*0.0*	*19.5*	*0.0*	*18.9*	*262.6*	*0.0*	*0.0*	*275.0*	*262.9*
	Residential and commercial	3.5	0.6	0.1	0.0	0.0	0.4	48.5	6.7	1.7	0.0	7.4
	Industrial and energy transformation	1.5	0.3	0.3	0.0	0.0	0.7	21.5	2.4	6.0	0.0	10.5
	Total heating and process	*2.0*	*0.3*	*0.2*	*0.0*	*0.0*	*0.6*	*27.7*	*2.8*	*3.3*	*0.0*	*9.1*
	Electricity	0.3	0.5	0.7	0.4	0.5	0.6	9.8	12.7	6.9	11.4	10.5
	Total	**13.8**	**0.5**	**0.4**	**3.8**	**0.5**	**4.6**	**192.4**	**10.8**	**4.6**	**49.2**	**73.2**
United States (federal)	Road	1.2	0.0	0.0	1.8	0.0	1.2	16.8	0.0	0.2	24.9	17.1
	Non-road	0.4	0.0	0.0	0.0	0.0	0.3	5.4	0.0	0.2	0.0	4.6
	Total transport	*1.1*	*0.0*	*0.0*	*1.8*	*0.0*	*1.1*	*15.5*	*0.0*	*0.2*	*24.9*	*15.6*
	Residential and commercial	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Industrial and energy transformation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total heating and process	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
	Electricity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	**0.9**	**0.0**	**0.0**	**0.5**	**0.0**	**0.3**	**12.3**	**0.0**	**0.0**	**4.8**	**4.8**

Note: Information on data for Israel: *http://dx.doi.org/10.1787/888932315602.*

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