Chapter 2

The Inventory approach to estimating support for fossil fuels

This second chapter introduces readers to the new Inventory of support measures for fossil fuels that the OECD has made available on its website in the form of an online database. Section 2.1 briefly sketches the structure of the database and its coverage, including what the OECD considers to be "support". Section 2.2 explains how the OECD collected the primary data that were then processed and transformed before they were eventually assembled in the database. In particular, the section describes the conceptual framework that the OECD uses to organise the information collected. Last, section 2.3 delves into the caveats that apply to tax-expenditure estimates since these account for more than half of all the measures the database contains.

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.

2.1. A tool for transparency: The OECD's online database of measures supporting fossil fuels

Using the online tool

The online *Inventory of Support Measures for Fossil Fuels* identifies, documents, and estimates almost 800 individual measures supporting the production or consumption of fossil fuels in OECD countries and selected partner economies. In most cases, the information has been collected and assembled by the OECD itself, and then verified in co-operation with the governments of the countries concerned.

Each of the countries covered by this Inventory corresponds to a separate dataset. Individual entries in those datasets correspond in turn to the particular policies or measures applied by a given country, providing for each of them annual estimates of their budgetary costs or revenue foregone and a detailed description. This description covers several relevant characteristics of the measure, including — where available — its history, its eligibility criteria and beneficiaries, its transfer mechanism, its formal incidence, the fuels it benefits, etc.

The database is available through the OECD's online statistics portal (DotStat), where users can select the particular dimensions they are interested in. Quantitative information on the amounts of support provided annually by the different policies inventoried is displayed for the period 2000-14, except where the data are not available or not applicable. All amounts are in nominal units of national currency, unless otherwise specified. Qualitative information on the characteristics of each individual policy or measure can be accessed by clicking on the corresponding information bubbles in blue. Doing so opens a metadata window on the right-hand side that displays the qualitative information assembled by the OECD.

A comprehensive concept of "support" as a starting point for subsequent analysis

The Inventory proceeds from the fundamental perspective that the identification of "subsidies" to any sector or industry requires first taking an inventory of the full set of measures that may qualify as support to that sector. For one, because of interactive effects among policies, it is difficult to determine *a priori* whether a particular support policy is inefficient, encourages wasteful consumption, or is environmentally harmful. Only with a full picture of the operating policies can various analytical tools be brought to bear on questions about the effects of those policies on human welfare and the environment. Hence, information precedes analysis.

The scope of what is considered "support" is therefore deliberately broad, and is broader than some conceptions of "subsidy". Essentially, it includes both direct budgetary transfers and tax expenditures that in some way provide a benefit or preference for fossil-fuel production or consumption relative to alternatives. This broader definition therefore encompasses policies that can induce changes in the relative prices of fossil fuels. However, although the present inventory covers measures that provide support (either absolute or relative) to fossil fuels, it does not attempt to assess the impact on prices or quantities of the measures considered, nor does it pass any judgment as to whether a given measure is justified or not. In that sense, the inventory casts a wide net that aligns well with its objective of promoting the transparency of public policies.

It is recognised that policies supporting fossil fuels have been put in place for various reasons, i.e. support measures may have a *raison d'être* of their own. A consequence of the Inventory's broad conception of support is that while a number of these measures may be inefficient or wasteful, others may not be. The report does not provide any analysis of the impacts of specific support measures, and so does not pass any judgement on which measures might be usefully kept in place and which ones a country might wish to consider for possible reform or removal. Its purpose is rather to provide comprehensive information about policies that confer some level of support, as a starting point for subsequent analysis looking at the objectives of particular measures, their impacts (economically, environmentally and socially), and possible reforms and alternatives.

Forty countries and 40 fuel types: What the database covers

In its current form, the database contains individual entries for support measures previously or presently operating in the OECD's 34 member countries and six partner economies: Brazil, the People's Republic China (henceforth "China"), India, Indonesia, the Russian Federation, and South Africa. In addition, support provided by sub-national governments (e.g. states, provinces or *Länder*) is included for the following federal countries: Australia, Canada, Germany, and the United States. Due to time and resource constraints, sub-national entries for the United States only cover 11 states at this stage, the selection of which was informed by their relative abundance of fossil-fuel resources. These 11 states are: Alaska, California, Colorado, Kentucky, Louisiana, North Dakota, Oklahoma, Pennsylvania, Texas, West Virginia, and Wyoming.

The range of fuels covered by this Inventory comprises both primary fossil-fuel commodities (e.g. crude oil, natural gas, coal, and peat) and secondary refined or processed products (e.g. diesel fuel, gasoline, kerosene, and coal briquettes). Primary fuels include in particular those fossil fuels that are extracted from unconventional sources, such as oil extracted from bituminous sands, shale-based natural gas, or coal-bed methane. Measures supporting the production or use of biofuels are not, however, included in the present inventory. Nor are measures supporting electricity, except where it can be shown that the electricity is almost exclusively derived from fossil fuels, with limited possibilities for cross-border power exchanges.[1] To help ensure consistency with other existing datasets, the database follows the classification of fuels described in the *Energy Statistics Manual* (IEA et al., 2004).[2]

To keep the scope of the exercise manageable, the Inventory does not cover measures supporting the production or use of energy-consuming capital, such as vehicles and other equipment and machinery powered using fossil fuels. Although incentives for accumulating energy-consuming capital are likely encouraging more use of fossil fuels than would otherwise be the case, they are, nevertheless, much less specific in their relation to these fuels than are measures targeting energy sources directly. Measures supporting the manufacture and acquisition of road vehicles, for instance, can be expected to affect fuel consumption but they only do so in an indirect fashion. In that sense, they may be better characterised as support for the automotive industry rather than support for fossil fuels.

Some other measures may be directed at fossil fuels but may do so in a way that encourages the uptake of relatively cleaner forms of energy or practices. This is the case, for example, where support measures encourage a shift from coal to natural gas in power generation, or where support incentivises the use of LPG or compressed natural gas in road vehicles. Although such measures may serve to reduce GHG emissions in the short-run, they could also contribute to delaying the transition to other forms of energy since they lower the costs of producing or burning fossil fuels compared with alternatives. While recognising the potential for short-run environmental benefits of these measures, this inventory reports them anyway since not doing so would necessitate that some set of criteria be developed for assessing their environmental effects and justifying on environmental grounds their non-inclusion in the present inventory. Crucially though, the Inventory is not concerned with the effects of particular policies as explained earlier, nor does it pass judgment as to whether a given measure is justified or not. The inventory is, in that sense, not the proper place to discuss the environmental merits of individual measures. Policies supporting the development and deployment of technologies for carbon capture and storage (CCS) are not, however, included in the present inventory (Box 2.1).

Box 2.1. The case of support for carbon capture and storage

Carbon capture and storage (CCS) refers to "a family of technologies and techniques that enable the capture of CO_2 from fuel combustion or industrial processes, the transport of CO_2 via ships or pipelines, and its storage underground, in depleted oil and gas fields and deep saline formations" (IEA, 2013). Although CCS is frequently associated with the use of fossil fuels in thermal power plants and industrial processes, policies supporting the development and deployment of CCS technologies are not considered support for fossil fuels in the present inventory, where they are instead treated as support for energy-consuming capital.

CCS technologies are also generally regarded as potential tools for climate-change mitigation. The IPCC's Fifth Assessment Report thus notes that many of its models "could not achieve atmospheric concentration levels of about 450 ppm CO_{2eq} by 2100 if additional mitigation is considerably delayed or under limited availability of key technologies, such as bioenergy, CCS, and their combination (BECCS)" (IPCC, 2014). This reflects the view that significantly reducing emissions from energy-intensive industries, such as steel and cement, may sometimes prove difficult without CCS. For coal- and gas-fired power plants, CCS offers a possibility for avoiding the stranding of assets through retrofitting. In order for fossil-fuel facilities to be equipped with CCS, however, the cost of the technology would need to fall and the costs of unabated fossil-fuel use rise further (e.g. through a price on carbon emissions). It is currently estimated that CCS technologies could end up increasing the costs of coal-fired power plants by 40% to 63% in the 2020s.

By the end of 2014, 13 large-scale projects for the capture of CO_2 were operating globally, and a further 13 were in an advanced planning stage (IEA, 2015a). These include the Boundary Dam coal-fired electricity plant in Saskatchewan, Canada, which captures more than one million tonnes of CO_2 per year (the equivalent of one-third the emissions of a 500-MW coal-fired power plant), and Australia's Otway Project, which has so far stored 65 000 tonnes of CO_2 with some financial support from the State of Victoria. CCS technologies can also be employed for capturing the CO_2 emissions from sources other than fossil fuels. This is the case of the Decatur CCS project in Illinois, United States, which is scheduled to begin operation in 2015 and will capture CO_2 from bioethanol production rather than from fossil fuels. Several pilot CCS projects at cement plants also capture CO_2 from limestone calcination.

Sources: IEA (2013, 2015a), IPCC (2014), Zero CO_2 database.

2.2. Methods and data sources

How the primary information is collected

Generally, the data in the Inventory have been obtained from government sources. Support measures were identified mainly through searches of official government documents and web sites. In some other cases, unpublished data were furnished directly by governments. If no data could be found, the OECD estimated the value of support where it deemed the necessary calculations feasible and plausible. The data presented are therefore as comprehensive as possible, but they are by no means exhaustive. There is, in particular, more information presented in the Inventory for those countries that have been relatively more transparent in their budget books. This does not necessarily mean that these countries have higher levels of support than other countries, but may reflect that they have been more transparent about the support that is provided.

The sources used for compiling information on individual support measures are mainly the annual budgets of countries (e.g. budget statements, public accounts or budget statistics), which sometimes contain an annex describing and estimating tax expenditures. This follows from the fact that policy makers often regard tax expenditures as potential substitutes for direct spending since they constitute another way of transferring public resources (OECD, 2010a). In some other cases, tax-expenditure reports are instead published as stand-alone documents on an annual or biennial basis. There are, however, a number of countries that do not make their tax-expenditure estimates public, a fact which further complicates the collection of information. Hence, a limiting factor in respect of tax expenditures relating to fossil fuels is the extent to which countries release such estimates already.

With a few exceptions, most of the countries covered by the Inventory report their budgetary transfers and tax expenditures on a regular basis one way or another. Countries do differ, nevertheless, in the depth and scope of their reporting (Box 2.2). As regards tax expenditures, most of the reports cover both corporate and personal income taxes. However, fewer cover VAT, and even fewer attempt to estimate tax expenditures in respect of excise taxes. Differences also arise in the level of aggregation at which outlays and tax expenditures are reported. In some cases, the information

available makes it possible to clearly identify the amounts of support benefitting users or producers of fossil fuels, such as where transfers are reported on an industry or sector basis. In others, the raw figures are too aggregated so that a further step is required to apportion the total support to the different industries or sectors benefitting from the measure. This is, for example, the case where measures relate to final energy consumption in general or to a range of natural-resource production rather than specifically to the production of fossil fuels.

Box 2.2. Reporting budgetary transfers and tax expenditures for fossil fuels: Examples from selected countries

Practices differ among countries as regards the reporting of budgetary transfers and tax expenditures. There is, however, a noticeable trend toward better reporting over time as governments gradually improve the quality and scope of the information they choose to release. In Italy, the *Delega Fiscale* now provides a legal basis for the annual reporting of tax expenditures and corresponding estimates of revenue foregone. In China, the Ministry of Finance has recently put in place an online portal for accessing the country's annual national financial accounts. Those contain detailed data on individual budgetary programmes, including the amounts disbursed by local governments.

Germany stands as a rare example: the Federal Ministry of Finance produces every two years a subsidy report (*Subventionsbericht*) containing detailed information and estimates for both budgetary transfers and tax expenditures. The information thus assembled is presented by sector, which makes it easier to assess how different industries in Germany compare in terms of total public support, and whether it is provided in the form of direct budgetary assistance or tax concessions. Being a federal exercise, the report does not, however, address the question of support provided by sub-national jurisdictions (*Länder*).

The Office of Management and Budget (OMB), an executive body, is responsible for preparing the budget of the US Federal Government. As part of its mandate, the OMB has been producing every year detailed reports of US federal tax expenditures ever since the Congressional Budget Act of 1974 required those tax provisions to be listed in the federal budget. Annual estimates from the OMB are easily accessible online but do not cover indirect taxes levied on motor fuels, nor do they cover the many tax expenditures US states provide at the sub-national level. The latter can, however, be found in the tax-expenditure reports that most US states now produce. The Joint Committee on Taxation (JCT) of the US Congress, a legislative body, also prepares in parallel its own list of federal tax expenditures, which does not always overlap with the list prepared by the OMB. Focussing on the energy sector more specifically, the US Department of Energy's Energy Information Administration (EIA) has periodically documented and commented on the various budgetary transfers and tax expenditures that benefit the production or use of fossil fuels at the federal level. Meanwhile, the Government Accountability Office (GAO) and the Congressional Research Service (CRS) have both at times produced in-depth reviews of US federal tax expenditures, thereby subjecting these policies to a considerable degree of scrutiny.

Sources: Bundesministerium der Finanzen (2013), CRS (2012), EIA (2011), GAO (2005), IMF (2012), JCT (2014), Ministry of Finance of the People's Republic of China (n.d.), OECD (2010a), OMB (2015).

How the information is then organised and processed

Once primary information is collected, each measure is then assigned a specific tag or identifier. This tag is in turn associated with a number of dimensions that describe the relevant characteristics of a measure. One such dimension is whether a measure belongs to the Producer Support Estimate (PSE), the Consumer Support Estimate (CSE) or the General Services Support Estimate (GSSE). Under the OECD's PSE-CSE accounting framework,[3] measures that benefit individual producers are classified under the PSE while those that benefit individual consumers are classified under the CSE. Measures benefitting producers or consumers collectively are classified under the GSSE, as are measures that do not increase current production or consumption of fossil fuels but that may do so in the future. Examples of measures belonging to the GSSE would include public support for industry-specific infrastructure development, such as public support for the construction of coal or natural-gas terminals, and government funding for sector-wide R&D in relation to fossil-fuel exploration and transformation.

For the purpose of the Inventory, the consumption of fossil fuels is defined as the stage at which fuels are combusted, whether it occurs in motor vehicles, stationary engines, heating equipment or power plants. Production therefore encompasses the following activities along the supply chain: exploration and extraction (EXTRACT), bulk transportation and storage (TRANS), and refining and

processing (REFIN). Hence, measures supporting the transport of coal by barge or rail or those supporting petroleum refineries would form part of the PSE (or the GSSE where applicable). Continuing further downstream, consumption is here understood as spanning the following: the use of fossil fuels in power and heat generation (GENER); their use in industrial processes and activities, outside of the energy sector (INDUS); and all other final uses of fossil fuels (END), whether in the transport sector, the residential sector, or primary industries outside of the energy sector (e.g. agriculture and forestry). Figure 2.1 summarises graphically how these various stages along the supply chain fit within the PSE-CSE framework described above.

Another dimension along which the database characterises measures is through their formal incidence. Unlike economic incidence, which is concerned with the final beneficiaries of a measure, formal or statutory incidence does not take into account supply and demand elasticities, and is therefore solely focussed on which aspect of production or consumption is formally targeted by the measure. Formal or statutory incidence can in that sense be understood as *de jure* incidence while economic incidence is better understood as *de facto* incidence. As with a measure's environmental effects, it is only through careful analysis that the economic incidence of a policy can be established. The Inventory therefore looks for now at formal incidence only. To that end, formal incidence is divided into a number of categories, each corresponding to a separate column in Table A.4 (in the Annex), depending on whether a measure relates to: output returns (the unit revenues received from sales); enterprise income (the overall income of producers); the costs of intermediate inputs, such as feedstock; the costs of value-adding production factors – labour, land (which includes access to sub-surface natural resources), capital, and new knowledge; or consumption in general. As displayed, the matrix presented in Table A.4 provides an organising framework for relating a measure's formal incidence to its transfer mechanism, i.e. the manner in which the transfer is created, whether that be through a direct budgetary transfer, a tax concession or a loan guarantee.

Figure 2.1. Adapting the PSE-CSE framework to fossil fuels

Indicator	UPSTREAM → DOWNSTREAM					
	EXTRACT	TRANS	REFIN	GENER	INDUS	END
PSE	X	X	X			
CSE				X	X	X
GSSE	X	X	X	X	X	X

This Inventory concentrates of necessity on budgetary transfers and tax expenditures relating to fossil fuels since data for other more complicated forms of support can be much harder to obtain, as with the assumption by the government of certain risks otherwise borne by the private sector.[4] Numerous other forms of support — notably support provided through risk transfers — are not yet quantified however. The data requirements for estimating the transfers associated with such measures are greater and the calculations more complex. This is particularly the case as regards preferential loans and loan guarantees, where estimating the direct cost to the government of the assistance conveyed would require that a present-value calculation be performed using carefully selected discount rates (Lucas, 2015, forthcoming). Regarding market price support for producers, the previous chapter has already indicated that applied import tariffs on the main fossil fuels were generally very low or inexistent, even when looking at most-favoured-nation (MFN) tariffs, which do not account for the myriad of preferential trade agreements that are currently in force (see Tables A.2 and A.3 in the Annex).[5] Market price support is therefore unlikely to be of serious concern for fossil fuels as maintaining artificially high domestic prices would imply a significant degree of protection against international competition.

Several of the measures contained in the Inventory benefit more than one type of fossil fuel. The main transformation of the data carried out by the OECD was thus to allocate support to particular fuels where official government sources do not provide such a breakdown. Following standard practice (see, for example, OECD, 2010b), transfers associated with policies benefitting more than one fuel or sector were allocated according to the relative value of production or consumption, or proportional to the energy equivalent, volume of production or consumption. It is recognised that the actual allocation of support across fuel types may, in practice, vary based on factors other than the volume or value of production or consumption, but this approach is adapted in the absence of more specific information. For these reasons, while the primary data come from government sources, the particular breakdowns shown in the database may not necessarily reflect the views of responsible governments. In very few cases mainly pertaining to exemptions from indirect taxes, the OECD estimated the value of the tax expenditures, based on the published rate of exemption and national or IEA data on the volume of fuel that was exempted. Where applicable, details of any data transformation or calculation made by the OECD are described online in the metadata for the measures concerned.

2.3. Understanding tax expenditures relating to fossil fuels

Governments often use tax expenditures to support particular activities or entities that they deem beneficial from a societal perspective. It is therefore not surprising that institutions such as the European Commission or the WTO consider tax concessions as amounting to some form of "subsidy" or "state aid".[6] Although tax expenditures are by no means the only mechanism through which governments support the production or use of fossil fuels, their interpretation is, nevertheless, subject to a number of specific caveats that should be borne in mind when going through the database. This is especially so as tax expenditures are most often estimated with reference to a benchmark tax level or system that is country-specific.

Types of tax expenditures relating to the use of fossil fuels

Many of the tax expenditures that the Inventory contains are targeted at the final consumption of fossil fuels. They are typically provided through lower rates, exemptions, or rebates with respect to the two main types of consumption taxes:

- value-added taxes (VAT), which are intended to be broad-based taxes on final consumption, representing a percentage of the value of the good or service sold; and
- excise taxes, which are levied on specific goods, and for which the value of the tax normally is unrelated to the value of the underlying good but rather to its weight, mass, or energy content.

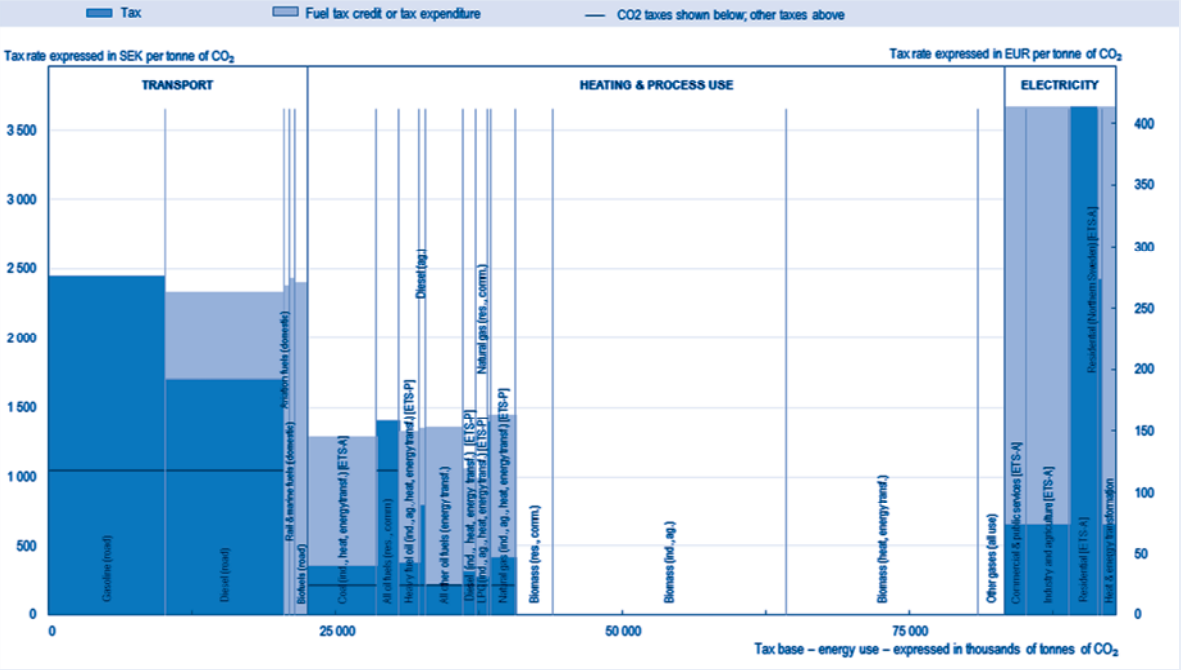
These are the most visible forms of tax expenditures relating to fossil fuels, as they often have a direct effect on final prices and therefore consumption, though the associated price impacts are not always easy to measure. Difficulties arise in particular as to the benchmark rates of tax that are used by countries for estimating the revenue foregone due to these tax expenditures. Not only do these benchmark rates vary across countries, but they also often vary across sectors and types of fuel, which then affects the range of provisions that governments consider to be tax expenditures (Box 2.3).

Some tax expenditures are applied broadly through general exemptions or reductions in countries' VAT rates. Other tax expenditures are more targeted. In this area, three main categories of tax expenditures stand out: (i) those related to specific groups of consumers; (ii) those related to specific types of fuel; and (iii) those related to how the fuels are used.

Box 2.3. Taxing energy use in the OECD and beyond

Complementing the present work that identifies, documents, and estimates measures supporting fossil fuels, the OECD has also looked in detail at the way energy use is taxed across countries, sectors, and fuels in the context of its publication *Taxing Energy Use*. This was done by assembling information on the specific tax rates that are applied to various energy sources in different sectors and countries, and then combining this information with corresponding data from the IEA on the volumes of energy used. The exercise makes it possible to express rates of tax on energy in a comparable fashion — usually units of national currency or EUR per GJ and per tonne of CO_2 — which facilitates the understanding of the structure and level of energy taxes, including tax expenditures where they exist. In particular, the publication provides a set of graphical profiles that illustrate concisely the use and taxation of energy in different countries and its implications for the price signals sent in relation to energy and carbon content. Figure 2.2 shows one such graphical profile using the example of Sweden.

Figure 2.2. The taxation of energy use in Sweden on a carbon-emissions basis



Source: OECD (2015b), DOI: http://dx.doi.org/10.1787/9789264232334-en.

In the first group, qualifying individuals or firms are taxed less heavily on their use of fossil fuels than are other users subject to the standard rate of tax. Often, beneficiaries include residents of particular regions that are deemed geographically or economically disadvantaged (e.g. France's overseas territories or certain areas of Italy). As with certain types of budgetary transfers, those concessions are generally intended to achieve social goals, such as supporting households' incomes. Other examples of tax expenditures in this first group include the exemptions from fuel tax that governments themselves (or diplomatic representations and international organisations such as the OECD) sometimes enjoy. This is the case in the United States, where state and local governments are generally exempt from excise tax for the fuel they purchase. In general, the tax concessions in this first group encourage higher consumption of the exempted fuels than would occur in the absence of the measures.

In the second group are tax expenditures that subject specific fossil fuels to reduced rates (or exemptions from tax altogether), even though these fuels are intended for the same end purpose as other fuels taxed at higher rates. A common example in the transportation fuel area is a lower tax rate (or exemption) on diesel fuel relative to gasoline (Harding, 2014).[7] Many countries also levy lower excise taxes on fuels deemed "cleaner" than gasoline or diesel fuel, such as compressed natural gas (CNG), liquefied petroleum gas (LPG), and biofuels, in an effort to encourage consumers to switch to

those fuels. To the extent such differences in tax rates are considered to be tax expenditures by the countries concerned, they are included in the Inventory.

Finally, in the third group are tax expenditures occurring as a result of differences in rates based on how the fossil fuels are used. Provisions within this group are frequently found in primary industries such as farming, forestry, fisheries, and mining, where the use of diesel fuel often attracts exemptions or rebates from the excise tax normally levied on purchases of fuel. This is, for example, the case in Canada, France, Germany, Hungary, Israel, and Switzerland. Aviation fuels are a special case since they are generally sold free of tax when purchased for use in international flights.[8] Complications may also arise in relation to the taxation of fossil fuels used as inputs in industrial production processes (Box 2.4).

An important point to bear in mind when interpreting any tax expenditure relating to VAT or excise taxes on fuel is that, in most of the countries the Inventory covers, much of the fuel consumed — especially fuel used in motorised vehicles — is taxed to some degree. That which is not is generally sold at a price that is at least at world-market parity. The overall net effect of this taxation, even after the exemptions, reductions, and rebates, is still to provide some degree of disincentive to consume compared with a situation in which no taxes were applied, and hence no tax expenditures would be measured. Deviations from the standard tax rate nonetheless still distort relative prices *within* an economy, and may thus favour the consumption of certain fuels in preference to others. Excise-tax concessions and selective reductions in VAT rates for fossil fuels counteract, in that sense, "the intention of energy taxes to increase the relative end-user prices of energy (for environmental or for revenue-raising reasons)" (OECD, 2015b). This type of non-neutrality reported by governments constitutes "support" for purposes of the Inventory.

Box 2.4. Tax expenditures relating to fossil fuels used as inputs to production

A significant portion of fossil fuels (e.g. for heating in manufacturing plants, or as inputs to other uses) is consumed by manufacturers and service providers. Some tax expenditures are thus targeted at fossil-fuel products that form an input into production processes. With some types of taxation, such as with VAT, governments attempt to tax only the final consumption. In so doing, firms are effectively and necessarily exempted from the VAT they pay on inputs, through an input refunding system. Such measures are specifically designed not to discriminate among different production methods. As such, exempting energy, including fossil fuels, from VAT when it is only an input to production, can be consistent with the broader tax-policy aims of VAT.

Excise taxes, however, intentionally raise the price of the taxed item — e.g. because its use is deemed harmful to society, or because governments can raise revenues easily and relatively efficiently on its consumption. Given this intent, there is little rationale for exempting businesses that use these goods as inputs to production, as the goal is not to tax final consumption but the specific product or activity. In this case, a tax exemption may actually limit the effectiveness of the tax.

Industries engaged in the transformation of fossil fuels into more refined products or electricity are also often exempted from excise taxes on both the fuels they use as feedstock (i.e. intermediate inputs) and those they use as process energy (i.e. a value-adding factor). This is due to what is sometimes called the "manufacturer privilege" — a provision of the tax code which deems that all fossil fuels used in the production of final energy products (such as gasoline, coal briquettes or electricity) cannot be taxed. Yet those same fossil fuels, when used by other industries as part of their normal production processes, are often taxed. If the subsequent consumption of the energy products resulting from this type of energy-transformation process is subject to taxation (e.g. in the case of an electricity tax at the point of distribution), it might be logical to exempt the fuels used as feedstock in order to avoid double taxation. On the other hand, coverage of all fuel consumed as energy would require either taxation of the energy consumed in the transformation process (i.e. process energy) or, failing that, a grossing up of the tax on the energy outputs (e.g. the electricity) to account for the energy used in the production process. Given this, the Inventory generally includes tax concessions relating to fossil fuels used as process energy where such measures are considered to be tax expenditures by the countries concerned (e.g. in Germany).

The particular case of tax expenditures relating to the extraction of fossil fuels

Industries engaged in the extraction of hydrocarbons and mineral resources are unique from other businesses in that the key input to their production — the natural resource below ground — is commonly publicly owned.[9] Moreover, there is often significant uncertainty about a resource's exact extent and quality, and its value often depends significantly on the cost of production in the particular location. As with other depletable resources, the production of fossil fuels thus has the potential to generate above-normal profits in the form of a rent.[10] Therefore, in addition to levying the regular corporate income tax on profits earned in resource extraction, governments typically levy additional charges that may be seen as representing the "sale price" for the publicly owned resource. These charges may take various forms such as royalties, supplemental income taxes, resource taxes, and state participation through production-sharing contracts.

At the same time, many fossil-fuel-producing countries have corporate tax expenditures that are targeted at the extraction or production of fossil fuels, and their transformation into usable inputs for intermediate and final consumption. These are generally premised on concerns relating to risk and uncertainty, energy security, capital intensity, high upfront costs, and long project timelines, including extended pre-production periods. Such tax expenditures reduce the costs of extraction, and this in an environment in which jurisdictions often compete for attracting investment by mining companies so that resources do not remain untapped.

Tax expenditures in this area are commonly provided through the corporate income-tax system and may be targeted at fossil fuels or at resource extraction more generally. They include, among other features of the tax code, accelerated-depreciation allowances for capital expenditure, investment tax credits, additional deductions for exploration and development expenses, and preferential capital-gains treatment for particular fields. Tax expenditures on production can also take less visible forms such as the special treatment of income from state-owned enterprises, tax relief for income earned on industry sinking funds (e.g. for site remediation), tax exempt bonds, or the use of foreign tax credits for what may be considered royalty payments.

Tax-expenditure features may also be found in royalty systems, resource-rent taxes, and other specialised fiscal instruments applying to resource extraction. Such features must, however, be considered in the context of the particular fiscal system of which they form a part. This is especially so for measures relating to the tax treatment of capital expenses and financing costs incurred by fossil-fuel producers, which may or may not constitute tax expenditures depending on the broader nature of a country's fiscal regime applying to resource extraction. A provision allowing for the expensing (i.e. write-off) of successful exploration expenditures in the year in which they are incurred may, for example, be deemed normal practice (i.e. the benchmark) under a cash-flow tax system, such as Australia's Petroleum Resource Rent Tax. By contrast, although a similar kind of provision exists at the federal level in the United States for independent oil and gas producers, it is there considered a tax expenditure since the Federal Government taxes resource extraction using the common imputed-income approach, whereby expenditures incurred as a result of successful exploration efforts are capitalised and amortised over the useful life of the asset (e.g. the well).

Similar issues arise in resource royalty systems. Lower royalty rates on less productive or more costly fields may arguably be tax expenditures in that they represent a concession relative to standard rates. On the other hand, they may be rough ways of taking into account higher costs and lower margins in particular fiscal systems that otherwise would over-tax — and therefore potentially render uneconomic — marginal projects, i.e. projects that generate little or no economic rent. In a fiscal system designed for capturing resource rent, variations from the "benchmark" rate may be the norm. The approach of the Inventory is to include such reported royalty concessions (equivalent to tax expenditures), consistent with the purpose of highlighting cases where more favourable treatment is provided for one sector or group relative to the norm. It is intended to facilitate discussion about the purpose and impact of such concessions. As with relief from excise duties and carbon taxes, the

support provided by particular tax or royalty concessions needs to be considered in the broader context of the fiscal system for resource extraction of which it forms a part (Box 2.5).

In general, the effect of tax expenditures supporting fossil-fuel production is to lower the cost of extraction and (since many are related to capital) provide an incentive for more investment, and potentially greater production, than would otherwise be the case. As noted in Chapter 1, this would generally be at the cost of reduced economic output elsewhere in the economy because of the diversion of investment. This can in turn affect both firm profitability and the price of fuels to be sold (depending on, among other things, the degree to which the price is set internationally). For firms with marginally profitable production, such schemes may not only have incremental effects on production, but can have a bearing on whether or not the firm continues producing at all. In other situations, such as where supply is constrained (by factors such as regulatory restrictions or limitations on labour or materials), tax benefits may simply increase firm profitability or contribute to inflation of input costs.

Box 2.5. Tax expenditures for resource extraction and the importance of the broader fiscal regime

The immediate write-off of expenditures of a capital nature — which include exploration and development costs — is normally considered to amount to some sort of preferential treatment under the tax systems of many countries. The reason is that in calculating taxable profits in most income-tax systems, capital expenses are amortised over the period to which they contribute to earnings. Allowing these types of expenditure to be written-off in full in the year in which they are incurred therefore provides companies with a benefit akin to a zero-interest loan from the government since it delays the collection of taxes. A present-value calculation would thus show a positive transfer from the government to the companies benefitting from such provisions.

However, when combined with a provision preventing the deduction of interest costs and other financing charges from taxable income, the immediate write-off of exploration and development expenses may not necessarily constitute preferential tax treatment (i.e. a deviation from "normal" taxation). This is because this particular tax configuration may approximate what is known as "cash-flow taxation". Under cash-flow taxation, it is a firm's cash flow rather than its true economic profit that forms the tax base so that "capital is costed by allowing an immediate write-off of investment expenditures at the time they are undertaken. No deductions for interest or depreciation are then permitted" (Boadway and Bruce, 1984). Cash-flow tax systems are theoretically equivalent to the more common imputed-income tax systems where the objective is to levy a neutral business tax. For that reason, measures such as the expensing of exploration and development costs may not necessarily be tax expenditures in countries that have adopted a cash-flow approach to taxing resource extraction.

Measurement and interpretation of tax expenditures

Unlike direct budgetary expenditures, where outlays can usually be readily measured, tax expenditures are estimates of revenue that is foregone due to a particular feature of the tax system that reduces or postpones tax relative to some benchmark tax system. This implies a number of important caveats concerning both the interpretation and comparability of the tax-expenditure estimates that governments produce. These caveats affect both: (i) what constitutes a tax expenditure; and (ii) how its size should be gauged. A number of these caveats are discussed in the remainder of this section.

Defining a benchmark in the broader context of countries' tax systems

A key challenge in determining or assessing tax expenditures is to identify the standard or benchmark tax regime against which the nature and extent of any concession is judged. The data on tax expenditures that are provided in the Inventory reflect estimates generated by national and sub-national governments themselves, and as such reflect the benchmark against which those governments chose to make these comparisons. Except in very few cases pertaining mainly to excise duties or VAT, the OECD did not select the tax benchmarks used in calculating the tax expenditures. Several approaches to deciding on the benchmark regime are possible, and these vary among countries:

- Many countries base their tax-expenditure estimates on a conceptual view about what constitutes "normal" taxation of income and consumption. Typically, the benchmark is defined to include structural features of the tax system, while special features intended to address objectives other than the basic function of the tax (e.g. raising revenues or internalising

externalities) may be considered to be deviations from the benchmark. The line between what is structural and what is special is, however, often not a clear one.

- Some countries take a reference-law approach and identify only concessions that appear as such on the face of the law as tax expenditures. Under this approach, a tax credit would likely be identified as a tax expenditure, while differential tax rates on two products within a broader category might not be.
- A few countries restrict their tax-expenditure estimates to those tax reliefs (e.g. refundable income tax credits) that are clearly analogous to public expenditure.

Another approach is not to look at the current or normal tax regime but rather at an "optimal" tax regime. This is of particular relevance when investigating tax expenditures related to fossil fuels, given the presence of external costs or negative externalities — the cost imposed on others in society by a private action. When external costs are introduced, the issue of a baseline level against which to measure tax expenditures can change significantly. Curbing atmospheric emissions of harmful pollutants is one of the important reasons why countries implement environmentally related taxes, though other external costs, like traffic congestion and noise pollution, also sometimes motivate taxes (supplementing their motivation as a means to raise revenue for public purposes). Through excise taxes, countries can place a price on environmental damage, thereby encouraging a more socially optimal level of emissions. Under this approach, such taxes are levied along with the taxes normally needed for general revenue raising.

Although taxes are generally regarded as powerful tools for pricing external costs, the pursuit of optimal taxation[11] is complicated in practice. Quite apart from essentially normative issues such as determining revenue needs, countries would need extensive analytical work to determine optimal tax rates, which would vary significantly over time, and across users, locations, and types of fuel. For these reasons, external costs are not commonly considered in establishing tax-expenditure baselines. The IMF recently estimated nevertheless the level of taxation that would be required to internalise some of the external costs associated with the consumption of fossil fuels, focussing in this case on CO_2 emissions, local air pollution (SO_2, NO_X, and PM 2.5), and road-traffic-related externalities such as congestion and accidents (Parry et al., 2014). Using a number of assumptions (e.g. a social cost of carbon of USD 35 per tonne), the study found congestion, traffic-related accidents, and road wear and tear to account for the majority of the external costs it considers, representing more than 70% of all the shortfall in corrective taxes estimated by the IMF in the case of many EU countries (e.g. Belgium, France, Malta, and Sweden) and various other economies like Bhutan, Cape Verde, New Zealand, Syria, and Turkey. Excise taxes on fuel are, at best, an indirect way to reduce congestion though, which is a phenomenon that has more to do with the time of day when a vehicle is being driven, and where it is being driven, than with the act of consuming liquid fuel or electricity in a vehicle *per se*. Other instruments than fuel taxes may therefore be more appropriate for addressing certain external costs that bear only a loose relationship with the quantity of fuel consumed.

Whatever baseline is eventually chosen to measure tax expenditures, it is important to consider the overall taxation system. Since most countries do not have theoretically pure tax systems, there are sometimes tax features that may seem to support fossil fuels, but which are in fact mechanisms to compensate or correct for other features of the system. Similarly, a feature of the tax system that may be considered a tax expenditure in one country may not be a tax expenditure in another country, given differing overarching systems for taxing fossil fuels. Box 2.5 already mentioned this problem in the context of natural-resource extraction but it also presents itself for fuel use. The hypothecation or earmarking of tax revenues to fund specific public expenditures — making the tax a kind of user charge — is an issue that involves similar complexity, at least as long as earmarked revenues cover the envisaged expenditures. Other complications can arise where countries have allowed some reductions in a tax on fossil-fuel inputs to production processes, and the scale of these rebates reflects the degree of exposure of an industry to international competition or the deployment of other policy instruments to reduce emissions (as has occurred with some carbon taxes and emissions trading systems).

Calculating tax expenditures

Even where the baseline is clear, countries use different methods to arrive at their tax-expenditure estimates. The *revenue-foregone method*, the most straightforward, looks at the rate of the tax concession multiplied by the base or uptake, with no accounting for potential behavioural responses due to changes in the tax rates. For example, a reduced rate of EUR 0.25 per litre of diesel fuel used by taxis from a normal tax rate of EUR 0.45 per litre would yield annual tax expenditures of EUR 180 million if taxi drivers used 900 million litres of fuel a year. In practice, most countries rely largely on the revenue-foregone method to estimate their tax expenditures since the other methods require extra information and more complex calculations.[12] Because the Inventory uses the tax-expenditure estimates that countries themselves produce, the data reported therein usually follow the revenue-foregone method.

Measures that defer payment of tax without changing the ultimate nominal tax liability are another source of valuation differences across tax-expenditure accounts. A common example is accelerated depreciation allowances for capital investments. By allowing the cost of capital assets to be deducted more quickly than they would under the benchmark system, these provisions result in higher deductions and lower taxes in the early years in the life of a particular investment, but lower deductions and higher taxes in the later years of the investment. There are two main approaches to estimating the tax expenditure associated with such measures. The *nominal cash-flow approach* measures the extent to which taxes in a particular year are higher or lower as a result of the accelerated allowance than they would have been in its absence. This measure is normally negative in the early years of an investment (indicating a positive tax expenditure) and higher in the later years. In contrast, the *present-value approach* measures the discounted value of the time series of annual cash-flow tax expenditures, normally estimated from the time at which the asset is purchased. The two approaches both provide useful information, but they are quite distinct and not directly comparable.

While most governments typically use the cash-flow approach to estimate their tax expenditures in respect of tax deferrals, a few complement their estimates with illustrative calculations using alternative assumptions and methods. This is the case in the United States with the estimates the OMB reports every year, and which present the annual value of tax expenditures for tax deferrals on both a cash basis and a present-value basis (OMB, 2015). Whichever valuation approach is used, however, countries typically calculate the value of each tax expenditure on the assumption that all other provisions remain unchanged. Due to interactions and behavioural responses, the revenue impacts of eliminating multiple measures is not necessarily equal to the sum of the individual values. Caution is therefore required in adding together estimates for multiple measures.

International comparability

Tax-expenditure accounting was not designed with international comparability in mind. The estimates reported in the Inventory provide useful information about the relative treatment of different products within national tax systems, and the economic incentives created for actors within these systems. In the absence of a common benchmark, however, tax-expenditure estimates are not readily comparable across countries. Even where countries have adopted broadly the same methodological approach, the way in which they have implemented it in response to practical issues, such as how far a relief should be regarded as a structural part of the tax regime, may well differ (e.g. depreciation allowances used in calculating taxable profits). In general, a fundamental limitation on comparability is differences among countries in the definition of the benchmark tax system. For this reason, a simple cross-country comparison of tax expenditures can lead to a misleading picture of the relative tax treatment of fossil fuels. Figure 1.4 in Chapter 1 has already shown, for example, that average effective rates of tax on the use of energy differ widely across countries, which has a strong bearing on any tax expenditure relating to fuel consumption (OECD, 2015b).

With this in mind, tax-expenditure estimates must be used carefully. The fact that a particular country reports higher tax expenditures relating to fossil fuels does not always mean that this country

effectively provides a higher level of support. The higher tax expenditures may also be due to factors such as:

- higher benchmark tax rates against which tax expenditures are measured;
- a stricter definition of the benchmark tax system that results in more features being singled out as tax expenditures; or
- a more complete set of tax-expenditure accounts.

Higher reported tax expenditures for some countries may therefore reflect higher levels of taxation or greater transparency in reporting rather than a higher level of "support".

Given differences among countries in levels of reporting with respect to tax expenditures, the OECD encourages all governments to be open and transparent in the reporting of tax-system features that may encourage the production or consumption of fossil fuels. Greater transparency will facilitate ongoing analysis and dialogue about how government policies, including those with respect to taxation, affect the production and use of fossil fuels. The European Commission (2014b) has already spearheaded efforts to express tax expenditures for fossil fuels on a common basis across EU Member States, and more work should be conducted in this area.

Notes

1. There are only a few such cases in the database.
2. Table A.1 in the Annex lists the different fossil fuels that the classification covers along with their respective codes as displayed in the online database.
3. The PSE-CSE accounting framework for measuring support to particular industries has long been used at the OECD to measure support to the agriculture sector and to the fisheries sector (since the mid-1980s and the late 1990s respectively). More information on that framework and its application for monitoring and evaluating agricultural policies can be found in OECD (2010b).
4. In practice, this implies that the inventory looks essentially for now at measures situated in the first two rows of Table A.4 in the Annex, with the addition of certain elements from rows three and four (e.g. royalty reductions and government buffer stocks).
5. Although Chile counts among the few countries that apply positive customs duties on their imports of fossil fuels, this reflects that country's reliance on a single MFN tariff (6%) applied uniformly on all imports rather than an explicit attempt to support Chilean fossil-fuel producers through higher prices. Chile being a party to numerous preferential trade agreements, the average import tariff it effectively applies on fossil fuels is likely close to zero.
6. Article 1 of the WTO's Agreement on Subsidies and Countervailing Measures (SCM) includes in its definition of a "subsidy" instances where "government revenue that is otherwise due is foregone or not collected." The European Commission's state-aid scorecard similarly takes into account measures such as a "tax credit and other tax measure, where the benefit is not dependent on having a tax liability", a "tax allowance, tax exemption, and rate relieve where the benefit is dependent on having a tax liability", and "deferred tax provisions (reserves, free or accelerated depreciation, etc.)." See for instance: http://ec.europa.eu/competition/state_aid/scoreboard/conceptual_remarks_en.html (accessed 8 April 2015).

7. The broader tax system must here be taken into account as some countries (e.g. New Zealand) have opted for distance-based road-user charges on diesel vehicles in lieu of an outright tax on purchases of diesel fuel. The choice of what constitutes "proper" or "normal" taxation for diesel fuel is not straightforward either. A recent OECD publication suggests, nevertheless, that the benchmark rate for diesel fuel ought to be at least equal to that for gasoline (Harding, 2014).

8. This is due to an international agreement dating from December 1944: the Convention on International Civil Aviation (also known as the "Chicago Convention"). This broad tax exemption was brought about to prevent distortions of aviation markets among countries, such as due to the double taxation of fuel, and to avoid inefficient tax avoidance behaviour, such as airlines shifting routes to reduce tax payments. Other arrangements generally exempt fuel used in international transport by rail and water as well. Mainly for that reason, the Inventory does not count as "support" fuel-tax exemptions for international aviation or international maritime transport. It does, however, include provisions exempting fuels used in domestic aviation and navigation.

9. Rules governing the ownership of underground resources in the United States differ from the rules applied in most other countries since private owners of non-federal US land also possess the corresponding mineral rights for sub-surface resources. This contrasts with other fossil-fuel-producing countries, where sub-surface resources generally belong to the public, irrespective of whether the land above is privately held.

10. Unlike manufacturing, many of the costs of production in natural-resource extraction depend on the location and geological characteristics of the resource being extracted. Given that market prices are volatile and determined by the marginal producer (usually the highest-cost producer supplying the market at any given time), the normal operation of the market can give rise to profits that are much larger (i.e. super- or above-normal) than those which would have been the minimum to justify investment in a particular well or mine.

11. That is, the level of taxation that accounts for all externalities, efficiency effects, the revenue-raising needs of the government, and the interaction of these effects on the overall economy.

12. The *revenue-gain method* estimates the increase in tax revenues that the government could expect if the tax expenditure were eliminated, thereby incorporating anticipated behavioural changes. Using the same example, the tax expenditure under this method would be the difference in tax rates — EUR 0.20 as before — multiplied by the expected use of diesel fuel by taxi drivers. Under this method, the use would be below 900 million litres since raising the tax rate would likely reduce the consumption of diesel fuel and increase that of gasoline. The *expenditure-equivalent method* estimates the level of funding that would be needed to meet the same outcome using a spending programme. In the previous example, it would estimate what level of direct payments would be needed to maintain the level of taxi drivers' income if the tax expenditure were eliminated.