OECD Companion to the Inventory of Support Measures for Fossil Fuels 2018

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OECD

BETTER POLICIES FOR BETTER LIVES

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Foreword

Two years after the historical ratification of the Paris Agreement, the momentum to tackle climate change persists and has led to several policy changes around the world. Estimates of support for fossil fuels continue their downward trend, mainly driven by fuel pricing reforms in non-OECD economies. Partner economies of the OECD, in particular India and Indonesia, have made great strides in phasing-out their consumer price supports. A number of fuel tax exemptions have been phased-out in OECD countries, and carbon taxes have been introduced in countries such as Mexico and France to internalise the external costs of fossil fuel consumption. Several G-20 and APEC countries have either completed or are currently undergoing peer reviews processes of national fossil fuel subsidies that encourage wasteful consumption.

This report and its associated database updates the status of existing support measures for fossil fuels, incorporates recently implemented measures, and expands country coverage. More than 1 000 policies conferring a benefit to the use or production of fossil fuels in 43 countries are identified. The majority of these policies were introduced decades ago in the form of tax expenditures, which are not revised with the same regularity as budgetary transfers, and thus continue in part because of this procedural summed to approximately between USD 150 and USD 250 billion annually over the period 2010-2016. The combined IEA and OECD estimates for fossil fuel support among 76 economies totals between USD 370 and USD 620 billion annually over the period 2010-2015. While several international organisations and NGOs develop their own data repositories of support measures for fossil fuels, the need for greater co-ordination is necessary in order to deliver a strong message to policy makers. To reconcile the OECD's bottom-up estimates of government support to individual programmes, with the IEA's top-down estimates of consumer price support, this edition of the *Companion to the Inventory of Support Measures for Fossil Fuels* suggests a solution to combine the two sets of estimates, and thus present a single figure on support given to fossil fuels.

The present report offers a practical strategy on how to incorporate government credit assistance in the *Inventory*. It explains a credit rating-based approach, developed by Deborah Lucas from MIT, to quantify the support element of government credit assistance (i.e. preferential loans and loan guarantees) to fossil-fuel-related projects. The current OECD database is comprised solely of support measures provided via budgetary transfers or tax expenditures, although its scope can be extended to cover other mechanisms through which government support can be granted. Government credit assistance can confer substantial benefits to carbon-intensive infrastructure, thus hampering the transition towards a low-carbon world, while inducing revenue losses for governments. Quantifying the support element of such measures therefore enhances transparency on the use of public resources.

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Acronyms and abbreviations

APEC	Asia-Pacific Economic Cooperation
BOT	Budgetary and Other Transfers
CHP	Combined head and power
CNG	Compressed natural sas
CNG	Compressed natural gas
CO2	Carbon dioxide
CSE	Consumer Support Estimate
EBRD	European Bank for Reconstruction and Development
ECA	Export-Credit Agency
EDGAR	Emissions Database for Global Atmospheric Research
EPS	PE Elektroprivreda Srbije
ETS	Emissions trading system
EXIM	Export-Import Bank
FAEP	Fondo de Ahorro y Estabilización Petrolera
FEPC	Fond de Estabilización de Precios de los Combustibles
GHG	Greenhouse-gas
GMI	Guaranteed minimum income
GSSE	General Services Support Estimates
HST	Harmonised Sales Tax
IADB	Inter-American Development Bank
IAEG	Inter-Agency and Expert Group
IEPS	Impuesto Especial sobre Producción y Servicios por Enajenación de Gasolina y Diesel
IMF	International Monetary Fund
KfW	German Development Bank
KSA	Kingdom of Saudi Arabia
LNG	Liquid natural gas
LPG	Liquid petroleum gas
OCI	Oil Change International
ODI	Overseas Development Institute
OTC	Other Transfers to Consumers
PAHAL	Direct Benefits Transfer for LPG
PDV	Present-discounted value
PSE	Producer Support Estimate

S&P	Standard and Poor's
SDG	Sustainable Development Goal Indicators
SOE	Stated-Owned Enterprise
TCP	Transfers to Consumers from Producers
TCT	Transfers to Consumers from Taxpayers
ToR	Terms of reference
TVA	Tennesey Valley Authority
VAT	Value-added tax
WEO	World Energy Outlook

Executive summary

The global momentum to reform support to fossil fuels has led to the implementation of several significant reforms since 2015 in several countries. Multilateral fora, such as APEC, the G-20, and the G7, have called repeatedly to phase out inefficient fuel subsidies and several countries that have voluntarily undergone APEC or G20 peer reviews have identified inefficient fossil fuel subsidies they are planning to phase out. These efforts are reflected in the latest *Inventory of Support to Fossil Fuels,* which highlights a sustained downward trend in fossil-fuel support identified by the OECD.

For a number of OECD and partner countries, recent government reforms have sought to reign in support that encourages the production and use of fossil fuels, and weighs heavily on government budgets. Countries like India, Indonesia, and Mexico have reformed prominent fuel pricing policies that used to support fuel consumption. Phasing out fossil fuel support results in a dual benefit of addressing climate policy objectives to reduce CO_2 emissions and local pollution, and raising public revenues.

The will to phase-out inefficient and distortive support measures has been echoed in various international platforms, and has taken shape in several policy changes and peer reviews. The four peer reviews undertaken to date, by the People's Republic of China, Germany, Mexico, and the United States, have identified several fossil fuel subsidies as inefficient and have described plans to phase them out over the short or medium term. These peer reviews highlight the importance of transparency in this domain. They have proven to be instrumental for learning and sharing best practices on estimating support, assessing its effectiveness on meeting public-policy objectives, and on sequencing reform. They have also revealed existing definitional gaps, both among and within countries (i.e. across ministries), particularly over what constitutes a "fossil fuel subsidy" and under what conditions a given subsidy can be considered "efficient".

Through its *Inventory of Support to Fossil Fuels* (hereafter the *Inventory*) and its support to existing peer-review processes, the OECD contributes to improving transparency of public policies and aims to shed light on how public resources are spent by reporting on a broad scope of support granted in favour of fossil fuel production or consumption. The OECD continues to identify, document, and estimate direct budgetary transfers and tax expenditures that confer a benefit or preference for fossil-fuel production or consumption relative to alternatives. The 2017 *Inventory* includes more than 1 000 individual policies identified as supporting the production or consumption of fossil fuels in OECD countries and eight partner economies (Argentina, Brazil, Colombia, the People's Republic of China, India, Indonesia, the Russian Federation, and South Africa).

Using data obtained from government sources, the report finds that the many measures the database contains had an overall value of USD 151-249 billion annually over the period 2010-2016, with support for the consumption of petroleum products accounting for the bulk of that amount. Producer support is much more significant in relative terms when looking at countries that are relatively well endowed with crude oil, natural gas or coal (e.g. Canada, Germany, the Russian Federation, or the United States).

Compared with the previous edition of the *Inventory*, support has flattened out over the past two years in OECD countries, but the downward trend in partner economies continues to be driven in part by Indonesia's recent reform of subsidies for the consumption of gasoline and diesel fuel.

The present report provides more transparent information on global support to fossil fuels. It provides a way to reconcile the estimates of budgetary support and tax expenditures detailed in the *Inventory* with another major set of national estimates of fossil-fuel support, provided by the International Energy Agency (IEA), which estimates price support to consumers. Combining the two datasets provides a single estimate of the magnitude of support to fossil fuels for both production and consumption. The resulting aggregate estimates of support to fossil fuels range between USD 373 billion and USD 617 billion over the period 2010-2015. The combined dataset covers 76 economies that collectively contribute 94% of global CO2 emissions.

With a similar but more mid-term perspective, the report also proposes a method to estimate the support element of government credit assistance, a type of foregone revenue that has yet to be quantified in the *Inventory*. This is a source of support that can confer benefits to the production and use of fossil fuels, as well as induce revenue losses for the government. Although data on the principal amount disbursed for direct loans or loan guarantees grants by governments is often available, the support element of such loans or guarantees has yet to be quantified in a systematic way due to methodological difficulties. In order to compensate for this methodological gap, the *Companion* proposes the credit-rating based approach developed by Professor Deborah Lucas of the MIT to calculate the support element of government credit assistance.

Preliminary results show that the subsidy-element, i.e. the revenue forgone, of government credit assistance to fossil-fuel-related projects could reach up to 20% of the face value of a loan, which implies that government credit assistance granted by G20 countries and multilateral development banks could be worth as much as USD 14 billion annually.

Although this report highlights that the progress towards phasing-out fossil fuel subsidies has been significant, further efforts are still needed. Over the past two decades, only a quarter of the total number of measures in the *Inventory* has been phased-out, and 21 measures have been added over the past two years. Since most support measures in place today have been introduced before 2000, countries would benefit from a critical self-assessment to revisit the relevancy and effectiveness of these measures in meeting their policy objectives.

The OECD collaborates with many of the several institutions that develop information on fossil-fuel support to ensure these efforts do not overlap as well as to enhance transparency in this area. But further co-ordination is needed and can be improved, especially as inconsistencies in definitions and data are sometimes used as an excuse to postpone action. Greater co-ordination efforts could also help move towards a consensus on key concepts, such as the conditions under which support to fossil fuel is not considered as "inefficient".

Chapter 1. Tracking progress in reforming support for fossil fuels

Chapter 1 uses the data compiled for the 2017 edition of the OECD Inventory to derive a few results and indicators on the magnitude and nature of support for fossil fuels in OECD countries and selected partner economies. The first section looks at broad trends in aggregate support and relates the observed evolution to recent policy changes and reforms. Section 1.2 discusses efforts to track and reform fossil fuel support in multilateral fora, such as the G20, APEC, and the UN. Section 1.3 makes the case for providing a joint database of IEA and OECD estimates and introduces a method to combine this data. The chapter concludes by suggesting that not only further action be taken by policy makers to continue reforming measures that support fossil fuels, but that data consolidation among different repositories is needed to minimise confusion in the policy debate.

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

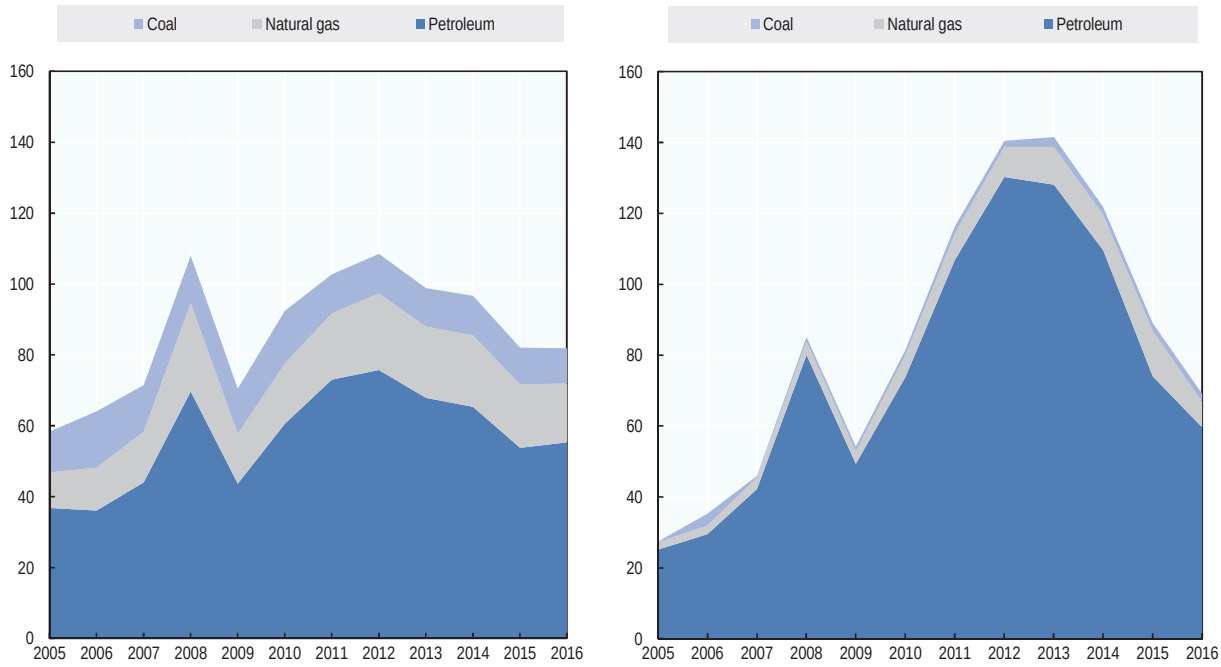
1.1. Global momentum for reform of support to fossil fuel strengthens

The downward trend in support for fossil fuels persists

The Inventory of Support Measures for Fossil Fuels 2017 now covers Latvia, which joined the OECD in 2016, and two additional partner economies, Argentina and Colombia. This brings the total number of countries covered by the *Inventory* to 43. The *Inventory* contains descriptions of more than 1 000 individual measures across 35 OECD countries and eight partner economies (Argentina, Brazil, the People's Republic of China, Colombia, India, Indonesia, the Russian Federation, and South Africa), summing up to an aggregate estimation ranging from USD 151 billion to USD 249 billion for the years 2010 through 2016 (Figure 1.1). Support in OECD countries has flattened over the past two years, hovering around USD 82 billion annually. For partner economies, the situation has changed dramatically as support continues its downward trend, from a peak in 2013 at USD 142 billion to USD 69 billion in 2016. While the recent low oil price regime has played a significant role in shrinking the size of support to fossil fuels, policy reforms have, although on aggregate to a lesser extent, also contributed to this trend.

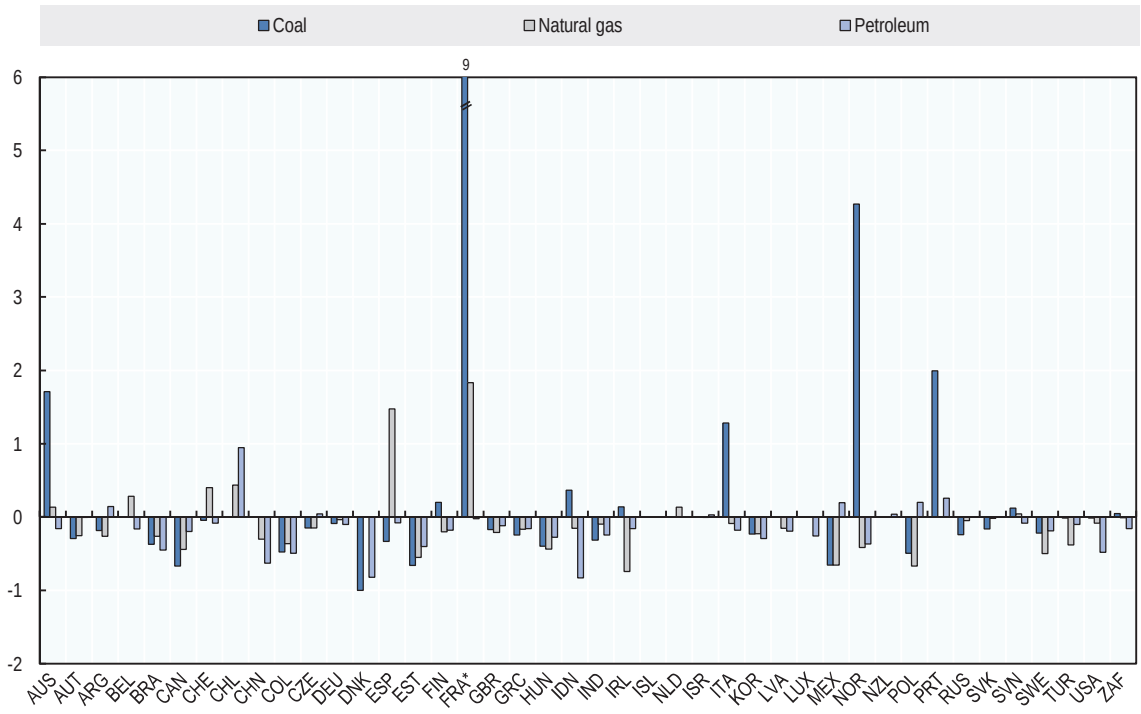
Figure 1.1. Support overall remains high at USD 151 billion despite signs of decline

Total support for fossil fuels in OECD countries (left) and selected partner economies (right) by year and type of fuel (billions of current USD)



Note: The above charts are based on the arithmetic sum of the individual support measures identified in the *Inventory*. Along with direct budgetary support, it includes the value of tax relief measured under each jurisdiction's benchmark tax treatment. The estimates do not take into account interactions that may occur if multiple measures were to be removed at the same time. Because they focus on budgetary costs and revenue foregone, the estimates for partner economies do not reflect the totality of support provided by means of artificially lower domestic prices.
For an in-depth analysis on benchmark tax treatments and the methods that lie behind the estimations of tax expenditures, the earlier edition of this report elaborates on this topic (OECD, 2015[1]).

Figure 1.2. Growth rate in fossil fuel in OECD and partner economies, 2014-16



Notes

1. This chart reports the change between 2014 and 2016 for the 43 countries covered in the *Inventory*. The data are clustered at the country level and disaggregated by fuel. The numbers on the vertical axis represent by how much the 2016 estimates for each fuel type have changed since 2014. Changes could be due to new legislation that either modifies an existing law or introduces a new one, or to changes in consumption or production, or it could be due to structural changes in the economy (e.g. in the energy market, the industrial sector, or residential sector).
2. After the introduction of the carbon tax component in fuel taxation in 2015, the tax rate on energy products increased in France. Energy-intensive sectors that are not under EU ETS and are at risk of carbon leakage pay pre-2015 tax rates (i.e. they are exempt from paying the carbon tax component of the excise tax on energy products). The increase in support to fossil fuels, in particular to coal, in France is in large part due to the increase in the benchmark tax rate following the new policy.

Petroleum products remain the biggest beneficiaries of government support in both OECD and partner countries, but the picture is starkly different for natural gas and coal for which according to the *Inventory,* support is more significant in OECD countries, representing about 20% and 13% of total support respectively; in partner economies both add up to around 13% of total support to fossil fuels. Taking a closer look into changes since the last edition of the *Companion*, by disaggregating the data at the country and fuel-type levels, the trend for support varies greatly across countries (Figure 1.2).

While most reported changes in fossil fuel support between 2014 and 2016 are reductions in support, there are a few cases where support has actually increased. These increases can be linked to modified taxation rules on energy products, or to changes in consumption or production patterns. The most notable positive spikes in Figure 1.2 represent, for example, substantial growth in support for coal that can be attributed to the introduction in France of an excise tax reduction for energy intensive industries exposed to carbon leakage risks and that are not part of the EU Emissions Trading System (ETS),[1] to the reinstated subsidy to cover the costs incurred by Store Norske, an operator of coal mines

in Norway, and to an increase in the tax expenditure granted to the use of coal in the production of electricity and CHP in Portugal.

Disaggregating further the *Inventory,* consumer support remains the main form of support representing 80% of the total support for fossil fuels measured by the OECD, followed by producer support at 13%, and support to general services at 8% (which is not targeted specifically to producers or consumers). Support is granted mostly via tax expenditures; about two-thirds of the individual measures contained in the OECD database are tax reductions, exemptions, or credits, which altogether account for 64% of the total value. As OECD and partner economies are responsible for 70% of global fossil fuel production and 75% of fossil fuel-based final energy consumption, these support measures apply to a sizeable portion of global fossil fuel production and use.

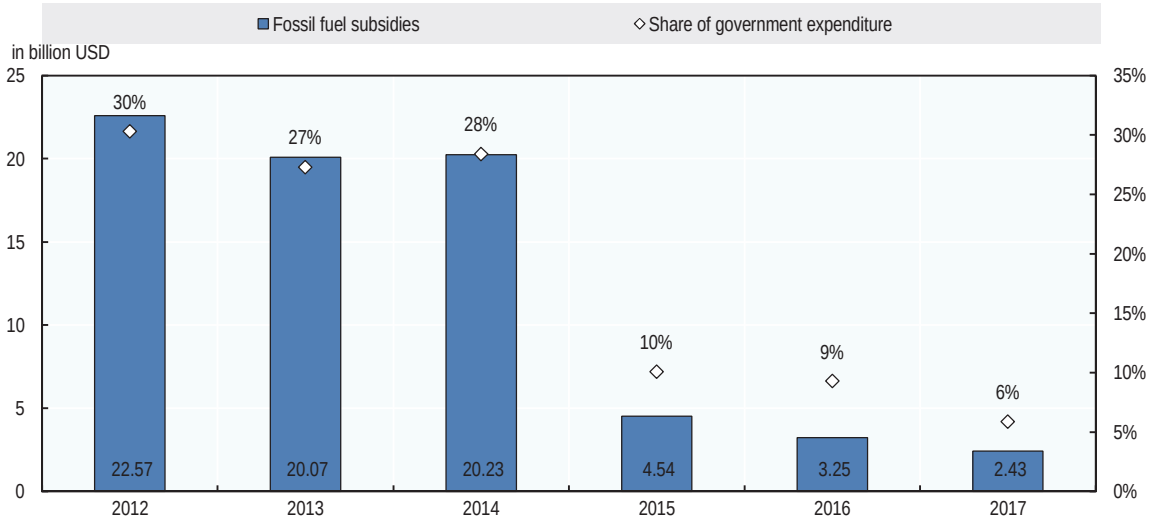
Reform efforts in OECD countries and partner economies forge ahead

Several countries make it a priority to end price controls on fossil fuels

Several countries, galvanized by global action against climate change and the sharp decline in fuel prices, have begun to reform their energy taxation system and more broadly to reshape their energy markets. Since the last edition of this *Companion*, energy pricing reforms have been well underway in Mexico (Arlinghaus and van Dender, 2017[2]). The government introduced a floating excise tax known as the IEPS (*Impuesto Especial sobre Producción y Servicios por Enajenación de Gasolina y Diese*l) with the goal to eliminate support to diesel and gasoline fuel consumption (OECD, 2015[1]). Starting in 2016, prices of gasoline and diesel were bounded within a band of +/- 3% of the 2015 price and on 1 January 2017, the regulation authorities allowed the maximum price for gasoline to rise by as much as 20%, but diesel remained bounded by a maximum increase of 3%. At the same time, regions for which the energy market is sufficiently competitive were allowed to fully liberalise their fuel prices. The market for liquefied petroleum gas (LPG) was fully opened to competition at this juncture. As a result, fossil fuel support amounted to about 0.4% of Mexico's GDP in 2016, compared with 1% in 2014. While a carbon-tax was introduced in 2014 to internalise the external costs of fuel consumption, tax exemptions or reductions are granted to certain categories of users, including public transport and industry.

Indonesia, like Mexico, has undertaken substantial fuel pricing reforms by greatly reducing fiscal pressure associated with its subsidies to the consumption of fossil fuels. Several policy reforms over the past decades have modified fuel prices. In 2015, gasoline subsidies were completely phased out and a cap on diesel subsidies was implemented to limit outlays on support of diesel consumption. The Indonesian government has continued to develop its energy-market reforms in an effort to rein in expenditure on fossil fuel support. In 2016, it reduced its cap on diesel subsidies by half, from USD 0.08 per litre to USD 0.04 per litre, and began a pilot programme to better target subsidies for 3-kg LPG cylinders used by households as cooking fuel with the objective of lowering the number of beneficiaries from 57 million to 26 million households. As a result of these fiscal consolidation efforts, projected fiscal savings from fuel subsidy reforms are around USD 15 billion a year. The 2017 budget allocation for fuel subsidies is only 12% of its 2014 value (Figure 1.3).

Figure 1.3. Fossil fuel government support in Indonesia



Note: This chart is based on information by the Fiscal Policy Agency of the Central Government of Indonesia. It reports estimates of fossil fuel subsidies converted into US dollars using annual market exchange rates for rupiahs.
Source: Indonesia Fiscal Policy Agency, Ministry of Finance (2017).

India continues to pursue its fossil fuel subsidy reforms after the complete deregulation of diesel prices in 2014. Following a trial period beginning in December 2012, the Indian government, pushing for the use of cleaner fuels, launched the Direct Benefit Transfer Scheme (PAHAL), which went into effect on 1 January 2015. Under PAHAL, consumers pay the non-subsidised prices for LPG cylinders and eligible consumers receive a cash transfer directly into their bank account.[2] At the same time, the government launched a widespread campaign, known as "Give it Up", to encourage wealthier households to voluntarily opt-out of the scheme. A similar scheme will be rolled out for kerosene, for which a pilot programme is still underway. As a result, consumer support estimates (CSE) for kerosene and LPG have dropped from INR 653 billion (USD 10 billion) in 2014 to about INR 197 billion (USD 2.9 billion) in 2016.

In Colombia and Argentina, fuel prices continue to be set by costly pricing mechanisms, whereby prices either follow an automatic formula as in Colombia, or a discretionary rule that is set by the government (Argentina). In both cases, pricing policies offer consumers a buffer from international price volatility. After the 2008 oil shock, Colombia established the FEPC (*Fondo de Estabilización de Precios de los Combustibles*), a fuel-price-stabilisation fund which smoothes prices monthly by the difference between export parity price and a 60-day moving average of the export parity price (Garcia Romero and Calderon Etter, 2013[3]).[3] FEPC was designed as a self-funding mechanism, but since fuel prices continued to increase, it soon generated a deficit and relies on government financing.

Argentina applies *ad hoc* price-fixing rules to its petroleum products, especially since the economic crisis of 2002 when the peso was largely devalued. Residential and industrial natural gas prices are subsidised and liquid fuel prices such as gasoline have been mostly managed through export taxes. Argentina used export taxes as a policy instrument to keep domestic prices low and insulate them from international fluctuations. Argentina reviewed its export tax policy in 2012 and lowered its tax rate from 45% to 14%, and then

again in 2014. These rates apply when oil prices fall below USD 80 per barrel (Bella et al., 2015[4]).

In addition to its discretionary energy pricing, the government pays universal subsidies for gas and electricity that are fraught with distributional inequity issues, since wealthier households benefit the most from subsidised energy prices. In September 2016, the government put in place measures to close the gap between the cost of imported LNG and its injection and what distributers pay, thus phasing out the outlays it needs to transfer to natural-gas producers to cover their operational losses. This price convergence plan is set to be completed by 2019 for most regions with the exception of Patagonia, which will continue to benefit from subsidised gas prices up to 2021. In parallel, the government has created a federal social tariff to better target its subsidies to vulnerable populations. Similar reforms are taking place in the electricity sector with progressive price adjustments.

Consumption support-related reforms in industrial, residential, and transport sectors proliferate in OECD countries

Several OECD countries have made progress in recent years in phasing out fossil fuels subsidies or reforming tax expenditures. Several of these reforms relate to policies that affect fossil-fuel consumption. In 2015, both Belgium and France initiated plans to remove the tax differentiation between gasoline and diesel. Belgium implemented a Rachet system to progressively close the gap between these prices, by increasing the tax rate on diesel and lowering it for gasoline. France plans to bring the difference down to EUR 0.10 per litre from EUR 0.18 per litre by the end of 2017, and eventually close the gap over five years (Ministère de l'environnement, de l'énergie et de la mer, 2017[5]). OECD in the past has suggested to realign the diesel taxation upwards at the level of gasoline taxation as a recommendation in its *Environmental Performance Reviews*; the additional revenue could be used for reducing the tax burden, e.g. income taxes, or public debt.

In Greece, a pilot means-tested guaranteed minimum income (GMI) programme was launched in November 2014 and is meant to be generalised in 2017 to replace some of the emergency *ad hoc* programmes that subsidise food, energy, and rent (OECD, 2016[6]). Korea introduced an energy voucher system for low-income households in December 2015 as part of its transition away from support to coal production.[4] In Italy, the Government proposal for the new National Energy Strategy (SEN) includes the two options (realignment half the way or alignment of diesel taxation at the gasoline level) (Ministero dello Sviluppo Economico, 2017[7]).

Sweden phased out two of its consumption support measures, providing reductions on a CO_2 tax for energy-intensive companies and the agricultural sector at the end of 2014. The revenue forgone since the implementation of these measures in 1997 is approximately USD 3 billion. In France, the excise tax exemption for fuels used in combined heat and power (CHP) generation came to an end in 2017. This concession applied to plants built before 2008 and accumulated a cost of USD 290 billion since its inception.

Several measures relating to heating in the residential sector came to an end. In May 2015, Estonia removed its excise duty exemption for heating fuels used by households, a support measure that averaged USD 15 million over the past decade. In the same year, Finland phased out the reduced energy tax rate for natural gas used in heating, representing forgone revenue totalling almost USD 800 million between 2008 and 2014.

At the sub-national level, the Canadian province of Newfoundland and Labrador ended its rebates on the Harmonised Sales Tax (HST) levied on electricity, heating oil, propane, and wood in 2015, and the following year, the state of Alaska in the United States terminated its Affordable Heating Program.

Production support-related reforms are limited

As for support to the production of fossil fuels, Germany continues to wind down its domestic hard coal production, located in North-Rhine-Westphalia, which is dependent on large budgetary transfers to compensate the industry for the shortfall between its high production cost and the market price of its coal. Currently, two hard coal mines remain open and support will cease by the end of 2018, but decommissioning-related support will continue until 2027. Although support to the industry has been declining since 1998, recent fluctuations can be explained by changes in the import price of coal.

In 2016, the Bureau of Land Management (BLM) in the United States issued the *Waste Prevention, Production Subject to Royalties, and Resource Conservation* rule to reduce waste of natural gas from venting, flaring, and leaks related to oil and natural gas production activities on onshore Federal and Indian (other than Osage Tribe) leases.[5] In doing so, it also aims to reduce support to fuel that qualifies as royalty-free by replacing provisions related to royalty-free use of oil and gas that were put in place more than three decades ago. Although the implementation of sections concerning the requirements and targets for waste reduction have been postponed, some elements of the rule that control wasteful use of royalty-free oil and gas, such as the provision requiring operators to submit a "waste minimization plan" with their drilling applications, became effective as of January 2017. Reduced use of royalty-free oil and gas as a result of more stringent rules around waste management could lead to revenue savings.

New measures benefitting production of fossil fuels are added

The *Inventory* identifies 21 new measures that were added in 2015 and 2016. New incentives have been introduced to bolster the development of commercially marginal oil fields (small fields, ultra-heavy oil fields, ultra-high pressure and high temperature field, and remote deep water gas field) in the United Kingdom as of 2015. Fiscal reform in the oil and gas sector has resulted in additional allowances that aim to increase post-tax profits in the sector (HRMC, 2015[8]). The UK government also funded a temporary seismic surveys programme in order to foster the exploration and appraisal of new under-explored potential sites, which would not be surveyed otherwise. In total, GBP 40 million (USD 65 million) was allocated from the budget to this Programme over two years (2015-16), of which 35 million has been reported as being spent.

The Russian Federation introduced two support measures to oil production that lower the extraction tax in order to stimulate the exploitation of hard-to-get hydrocarbon deposits. These measures were introduced in 2015 and will remain valid for 12 to 15 years after exploitation of a field has started. Korea's coal mining sector has benefitted from government deficiency payments of around KRW 30 billion (USD 30 million) in 2015 and 2016, to recover the shortfall between the cost of production and the market price, after this measure was phased out in 2010.

In Argentina, the Secretariat of Energy endorsed an outlay of temporary financial aid to companies distributing natural gas through networks, arguing that such support would cover the costs and investments associated with the normal operation of the public distribution service of natural gas through networks. This measure entailed a government

outlay of ten consecutive instalments of up to ARS 2.6 billion (USD 150 million), as of its implementation in March 2015.

Pricing reforms for fossil fuels pick up in other countries

Many oil-exporting MENA countries have undertaken significant steps to reform their energy-pricing policies. In 2015 and 2016, Algeria, Bahrain, Kuwait, Oman, Qatar, and the Kingdom of Saudi Arabia (KSA) raised their gasoline prices by 20% to 60% (IEA and OECD, 2017[9]). These countries, which are heavily dependent on oil or gas-derived export receipts, have made it a priority to diversify their economies away from oil- and natural-gas-related activities. For example, the KSA included a Fiscal Balance Programme in its Vision 2030 programme, whereby energy price reform will be the primary means for balancing the national budget. The abundance of oil and gas resources in the MENA region transformed the economies of this region over the last century, but the opportunity costs of maintaining current policies are rising (Oxford Energy Institute for Energy Studies, 2017[10]). The KSA Vision 2030, for example, lays out a complex web of interrelated reforms that will be needed to reconfigure an economy founded on the exploitation of non-renewable resources.

Malaysia began reforming its energy pricing policy close to a decade ago and completed the phasing out of its diesel and gasoline consumption subsidies at the end of 2014, but the government maintains its LPG subsidises to households. Thailand has an equally long history of energy pricing reform that began with the harmonisation of LPG prices across sectors to reflect supply costs, and in January 2015 it imposed a uniform wholesale price that tracks closely the import parity price. These reforms have resulted in budgetary savings of USD 1.3 billion.[6] Low-income households and businesses can still benefit from subsidies for LPG purchases provided they are registered with the government. Thailand has continued to work on unshackling natural gas prices, by first implementing several price hikes, and then completely ceasing its price controls at the beginning of 2015 and allowing CNG prices to follow market trends (IEA, 2017[11]).

1.2. Developments in tracking and monitoring fossil fuel support

G20 peer reviews of inefficient fossil fuel support is a salutary experience

G20 countries are committed to periodically reporting their fossil-fuel subsidies following the 2009 summit in Pittsburgh, where the G20 leaders agreed to “rationalise and phase-out inefficient fossil fuel subsidies that encourage wasteful consumption over the medium term while providing targeted support to the poorest”. In February 2013, G20 Finance Ministers committed their countries to developing a framework for voluntary peer reviews that focussed on inefficient fossil fuel subsidies leading to wasteful consumption.

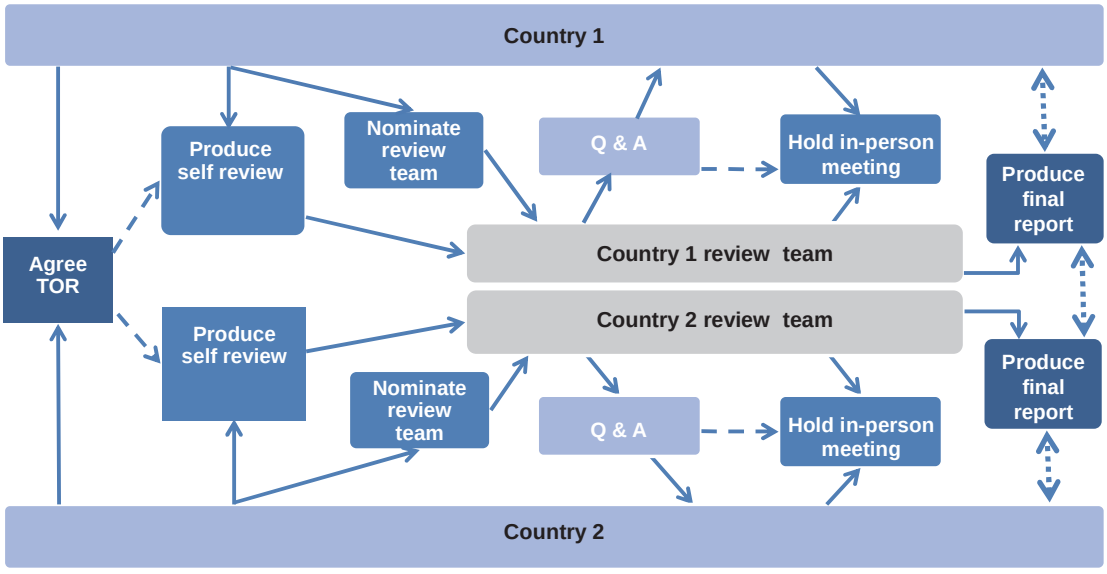
The countries reviewed agree to a set of terms of reference (ToR) to establish the scope of the measures reviewed and the timeline of the review process. They then produce a report in which they enumerate the measures to be reviewed, and provide some context and background on their implementation and possible reform (or phasing-out). The review team submits questions and comments on this report, which are examined at a meeting attended by country representatives from both the review team and the country under review. A final report which is agreed to by all parties is prepared and issued.

The People’s Republic of China (hereafter “China”) and the United States were the first countries to undergo this process. In 2015, they each prepared reports describing existing support measures, and reviewed these measures on the basis of their inefficiency and the

extent to which they encouraged wasteful consumption. Both countries proposed a timetable for reform, and submitted reports for review to a designated team of experts. Review teams were comprised of representatives from Germany, Indonesia, the United States, the IMF, and the OECD for the review of China; and of Germany, Mexico, and the OECD for the review of the United States. The OECD was also asked to chair the reviews and to act as co-ordinator. Following meetings in Beijing and Washington, D.C. in, respectively, April and May 2016, peer-review reports were finalised and published in September 2016.

Subsequent to the first successful round of reciprocal peer reviews under the auspices of the G20, Germany and Mexico agreed to a review of their fossil fuel subsidies in 2016. In addition to mutually reviewing each other's measures, the two countries invited China, Indonesia, Italy, New Zealand, the United States, and the OECD to take part. The OECD also chaired these reviews and acted as co-ordinator. A meeting of the review panel was held in Berlin in February 2017 and published in the autumn of 2017. A third round of peer reviews began in the summer of 2017 with Indonesia and Italy; the peer review process for these countries should conclude by end of 2018.

Figure 1.4. G20 Peer review process of inefficient fossil fuel subsidies



Note: Starting from the left side of the chart, the process begins with an agreement on the ToR and ends with a final report. This was the process for the first four peer reviews but could change at the request of member countries.

These peer reviews bring to the fore the issues around fossil fuel support and the formidable task of undertaking successful reforms. Several lessons can be learned. First, participation in peer reviews encourages a country to look thoroughly at their support policies – how and why they were implemented, and how they can be reformed or eliminated. Second, preparation of the country reports and peer reviews often generate more information about policies than what is covered in countries' annual reports to the G20. Third, preparing for the reviews can be a salutary learning experience for the countries under review (including across ministries) and the peer reviewers. There has been an element of precedent-setting in the structure and conduct of these reviews, as well as in the types of policies discussed and how these were examined. Last but not

least, the process revealed differences between how countries interpret such terms as "subsidy" and "inefficient".

APEC peer reviews

A similar peer review process is taking place in the context of Asia-Pacific Economic Cooperation (APEC). Peru, New Zealand, the Philippines, and Chinese Taipei underwent peer reviews of their inefficient fossil fuel subsidies in, respectively, 2014, 2015, 2016 and 2017, while Viet Nam is expected to have completed its peer review in 2017. Brunei Darussalam is also expected to undergo a review by the end of 2017. Participants in this exercise have derived similar lessons learned.

SDG indicators on fossil fuel support are being developed

On 25 September 2015, the General Assembly of the United Nations adopted a set of 17 Sustainable Development Goals (SDGs) related to ending poverty, protection of the planet, and prosperity for all as part of a new agenda for sustainable development. Each goal has specific targets to be achieved by 2030. In order to monitor progress it created an Inter-agency Expert Group on SDG Indicators (IAEG-SDGs), which is composed of 28 member states and regional and international agency. This group has been tasked with developing and implementing the global indicator framework for the goals and targets agreed to by UN member states.

Target 12.C calls for UN members to

> *rationalise inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities.*

Work is underway to develop an agreed upon set of indicators and sub-indicators to quantify fossil fuel subsidies and guidelines for countries on how to report their FFS estimates. All countries, starting in 2020, would then start reporting these data on an annual basis.

1.3. A joint IEA-OECD estimation of global fossil fuel support

The case for developing a joint IEA-OECD estimate of fossil fuel support

The IEA has provided estimates of fossil-fuel consumption subsidies since 1999 as part of its annual *World Energy Outlook* (WEO). This report estimates the cost of fossil-fuel subsidies that result from under-pricing by comparing observed domestic energy prices with international reference prices (either import-parity or export parity). The difference between prices yields "price gap" estimates that, when multiplied by the associated volume of consumed fuel or electricity, quantifies the extent to which fossil fuels consumers benefit from lower domestic prices. In this sense, the IEA estimates convey full information about the magnitude of policies that reduce domestic fuel prices, hence subsidising their consumption.

The IEA estimates that fossil fuel subsidies in 2015 were around USD 221 billion, down from USD 376 billion in 2014.[7] The fall in oil prices has triggered various policy shifts in

the energy sectors that, together with a lower international reference price, have brought down the level of fossil fuel subsidies. Their estimates identify 41 countries, which account for half of global energy consumption, that subsidise fossil fuel consumption. Eleven of these countries, mostly located in the MENA region, make up around half of total consumption subsidies.

While the IEA estimates quantify the extent of fossil-fuels subsidies to consumers that affect domestic prices, they do not necessarily capture all the transfers generated by other policies that also confer benefits to consumers, such as direct budgetary transfers to consumers or reduced excise taxes, or policies that provide support to the production of fossil fuels without directly affecting end-user prices. Given the specific scope of the "price gap" approach, the OECD *Inventory* of budgetary transfers and tax expenditures, which is nested in the well-established framework of Producer Support Estimate (PSE) and Consumer Support Estimate (CSE), casts a wider net and thus complements the IEA data on fossil fuel subsidies.

The IEA and the OECD estimates of these subsidies are prepared separately, but together they provide an even fuller assessment of the magnitude of fossil fuel support for the countries that they both cover. The IEA figures capture information on prices affected by government intervention or support. The OECD *Inventory* takes stock of individual policies that lower domestic end-user prices, thus translating into price support to consumers. In addition, the *Inventory* includes other consumption-side support and producer support. These two approaches represent two ways of estimating consumer price support. The information gathered by both organisations, when brought together can give a more complete and more accurate picture of support.

The complementarity between the two sets of estimates is used for the first time in this report to develop a single figure on support for fossil fuels and to track progress on their reform. The aggregate figure, or Total Support Estimate (TSE), incorporates three broad categories of support measures: price transfers, budgetary transfers, and revenue forgone (i.e. tax expenditures) (OECD, 2016[12]). In practice, an aggregate figure for support to fossil fuels would be the sum of the following components:

$$TSE = BOT + GSSE + \underbrace{TCT + \underbrace{(TCP + OTC)}_{consumer\ price\ support}}_{CSE}$$

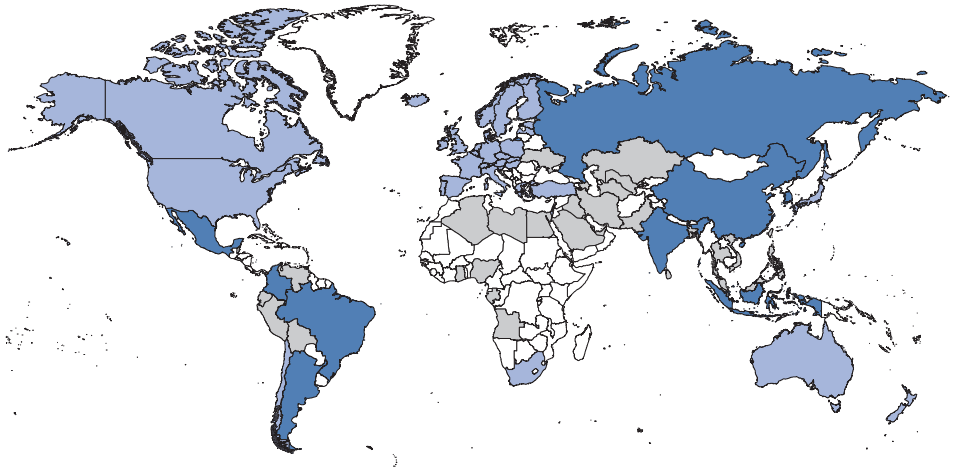
where BOT for budgetary and other transfers to producers, $GSSE$ for general services support estimates, TCT as transfers to consumers from taxpayers, TCP as transfers to consumers from producer, and OTC as other transfer to consumers. Estimates of consumer price support are equivalent to the sum of TCP and OTC estimates in the PSE-CSE framework. Calculating the TSE for fossil fuels using both IEA and OECD estimates broadens the scope and coverage of the IEA FFS database and the OECD *Inventory*, alleviating confusion over apparent differences between the two datasets.

Country coverage in the IEA and the OECD combined data

Since domestic fuel prices are higher than international reference prices in most OECD countries, the calculations on consumer support that are based on the difference between an international reference price and the domestic price estimation is not that relevant, and thus there is little overlap between OECD and IEA country coverage.[8] However, other transfers are more prevalent in OECD countries and their partner economies and should be accounted for when examining fossil fuel subsidies. There are eight countries for

which data have been reported in both datasets: Argentina, China, Colombia, India, Indonesia, Korea, Mexico, and the Russian Federation. The IEA identifies 41 countries with fossil-fuel consumption subsidies and the OECD reports on 43 countries. In total, the combined data from the IEA and OECD cover 76 countries (Figure 1.5), which are responsible for 94% of global CO_2 emissions.[9]

Figure 1.5. Fossil fuel support country coverage by the IEA and the OECD



Note: This chart illustrates coverage by the IEA in *grey*, by the OECD in *light blue,* and represents the overlapping countries in *dark blue*. Where there is no colour, this signifies that the country is either not covered by the IEA or the OECD, or that it has not been identified as giving substantially large support to fossil fuels.

Aggregating IEA and OECD estimates

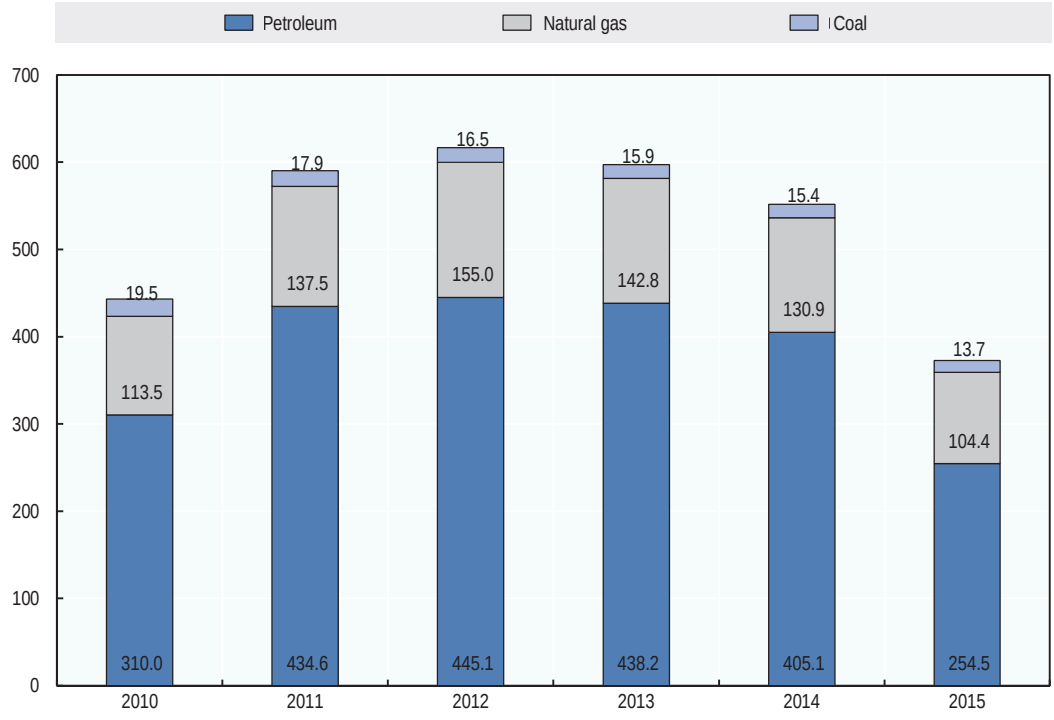
Providing a combined IEA and OECD estimate for fossil fuel support requires reconciling the estimates for countries covered by both organisations; for the other countries covered by only one of the two, taking the available estimates suffices. Estimates from these two databases, except for the overlapping countries, are complementary. However, IEA data do not capture support to producers of fossil fuels, thus the combined database would still be missing information on producer support for countries not covered by the OECD *Inventory*.

Since the OECD *Inventory* methodology rests on collecting individual figures for budgetary transfers and tax expenditures, finding the price-gap equivalent necessitates identifying which of the measures in the *Inventory* translate into reduced consumer prices. Because the benefits conferred to producers and consumers of fossil fuels by a support policy are specific to each country, identifying which measures result in price transfers must be done on a case-by-case basis. There are common features of fiscal measures that qualify as price transfers and hence this would result in under-pricing of fossil fuel products. Reductions in value-added taxes (VAT) and direct budgetary transfers to compensate producers for the opportunity cost of selling their products at a low domestic price instead of at its export-parity or import-parity price are considered to overlap with "price-gap" estimates.

Once the appropriate measures are identified and their corresponding amounts are summed up to give an OECD equivalent of a price-gap estimate, the latter is compared with the IEA figures. Conceptually, an OECD estimate derived from individual measures

that capture transfers to consumers from producers and taxpayers should match the IEA price-gap estimates.[10] Empirically, however, there can be several sources of discrepancies between OECD and IEA numbers. First, as OECD numbers are derived from individual policy measures, it could be that some measures that can affect domestic fuel prices have not been included in the *Inventory*, or have not been included when calculating the OECD estimate for the MPS. Another source of discrepancy could arise from measurement errors in either the OECD or IEA estimates, as well as VAT exemptions for certain consumer categories that are not captured by the IEA estimates. A third possible source of discrepancy is differences in opinion about the exact nature of the support measure. This issue arises both because (i) the definition of a support measure depends on a counterfactual "baseline" and analysts may differ over the appropriate baseline and (ii) the support policies may be quite nuanced and not all details can receive the same level of analytical attention. Lastly, given that OECD estimates are based mostly on figures released on a fiscal-year basis, the reporting of transfers (e.g. refunds for qualifying fuel consumption) could be delayed. The presence of reporting or time lags for fuel price pass-through could explain some of the divergence in the numbers.

Figure 1.6. IEA-OECD joint estimate of support for fossil fuels
USD billions



Note: This figure is based on a rule-of-thumb to combine the IEA estimates of consumer price support with OECD *Inventory* estimates. Since the IEA quantifies the price transfers resulting from under-pricing fossil fuels or foregone revenue stemming from selling products at prices lower than international prices, individual support measures in the OECD *Inventory* are sorted according to whether they lower the domestic price and then used to estimate an equivalent price transfer estimate. The rule-of-thumb then instructs to choose the estimates for which the six-year period total is the larger of the two. This rule-of-thumb addresses the potential sources of discrepancies between the two estimates that can stem from budgetary reporting rules, measurement errors, or time lags in the price pass-through.
Source: (IEA, 2016[13]), (OECD, 2015[1]).

To begin merging the two datasets, the exercise is limited to the years 2010 to 2015, the period during which data coverage is the best for most countries in both databases. In order to provide a single set of OECD and IEA estimates for this edition of the *Companion*, OECD estimates were compared to total IEA estimates over the six-year period and the larger of the two estimates for consumer price support was used in the combined dataset.[11] While it serves as a rule-of-thumb, summing up the estimates over six years minimises the risk of double counting by addressing issues of budgetary reporting lags and time lags related to fuel price pass-through.[12] Measurement errors can also be reduced by comparing total estimates over several years since data are often revised and improved retroactively.

When combining the two sets of data using the rule-of-thumb approach, the TSE amounts to USD 373 billion in support for fossil fuels in 2015, a decrease from USD 551 billion in 2014 (Figure 1.6). Over the period 2010-2015, the difference between the IEA and OECD estimates averages USD 42 billion, approximately 8% of the total number. Coal support estimates are dwarfed by support to petroleum products and natural gas, 72% and 25% respectively. The decline in total support in the form of subsidies is driven in large part by the decline in oil prices that shrink the distance between domestic and international market prices in non-OECD countries, and therefore the support needed to compensate the shortfall. The decline in consumer price support across countries ranges anywhere from an 80% to 3% decrease between 2014 and 2015.

1.4. Conclusions and policy implications encouraging collaboration and co-ordination to support reform

Data show there is a downward trend in support to fossil fuels among OECD countries and partner economies, but country-level information indicates there are large differences in the progress made towards reducing support. The modest global cyclical upturn coupled with the prolonged slump in fuel prices point to structural challenges that can have implications for long-term economic growth. In this context, the future role of fossil fuels is uncertain, with consumption preferences beginning to shift away from fossil fuels even while other parts of the energy sector continue to lock in long-lived capital assets and infrastructure.

Strong efforts to reduce GHG emissions are needed, as the current low oil price regime could render investment in new, cleaner technologies less profitable, thus setting back the momentum towards decarbonisation that has been building. New technologies have been deployed and several incentives have been created, revolutionising an energy sector that has experienced little fundamental change over the last century. Yet government-support for investment in the production of fossil fuels forges ahead (Piggot et al., 2017[14]). This inconsistency in energy policy is a source of a serious misalignment and can be attenuated by reducing inefficient support to fossil fuels.

Transparency is central to international and domestic initiatives focusing on FFS reform. OECD efforts to track support measures across an increasing number of countries contributes to this end. Other institutions, such as the IEA, IMF, the World Bank, the European Union, and more recently Oil Change International (OCI), the Overseas Development Institute (ODI), and the Inter-American Development Bank (IADB), develop complementary information that can further improve the collective knowledge about fossil-fuel support. The OECD collaborates with many of these institutions, where practicable, to identify efforts that do not overlap. The present effort to highlight the

complementary between the IEA and OECD data is a step in providing a fuller and more accurate picture of fossil fuel support.

Co-ordination among institutions is valuable. Without it, inconsistencies in the data can be used as an excuse to postpone action. Efforts to harmonise, to the extent possible, international and national-level data under the Sustainable Development Goals (SDG) indicator 12.c.1 are underway to track progress in reducing government support to fossil fuels. This effort may also involve attention to concepts like "inefficiency" that are at the core to the G20 and G7 call to phase-out inefficient subsidies. The G20 voluntary peer review process has revealed definitional differences within countries, i.e. across ministries, and across countries for terms such as "inefficient" and "subsidy". A broader understanding of these concepts would strengthen transparency on resource allocation and reform processes.

Notes

1. In 2015, with the addition of a carbon tax to the taxation of energy products in France, exemptions to energy-intensive industries that are not part of the EU ETS and are exposed to the risk of carbon leakage were introduced to shield concerned sectors from increases in excise tax rates on fossil fuels. The resulting positive growth in support to fossil fuels between 2014 and 2016, as illustrated in Figure 1.2, is directly linked to the exclusion of energy-intensive industries from the new carbon tax on fossil fuels.
2. The government limits the LPG subsidy to twelve 14.2 kg cylinders annually.
3. This formula was introduced in 2011 and limits price changes to 3% per month. The FEPC has been designed as a self-funding mechanism replenishing when the reference price is higher than the parity-export price (Garcia Romero and Calderon Etter, 2013[3]). Conversely, when the reference price is lower than the parity export price, the fund draws upon its resources to compensate producers for higher international prices without passing them on onto final consumers. The fund was initially financed through savings from Ecopetrol, the national oil company and the *Fondo de Ahorro y Estabilización Petrolera* (FAEP), to which Ecopetrol transfers a share of its annual dividends but it ran out of resources in 2010 as prices continued to increase (OECD, 2014[26]).
4. The last two developments are not yet reflected in the *Inventory* as they are still in the process of implementation.
5. A more comprehensive and precise discussion of the rule and royalty-free oil and gas use can be found at: www.blm.gov/programs/energy-and-minerals/oil-and-gas/operations-and-production/methane-and-waste-prevention-rule.
6. This figure is obtained from a representative of the Energy Policy and Planning Office of the Ministry of Energy in Thailand.
7. These figures do not include subsidies to fossil-fuel generated electricity.
8. Most OECD countries do not apply price controls on their energy products and tend to levy excise taxes that result in a domestic price that is higher than its import-parity (or export parity) price.
9. This calculation is based on data from the European Commission Emissions Database for Global Atmospheric Research (EDGAR).
10. Technically, there is a possibility that IEA estimates capture the impact of cross-subsidies from producers to consumers that are not funded by the government. However,

the OECD price-gap equivalent is can be a close approximation of the IEA price-gap estimates.

11. Estimates are disaggregated by fuel type: coal, oil, gas, and electricity.

12. A shortcoming of this rule-of-thumb is its inability to deal with the cross-subsidies from producers to consumers that are not publically funded and included in the IEA estimates, but not the OECD estimates. Should IEA estimates prevail as the larger of the two, then the possibility of counting these as consumer price support could result in overestimation of support.

Chapter 2. The government support component of loan guarantees and concessional loans linked to fossil fuels

Chapter 2 examines government credit support as a type of support to fossil fuels. It introduces a method elaborated by Professor Deborah Lucas of the Massachusetts Institute of Technology to quantify the support element of government credit assistance. Section 2.1 makes the case for why it is important to measure the support element of loan guarantees and concessional loans. Section 2.2 provides examples of government credit assistance granted by different types of financial institutions. Section 2.3 discusses how and why governments incur a cost when providing credit assistance to fossil fuel energy-related projects. Section 2.4 examines how credit assistance is reported in government budget reports and the implications of different accounting practices. Section 2.5 explains the method used to quantify the subsidy element of government credit support, both in theory and in practice. Section 2.6 provides real world examples of loan guarantees and derives the support element of the specific credit support program. Section 2.7 examines the value of credit assistance to the beneficiaries. The chapter concludes with remarks on how the method could be applied to allow the Inventory to incorporate information on government credit support.

2.1. Why measure the support component of preferential loans and loan guarantees?[1]

Governments play an important role in allocating financial resources and risk in the energy markets. Around the world, they provide support to investment in the production of fossil fuels or in the energy sector either through loan guarantees or direct concessional loans. In doing so, they increase access to credit or lower the cost of borrowing for the firm that would have otherwise been excluded from the credit market or penalised by higher interest rates.

When a government provides a loan guarantee for a project, it pledges to repay some or all of the outstanding amount to the lender should the borrower default. As guarantors governments pass the risk underlying such investment to taxpayers, who inevitably become *de facto* equity-holders in the project. In the event of a default, the government would have to pay back the loan by cutting spending or levying additional taxes to finance this expenditure; debt financing is another way to pay back losses in the short run, but issuing additional debt simply means pushing repayment into the future.

Direct government lending for energy projects is an alternative and widely used form of credit support with costs and benefits comparable to loan guarantees. As for loan guarantees, direct government loans provide support to investors through better contractual terms than those that would have been obtained on private markets, including through favourable interest rates, or repayment conditions. Recipients may, for instance, be granted the right to spread payments over a longer period of time or defer them until the end of the loan so as to maximise their earnings before covering the debt payments. Delaying the start of the repayment period can lower the likelihood of default as it pushes repayment further into the future. However, longer loan maturity can lead to a severer default because it increases total indebtedness and exposes the project to a longer period of uncertainty during which adverse events could occur (CBO, 2004[15]).

Government credit support, therefore, can result in a cost to the government that should enter into the evaluation of government support policies to fossil fuels. The potential subsidy cost of the loan guarantee or direct loans should be expressed in a way that can be compared with other support measures that have been included in the OECD *Inventory* of government support to fossil fuels.

Subsidised government financing support may take the form of a loan provided at non-market terms and conditions (e.g. with a below-market interest rates or with a tenor which is not available in the private market), a loan guarantee with a below-market credit risk premium, or simply even provision of a loan or loan guarantee that would not otherwise have been offered by a private entity. Such loans and guarantees may also be provided by official sources at costs which are commensurate with purely private financing (i.e. with no measurable support element).

In order to quantify the cost to the government of extending a credit or credit guarantee, one needs to determine the terms and conditions of financing that could have been provided by the private sector for the same transaction had the government not stepped in. The difference between what would have been paid by the debtor and what is actually paid is the subsidy cost of the loan or loan guarantee to the government. The challenge of finding an appropriate market pricing counterfactual, even in the absence of private funding, can be addressed using valuation approaches common in the private sector.

2.2. Examples of government credit assistance

Government credit programmes are generally provided through domestic, bilateral or multilateral financial institutions (mainly development banks), export credit agencies or majority state-owned banks. Examining some of the loan guarantees taken on by governments can provide a glimpse into the size and scope of the projects benefitting from this support measure. The examples below are grouped by the type of financial institution through which the credit assistance is granted. Since an estimate of the support value of the loan guarantee is generally unavailable, only the principal loan amount is provided here.

Multilateral financial institutions

Multilateral financial institutions account for the largest share of government credit support. Membership shares vary across institutions but tend to concentrate in large and high-income countries. Projects receiving the funds, however, are generally located in developing regions outside OECD countries. Table 2.1 lists the major multilateral institutions and the average amount of credit provided for fossil fuel-related projects in 2013-14 by them, as reported by the organisation Oil Change International (OCI). These figures represent the principal amount of the government-backed loan and not its subsidy component.

Table 2.1. Multilateral development bank finance for fossil fuels

USD million

Institution	2014	2015
African Development Bank	273	143
Asian Development Bank	725	322
European Bank for Reconstruction and Development	1 231	1 060
European Investment Bank[1]	4 305	3 455
Inter-American Development Bank	350	100
World Bank	4 202	1 971

Note: OCI report the total face value of the loan or the loan guarantee to fossil fuels as a subsidy and not the "support element" of the credit assistance.
1. Strictly speaking, the European Investment Bank (EIB) is not classified as a multilateral development bank. See: www.eib.org/about/partners/development_banks/index.htm.
Source: (OCI, 2017[16]).

Export credit agencies

Export Credit Agencies (ECA), present in most OECD countries, are agencies that provide support (in the form or loans, loan guarantees and insurance) for or on behalf of the government for the export of goods and/or services.[2] ECAs can be private companies operating on behalf of the government or actually part of the government. ECA operations comprise direct loans and loan guarantees provided for the purchase of exported goods and services. Here, the guarantee issued by the ECA covers the repayment risks of the foreign buyer's debt obligation.

Some ECAs already quantify the cost of their credit assistance. The United States' Export-Import Bank (EXIM), for example, is obliged to define the subsidy cost of a credit based on the terms of credit and the estimated probability of default in line with the Credit Reform Act of 1990. The subsidy element of the credit support represents the share of the credit paid by the agency itself, while the remainder is borrowed from the US Treasury at interest rates based on Treasury securities of comparable maturity (EXIM, 2016[17]).

In many cases, the subsidy cost of the individual loan guarantees provided by EXIM is calculated to be negative or zero under this system; this reflects the fact that the fees collected for certain transactions more than offsets the estimated loss that is determined by the US budget scoring model, which does not incorporate a risk premium as a cost. With respect to other ECAs, recent years have witnessed steady positive returns with ECAs more than covering their costs and losses on a cash basis of accounting. Nonetheless, the terms and conditions of most ECA-financed transactions would likely be considered as "below-market" if judged according to a market pricing counterfactual approach.

State-owned enterprises

State-owned enterprises (SOEs) also often benefit from implicit or informal credit guarantees. A leading example is the Tennessee Valley Authority (TVA), wholly owned by the United States government and the largest wholesale supplier of electricity in the United States. Although the TVA relies on debt financing, its debt has consistently been rated AAA. This reflects the implicit guarantee from the US government on its debt obligations. Credit support through this channel may be classified separately from the traditional credit assistance programmes, but omitting this source of support from a comprehensive inventory would under-report the total costs borne by the government. Information on the financial support granted to SOEs is, however, mostly undisclosed. Out of necessity, the analysis in this report will focus on channels for providing government support other than SOEs.

2.3. The cost of government credit assistance

Since money today is more valuable than money tomorrow, the subsidy cost of extending a loan guarantee or a loan arises when the discounted value of the sum of future expected repayments and fees is less than the loan amount disbursed. To compare the value of money today with its value in the future, one would have to use the rate at which money loses its value over time and with risk; the value of money to be received in the future would have to be discounted using this rate (Scott, 2017[18]). Applying this concept to quantify the support element of an assistance direct loan, the sum of the expected cash flows from the repayment of the loan would must be discounted to represent their present

value. Whenever the present discounted total value of the loan cash flows is lower than the principal value of the loan disbursed, the government that is backing or granting the loan incurs a cost equal to that difference in value.

Measuring the cost of a loan guarantee can be less straightforward than for a preferential loan because it is harder to infer the appropriate discount rate. However, with regards to the cost incurred by the government, a loan guarantee is conceptually not very different from a direct preferential loan because both expose the government to uncompensated default losses. A loan guarantee can either grant the firm access to credit or lower the borrowing costs in the same way that a direct concessional loan does. When a firm borrows at a lower cost due to government backing, the value of the loan guarantee amounts to the value of the savings from paying a reduced interest rate that does not fully compensate for the default risk. But to translate the future value of cash inflows into its present day, it is important to use the appropriate rate at which future "money loses its value", i.e. the discount rate. The guarantee cost, and the implied discount rate in guarantee cash flows, can be inferred by comparing the value of an equivalent preferential loan and a risk-free loan with the same promised cash flows.

Elements needed to measure the cost of government credit assistance

To estimate the support component of a direct loan or a loan guarantee, the following loan contractual information is needed:[3]

- principal amount issuance
- interest rate charged on the loan
- maturity
- repayment terms: coupon payments if relevant, or projected cash flow from loan repayments
- any other additional fees and costs

Non-contractual information is also necessary to estimate the support component. That includes default probabilities, expected losses in the event of a default, and the appropriate discount rate including a risk premium. That information is generally inferred from data on loans with similar attributes.

In order to arrive at a grant-equivalent of the loan guarantee or a direct loan, one needs to calculate: the discounted value of expected future cash flows of the loan and compare it with the principal amount borrowed. The exercise is to express the sum of future cash flows from the loan in terms of the present value as discussed in the previous section. Given the time value of money and the risk embedded in the loan, the future value of cash flows must be discounted accordingly. The discount rate represents the opportunity cost or the foregone earnings of loaning the money today as opposed to investing it; the greater the risk and thus the opportunity cost of the loan, the lower the present value of future cash flows, and eventually the higher the cost of the credit assistance.

Box 2.1. Calculating the cost of credit assistance to the government: An illustration

To illustrate how the cost of a direct loan and loan guarantee can be equivalent, one can start with a simple example.[1] Assume that the government issues a direct loan of USD 100 at its own borrowing cost of 4%. The firm is expected to pay back the loan in one year's time with certainty. The government will receive USD 104 a year from now, which implies that today, the value of the repayment discounted by the government's risk-free rate would be:

$$V_{rf} = \frac{USD\ 104}{1.04} = USD\ 100$$

where V_{rf} is the present value of a one-year maturity loan if the firm's riskiness was equivalent to that of the government's, in this case, it is the principal amount disbursed.

Let's assume instead that the firm has a 30% possibility of defaulting on the loan, and in the event of default that the government could recover only 40% of the loan. Because of the default risk, the discount rate on the loan includes a risk premium of, for example, 0.005%, which increases the discount rate to 4.5%. The expected value of the loan repayment would be a weighted average of the amount repaid under a default scenario and the full repayment amount. This would be equal to:

$$V_r = 0.30\left(\frac{USD\ 40}{1.045}\right) + 0.70\left(\frac{USD\ 104.5}{1.045}\right) = USD\ 81.48$$

Introducing repayment uncertainty reduces the expected amount that the government gets back; i.e. the value of the risky loan, V_r. The cost of the direct loan, C_{dl}, is the difference between the present value of the total repayment when the loan is expected to be paid with certainty and when the loan is expected to default with a positive probability. The difference between these two magnitudes is the cost of the direct loan to the government.

$$C_{dl} = V_{rf} - V_r = USD\ 18.52$$

Similarly, should the government guarantee the same loan instead of disbursing it directly, the cost of the guarantee would be a weighted average of what the government would pay in the case of a default and when the firm fully pays the loan. In case of a default, the government pays the face value of the loan at maturity less the recovered amount and in case of a full repayment, the government pays nothing. The expected present value of the loan guarantee is thus,

$$C_{lg} = 0.30\left(\frac{-USD\ 104.5}{1.045} + \frac{USD\ 40}{1.045}\right) + 0.70(USD\ 0) = USD\ 18.52$$

This example introduces the concepts that are crucial to the subsequent discussion on the measurement of government credit assistance. First, it shows that risk-adjusted present value of a loan is an essential element for calculating the cost of credit assistance. Second, it illustrates that the cost to the government of a direct loan or loan guarantee, for the same underlying investment project, should be the same. In reality, loans are granted on much longer maturities than one year and the default and recovery rates are not always available. Also, the same discount rate is used in all three scenarios, implying that the only risk measures used here are the default rate and the rate of recovery. Other factors contribute to the riskiness of the firm and that information is usually captured by the firm-specific discount rate. Thus, the cost of credit assistance to the government hinges on the choice of the discount rate that best describes the firm's credit worthiness.

1. This is based on an example provided in (CBO, 2004[15]).

2.4. Practices in reporting loan guarantees

Governments and multilateral institutions implement different methods to measure and report costs related to credit assistance. These approaches can be categorised under three different methods using: 1) a cash basis approach; 2) an accrual approach using government borrowing cost; and 3) an accrual approach using a market interest rate as a discount rate. The first two approaches, while simpler to implement, suffer from serious limitations as they fail to capture the full extent of the subsidisation. The last approach is the most suited for deriving the cost of credit assistance, but it relies on firm-specific data that is not always available.

Cash basis

Governments using cash-based accounting only report the realised cash flows from the subsidised loan or loan guarantee in the year instead of reporting the cost incurred when the guarantee or loan was granted. By reporting the per-period payments made on the loan guarantee, the guarantee often appears to be profitable because fees are received upfront and the cost of the guarantee is deferred into the future until a credit-default materialises. Using this approach, a very risky loan or guarantee can be made to look less costly compared with a less risky loan or guarantee since the cash-based approach abstracts from the timing and uncertainty associated with a loan's cash flows.

When comparing the cost of a comparable loan guarantee with that of a direct loan, the loan guarantee under this method would appear to result in a lower cost for the government, since the cost of the direct loan would appear at the time of the disbursement as the total amount of the principal extended,, whereas the cost of the loan guarantee would be reported only in the event of a default. Some governments exclude the cost of credit assistance from budgets to avoid these issues, but in doing so, they compromise their budgetary transparency as they understate the costs.

Accrual basis

Accounting practices that report the value of a loan on an accrual basis address the shortcomings of cash-based reporting. An accrual-based approach to estimating the cost of credit assistance uses the difference between the amount of the loan disbursed and the present discounted value (PDV) of the expected repayments and fees from the loan. In order to translate the value of the expected payments into their present value, the time value of money and uncertainty are accounted for. Two methods are used to derive the present value of the loan guarantee or direct loan: one is to use the government's borrowing cost as the interest rate with which to discount future loan-related cash flows; another is to use a discount rate that reflects the risk underlying the loan in addition to the time value of money. The latter reflects a market discount rate that investors would use for loans of similar risk.

An accrual-based method for valuing the cost of government credit support using the interest rate on government debt assumes that a government is fully able to diversify the underlying risk and therefore benefits from relatively low borrowing rates which can be used to measure its cost of capital. The question of whether this assumption holds true has given rise to several papers. While to some extent it is true that a government has greater capacity to eliminate its exposure to idiosyncratic risk, it cannot eliminate completely economy-wide uncertainty. Therefore, the government's cost of capital should reflect the time value of money and the market (non-diversifiable) risk associated with the investment project (CBO, 2004[15]).

Using a government's borrowing rate on government debt to discount the value of the loan guarantee lowers the cost of credit assistance relative to a more comprehensive cost measure because such a discount rate embeds only the borrowing cost for the government but not the investment-specific risk passed on to taxpayers. Financial economics provides several approaches to determine an appropriate firm-specific, project-specific or credit instrument-specific discount rate. The common thread among all the existing methods is the pricing of the riskiness of the firm. While the cash flows of a firm can be financed via equity or debt issuance, in the end it is uncertainty about total cash flows that underpins the discount rate for valuing the firm and not its financing structure (Tirole, 2006[19]).[4]

Similarly for the government, its discount rate for a guaranteed loan should not be tied down by its borrowing cost but by the riskiness of the loan. When a government shoulders the credit risk associated with an energy project and thereby provides the loan at a lower price, it incurs an opportunity cost because of the under-pricing of the risk; government stakeholders, i.e. taxpayers, subsidise the loan. Following this logic, the market-risk based method proposed by (Lucas, 2017[20]) prevails as the preferred approach for estimating the support element of government credit assistance.[5]

2.5. Quantifying the support element of government credit assistances

Quantifying the support element of government credit assistance in theory

Deriving the present value of the loan under market pricing, or its fair value, requires three elements: a default rate, a recovery rate, and a market risk premium, in addition to the abovementioned contractual information.[6] The default rate is the probability that the firm does not meet its repayment obligations, and the recovery rate is the share of the loan that the lender can get back in the event of default. The default rate and the recovery rate are linked and allow for the calculation of the expected value of future cash flows from the loan.[7] The market risk premium is the component of the discount rate that represents the undiversifiable aggregate uncertainty; it captures the risk that is related to economic business cycles and aggregate changes in asset values. Consider a loan with the following features:

- maturity T
- full promised payment C
- a default probability of d
- a recovery rate g, and
- a market interest rate r.

Using this information, the expected value of the loan guarantee is the difference between the value of the promised loan payments if they were risk-free and the value of expected loan payments taking into account default losses. The expected loan cash flow at a future time t, if the loan has not already defaulted, is the weighted average between the recovered amount in the event of a default and the full promised payment with no default $d_t g_t C_t + (1 - d_t)C_t$. This expected cash flow, in t, depends on the firm not defaulting up until now, for $t - 1$ periods, since the first disbursement of the loan. The probability that default did not occur thus far is expressed as the multiplicative term $\prod_{t=1}^{k-1}(1 - d_t)$, where $k - 1$ represents the number of time periods that default did not take place. Lastly, the total expected repayment value must be discounted using the market interest rate. The fair value of the loan when all the information elements are available can be derived using the following expression,

$$V_r = \sum_{k=1}^{T} \frac{\prod_{t=1}^{k-1}(1-d_t)[d_k g_k C_k + (1-d_k)C_k]}{(1+r)^k}$$

The cost of the loan guarantee is then the difference between the risk-free value of the loan V_{rf}, i.e. when the default rate is null, and its fair value V_r, .

$$V_{rf} = \sum_{k=1}^{T} \frac{C_k}{\left(1+r_{rf}\right)^k}$$

Quantifying the support element of government credit assistance in practice

Explicit firm or project-specific default probabilities, recovery rates, and market discount rates are not always available. However, if a firm's debt is publically traded, its market price will reflect the market rate that private financial institutions required along with their beliefs about default and recovery rates. This discount rate is the yield or return the lenders demand for holding a risky asset in their portfolio, applied to promised cash flows. To calculate the value of the direct loan or the loan guarantee that would result from private lending, the appropriate risk-adjusted discount rate would be the interest rate charged by the private sector.

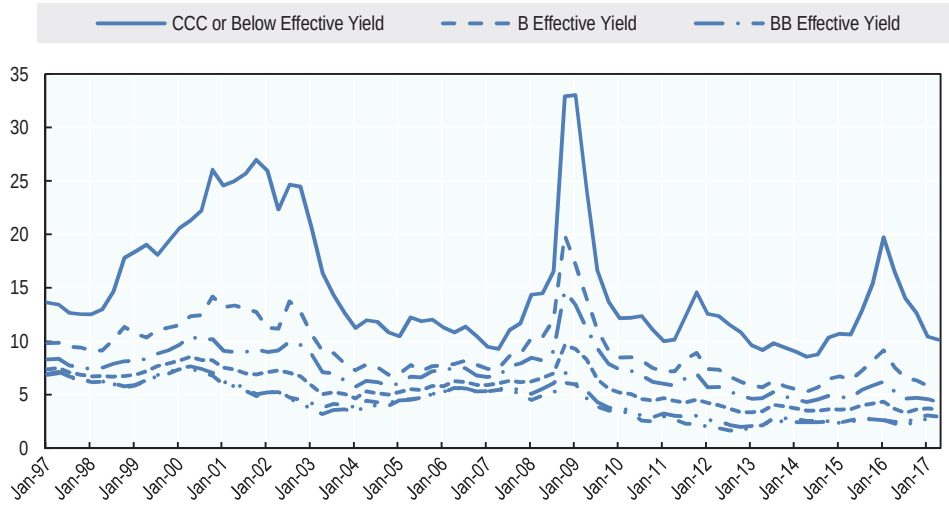
Information about a firm's creditworthiness can be extracted from its credit-ratings. In practice, one candidate proxy is the credit rating of the energy-project sponsor (Lucas, 2017[20]). Rating agencies assign a grade to an issuer or a security to measure its credit worthiness (or likelihood of default), taking into account the borrower's risk-related factors: capital, cash flow, liquidity, capability, and at the firm's line of business. Since credit ratings and yield spreads are strongly correlated because they can inform on the default risk and recovery rate of a firm, one can use the firm's credit rating to back-out the corresponding yield spread (the difference between the yield on a firm's debt and the corresponding government rate) (Figure 2.1). The most precise credit-rating would be the one that is specific to the issued debt, but the firm's credit rating or the credit rating of a similar debt instrument – of equivalent magnitude, issuance date, and maturity – can be used as a proxy. Figure 2.1 illustrates the link between a given credit rating (e.g. from AAA to CCC) and its associated average corporate bond yield as calculated by BofA Merrill Lynch. It is evident from the graph that the relationship is monotonically decreasing, i.e. the lowest credit ratings (CCC) are related to the highest yields.

Since the yield on government bonds is usually readily available for different bond maturities, the yield on the firm's debt can either be derived from the risk-free bond yield augmented by the firm- (or issue-) specific yield spread, or using a firm's credit rating and applying the associated spread. The fair value of the loan can be derived by an equivalent expression of the present value of the loan cash flows using the risk-adjusted discount factor based on the firm-specific yield,[8]

$$\widetilde{V}_r = \sum_{k=1}^{T} \frac{C_k}{(1+\tilde{r})^k}$$

The credit rating-based discount rate captures the average risk characteristics of firms that are assigned the specific grade. More explicit data on firm or project are preferred, but given the lack of disaggregation or the unavailability of data, this method benefits from its simplicity while approximating firm-specific risk sufficiently enough.

Figure 2.1. Corporate credit ratings and bond yields (in %)



Note: The chart above is based on quarterly US corporate bond yields from BofA Merrill Lynch for different credit ratings.
Source: (BofA Merrill Lynch, 2017[21]).

2.6. Real-world examples of loan guarantees and estimation of government support

The following employs three examples used in Lucas (2017[20]) to illustrate how government support is measured for different projects with differing levels of data availability.

US Export-Import Bank loan guarantee to Pemex

In July 2012, Petróles Mexicanos (Pemex), the Mexican state-owned oil company, issued USD 1.2 billion in bonds backed by the US Export-Import Bank to purchase US-made goods and services. The calculations of the support element from the loan guarantee imply that the support value is USD 206 million from the Ex-Im Bank.

Source of information

The subsidy estimate relies on information from public sources, including a press release from the US Ex-Im bank, information releases from rating agencies, Pemex's Form 20-F Report filed with the US SEC for 2012, and other media coverage. The available information is gathered in Table 2.2.

Table 2.2. Information on the loan guarantee to Pemex

	Principal amount (USD)	Interest rate (%)	Credit rating	Yield spread (%)	Risk-free rate (%)	Discount rate (%)
Bond 1	400	2.0 (F)	BBB	2.4	1.65	4.0
Bond 2	400	1.95 (F)	BBB	2.4	1.65	4.0
Bond 3	400	1.7 (F)	BBB	2.4	1.65	4.0

Source: (Lucas, 2017[20]).

Contract terms: USD 400 million

The guaranteed loans reportedly have a ten-year repayment term that matches terms typically offered by other export credit agencies. The total USD 1.2 billion raised was spread across three separate Pemex offerings:

- One note with a fixed interest rate of 2.0%, issued on 6 July 2012.
- One note with a fixed interest rate of 1.95%, issued on 6 July 2012.
- One note with a fixed interest rate of 1.7%, issued on 26 July 2012.

For the purpose of these subsidy calculations, and in the absence of information about repayment terms, the bonds are assumed to pay an annual coupon at the stated interest rate and to return the principal in a lump-sum at maturity.

Risk-adjusted discount rate

The subsidy value is calculated based on discounting the promised cash flows at a yield on comparable non-guaranteed bonds of similar maturity and risk. In this case, information is available on several other Pemex issues of a similar maturity that same year. The interest charged is a fixed rate ranging from 3.5% to 4.875%.

Another point of reference for the market yield spread comes from Pemex's credit ratings for foreign current offerings that were issued around that time by Fitch and S&P. Both agencies rated Pemex BBB, citing the strong backing from the Mexican government, which was rated AAA at the time. Moody's rated a recent Pemex issue as Baa3, and noted that its stand-alone rating without the implicit support of the Mexican government would fall to b3.

For the subsidy calculations, 4% is taken to be the market discount rate, based on several considerations: the ten-year US Treasury rate at the time of issuance was 1.65%. The BBB credit spread was 2.4%. The sum of the two is 4.05%, which is consistent with, although slightly higher than, the rates paid on the two direct loans issued at about the same time with similar maturities but without a guarantee. Direct loans often have higher priority in bankruptcy than do bonds, which may be a factor in the slightly lower rates charged.

The loan information from the first line of the table will be used in the following way:

$$\tilde{V} = \sum_{k=1}^{9} \frac{(USD\ 400)(0.02)}{(1+0.04)^k} + \frac{USD\ 400 + (USD\ 400)(0.02)}{(1+0.04)^k} = USD\ 335.11$$

The promised cash flows on the guaranteed bonds and the cost of the guarantee to the government are summarised in Table 2.3.

Table 2.3. Calculating the cost of the loan guarantee

Year	Promised cash flows on Pemex bonds (USD million)			
	Bond 1	Bond 2	Bond 3	Total
1	8	7.8	6.8	22.6
2	8	7.8	6.8	22.6
3	8	7.8	6.8	22.6
4	8	7.8	6.8	22.6
5	8	7.8	6.8	22.6
6	8	7.8	6.8	22.6
7	8	7.8	6.8	22.6
8	8	7.8	6.8	22.6
9	8	7.8	6.8	22.6
10	408	407.8	406.8	1222.6
$\tilde{V}$ present discounted value of the loan	335.11	333.49	325.38	993.98
Support component	65	67	75	207

Note: Besides the support component stemming from the US Ex-Imp Bank guarantee, there is an additional guarantee provided by the Mexican government to Pemex. As a state owned enterprise, Pemex benefits from a higher credit rating than what its standalone rating. A similar approach would be applied to estimate the Mexican government cost of support for Pemex's investment project.
Source: (Lucas, 2017[20]).

KfW loan to Electroprivreda Srbije for Kolubara project

PE Elektroprivreda Srbije (EPS) and German Development Bank (KfW), on the behalf of and with financial support of the government of Germany, signed a loan agreement in late 2012 for EUR 65 million and a grant of EUR 9 million to be used for the implementation of project "Energy Efficiency through Efficient Coal Quality Management in MB Kolubara".

Contract terms

The total funds needed for the project were reported to be EUR 181.6 million. The European Bank for Reconstruction and Development (EBRD) supplied EUR 80 million and EPS committed to provide EUR 27 million from its own funds. Few details about the deal are publicly available. Nevertheless, the example is useful in illustrating the principles that would be used to value the support from KfW using information that certainly was known to KfW.

Risk-adjusted discount rate

Because EPS is a wholly state-owned company, its credit risk is at least as high as that of the Serbian government. That is because if Serbia defaults on international debt, that default is likely to include cessation of payments on EPS debt. There is the additional risk that if EPS were to experience large unanticipated losses, it could default on its debt even if Serbia honoured its other credit obligations.

Serbia was rated BB- with a negative outlook by Standard and Poor's (S&P) in August 2012, and it reaffirmed that rating in March 2013. The rating is mapped to a discount rate by reference to yield spreads and taking the AAA European government bond rate as the base rate. In late 2012, the BB yield spread was 3.8%, and the B yield spread was 5.17%.[9] Because Serbia falls into the lower range of BB ratings, and because the risk of EPS is likely to be higher than that of the Serbian government, the relevant yield spread is taken to be 4.5%.

The base yield to which the yield spread is added depends on the maturity of the KfW loan, which is not reported. The yields on AAA-rated 5-year, 10-year and 20-year bonds in late 2012 were 0.9%, 2.0%, and 2.8%, respectively.[10]

The subsidy also depends on the unknown interest rate charged by KfW. (Lucas, 2017[20]) shows the subsidy cost as a function of the yield spread charged on the loan and a ten-year-maturity of the loan. The reported subsidies are calculated by deriving promised cash flows based on maturity and assumed bond yield (yield spread charged plus base AAA rate), and discounting by the base AAA rate plus the 4.5% assumed market yield spread to find the value of the promised cash flows. The difference between the loan principal and the present value of the promised cash flows is the implied subsidy.

The value of the estimated subsidy ranges from USD 5 million to USD 28 million depending on how concessionary the interest rate charged and the maturity of the loan.[11] Longer maturity loans entail higher subsidies because the below-market rate advantage is realized over a longer period. Development banks often provide longer-term financing, suggesting that the subsidies on the ten-year loans may be the most indicative of the true subsidy amount. Note that those credit subsidies significantly exceed the value of the EUR 9 million grant, which would have been the only subsidy accounted for under current practice (Table 2.4).

Table 2.4. Information on the loan guarantee to EPS

	Principal amount (USD)	Interest rate (%)	Credit rating	Yield spread (%)	Risk-free rate (%)	Discount rate (%)
10-year fixed rate loan						
Yield spread 0.5%	65	2.5	BB	4.5	2.0	6.5
Yield spread 1.5%	65	3.5	BB	4.5	2.0	6.5
Yield spread 2.5%	65	4.5	BB	4.5	2.0	6.5

Source: (Lucas, 2017[20])

The loan information in the case that the interest rate charged is derived from the assumption that the yield spread used is 0.5% will be used in the following way,

$$\widetilde{V}_r = \sum_{k=1}^{9} \frac{(USD\ 65)(0.025)}{(1+0.065)^k} + \frac{USD\ 65 + (USD\ 65)(0.025)}{(1+0.065)^k} = USD\ 53.87$$

The promised cash flows on the guaranteed bonds and the cost of the guarantee to the government are summarised in Table 2.5.

Table 2.5. Calculating the cost of a loan guarantee for ten-year maturity bonds

Year	Promised cash flows on EPS bonds (USD million)		
	Yield spread 0.5%	Yield spread 1.5%	Yield spread 2.5%
1	1.625	2.275	2.925
2	1.625	2.275	2.925
3	1.625	2.275	2.925
4	1.625	2.275	2.925
5	1.625	2.275	2.925
6	1.625	2.275	2.925
7	1.625	2.275	2.925
8	1.625	2.275	2.925
9	1.625	2.275	2.925
10	66.625	67.275	67.925
$\tilde{V}$ present discounted value of the loan	46.31	48.45	52.99
Support component	19	17	12

Source: (Lucas, 2017[20]).

2.7. The value of loan guarantees for the firm

To assess the net value of government credit assistance, there are several costs and benefits to be accounted for, such as the environmental and social externalities associated with energy projects (positive or negative), the impact of the credit support on market prices for loans, on investment patterns, as well as on the firm's own financing structure and leverage. A discussion of the cost of government credit assistance cannot be without mention of the benefits conferred onto the borrower that go beyond the access to credit or the reduced borrowing cost.

Investment projects in the energy sector necessitate large-scale long-term financing. Financial institutions cannot always accommodate the needs of such undertakings due to the lack of full information on the viability of the project or of financial constraints they face. The existing informational asymmetry, i.e. the firm disposing more information about its balance sheet and growth prospects than the lending institution, creates a friction in financial markets. Financial institutions end up confounding high-risk borrowers with low-risk borrowers and therefore mispricing their respective risk.[12] In doing so, low-risk borrowers are penalised with high borrowing costs and high-risk borrowers benefit from loans terms that do not fully capture their level of risk. This informational asymmetry results in a misallocation of funds that excludes low-risk borrowers from the credit market and brings in higher-risk types. This market failure can be assuaged with government-backed financing through lower borrowing costs or increased access to credit.

The benefit of credit support to the recipient may go well beyond the value of the support element of the loan. The feedback of credit support on a firm's credit worthiness can affect its future capacity to raise funds, known as the leverage effect. The debt granted via government support changes the capital structure of firm since the firm usually finances its investments through a combination of debt and equity. The private value to firms benefitting from government credit support is even harder to ascertain because it would depend on: a borrower's particular tax status; its financial situation, including the profitability of the project and the borrower's access to credit markets; leverage effects;

and the competitiveness of the industry. These dynamic effects would not be reflected in an *Inventory* of support measures which has thus far only captured the revenue loss from granting the support.

2.8. Implications for the *OECD Inventory of Support to Fossil Fuels*

Government credit support to fossil fuel-related projects is pervasive and can result in inefficient allocation of public resources by locking-in long-lived carbon-intensive capital assets. Over the period between 2013 and 2015, G20 countries and multilateral development banks granted an average of USD 71.8 billion annually to fossil-fuel related projects (OCI, 2017[22]). According to preliminary estimates of the share of government credit support, it contributed to an additional support component ranging from USD 2.2 billion to 14 billion.

The cost of bearing the risk of granting credit to such investments results in a revenue forgone that could be quantified and integrated in the *Inventory*. In order to provide estimates on credit support akin to the estimates of tax expenditures and direct budgetary transfers that are included in the *Inventory*, two streams of information would need to be collected: information on the conditions associated with all government loans and loan guarantees, and information on the credit ratings of the firms or projects benefiting from such support and on the yield on government debt.

For information on the conditions associated with government loans and loan guarantees, a starting point would be to harness the information on the fossil fuel projects benefitting from credit support and the principal amount they received that has been collected by different institutions, such as Oil Change International (OCI). Finding loan specific information in a systematic way is no simple task. However, working closely with governments on disclosing information, and resorting to publically available data are a way forward to tackling this task and contributing to greater transparency on the use of public resources.

For information on the credit ratings of the firms or projects benefiting from such support, credit agencies, such as Standard & Poor's (S&P), Moody's, and Fitch Group, could provide such information, as well as the more consolidated databases, such as Datastream, which report credit ratings from the three aforementioned credit agencies. Datastream and other proprietary databases can also provide information on yield spreads that correspond to different credit ratings. The two data elements would be used to obtain the risk-adjusted discount rate and eventually the support component of credit assistance.

Expanding the *Inventory* in this direction could bring to the fore information on support to fossil fuel-related projects with long lifespans that emerged only because they were granted this type of assistance. Investment of the kind today can widen the existing infrastructure gap between what is needed to achieve climate policy objectives and the present situation (OECD, 2017[23]). Given the concerted efforts to decarbonise economies and move to less-environmentally-harmful energy sources, credit assistance directed to carbon-intensive infrastructure is incongruent with such efforts.

Several institutions have been taking stock of fossil fuels projects that benefit from government credit assistance, and the OECD could become part of this stream of work. However, given the intensity of effort and resources needed to gather the necessary data, the OECD would need to explore the options to conducting such work and assess whether it would be worthwhile pursuing. Data on government credit support is nevertheless an important element that shed light on government contributions to carbon-intensive

infrastructure and to the risk of stranded capital assets. Work on gathering and reporting such information could provide a more accurate picture of the grant-equivalent value of government-mediated credit instruments than would information on the principal value of those instruments alone.

Notes

1. The OECD commissioned Professor Deborah Lucas from the Massachusetts Institute of Technology to develop a paper on quantifying the support element of government credit assistance, i.e. direct loans and loan guarantees, for fossil-fuel related projects. This chapter is in large part an abridged version of the work by Professor Deborah Lucas.
2. A complete list of ECAs can be found at: www.oecd.org/trade/xcred/eca.htms.
3. The discount factor is a crucial element to appraise the subsidy component of credit assistance, but it does not appear in the loan contract.
4. The assertion refers to the Modigliani-Miller Theorem, which abstracts from any market incompleteness or friction. While these assumptions have proven to be too restrictive, the main message is that capital cost is tied down by uncertainty and not capital structure (Tirole, 2006[19]).
5. Risk relevant to the government is non-diversifiable market risk. Governments have the ability to pool financial assets to reduce exposure to idiosyncratic risk, but the capacity to lower aggregate risk is limited. To price the risk of a government loan, it is important to use an appropriate measure to capture the relevant type of uncertainty, which in this case is aggregate economy-wide uncertainty.
6. The fair value of a loan is the price received if the firm were to sell or exchange the asset on the market.
7. Usually, the higher the default rate, the smaller the recovery rate.
8. $\tilde{V}$ and $\tilde{r}$ are the counterparts to the value of the loan guarantee and the discount factor using credit rating-based yield spreads that might not be specific to the project or issuance.
9. From the index value of option-adjusted spreads as reported by Bank of America Merrill Lynch.
10. Yield spreads are based on the ECB Euro area yield curves data.
11. Calculating the subsidy cost for each maturity (5-year, 10-year, and 20-year) and yield spread (0.5%, 1.5%, 2.5%) combination is detailed in (Lucas, 2017[20]). For illustrative purposes, support cost in this chapter is calculated for a ten-year maturity loan. The higher the maturity, the higher the cost of the loan guarantee.
12. Known as the "lemons problem" (Akerlof, 1970[25]).

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Annex A. Additional data on fossil fuels

Table A.1. The IEA's classification of fossil fuels

Broad category	IEA short name	IEA full name
Solid fuels	ANTCOAL	Anthracite
	BITCOAL	Other bituminous coal
	BKB	BKB
	BROWN	Brown coal (if no detail)
	COALTAR	Coal tar
	COKCOAL	Coking coal
	GASCOKE	Gas coke
	HARDCOAL	Hard coal (if no detail)
	LIGNITE	Lignite
	OILSHALE	Oil shale and oil sands
	OVENCOKE	Coke oven coke
	PATFUEL	Patent fuel
	PEAT	Peat
	SUBCOAL	Sub-bituminous coal
Liquid fuels and associated products		
	ADDITIVE	Additives and blending components
	AVGAS	Aviation gasoline
	BITUMEN	Bitumen
	CRNGFEED	Crude, NGL, or feedstocks (if no detail)
	CRUDEOIL	Crude oil
	ETHANE	Ethane
	JETGAS	Gasoline type jet fuel
	LPG	Liquefied petroleum gases (LPG)
	LUBRIC	Lubricants
	NAPHTHA	Naphtha
	NGL	Natural gas liquids
	NONBIODIES	Gasoil or diesel oil, excl. biofuels
	NONBIOGASO	Motor gasoline excl. biofuels
	NONBIOJETK	Kerosene type jet fuel excl. biofuels
	NONCRUDE	Other hydrocarbons
	ONONSPEC	Other oil products
	OTHKERO	Other kerosene
	PARWAX	Paraffin waxes
	PETCOKE	Petroleum coke
	REFFEEDS	Refinery feedstocks
	RESFUEL	Fuel oil
	WHITESP	White spirit & SBP

Broad category	IEA short name	IEA full name
Gaseous fuels	BLFURGS	Blast furnace gas
	COKEOVGS	Coke oven gas
	GASWKSGS	Gas works gas
	NATGAS	Natural gas
	REFINGAS	Refinery gas

Source: Adapted from the IEA, http://wds.iea.org/WDS/tableviewer/document.aspx?FileId=1496.

Table A.2. MFN tariffs applied by OECD countries on imported hydrocarbon fuels, as of 1 January 2018

Country	Crude oil and liquid petroleum products							Gaseous hydrocarbons		
	Crude oil	Motor gasoline	Aviation spirit	Kerosene	Jet fuel, kerosene-based	Diesel	Heavy fuel oil	LNG	LPG	Gaseous natural gas
HS (2017) code	2709	2710.12 ex	2710.12 ex	2710.19 ex	2710.19 ex	2710.19 ex	2710.19 ex	2711.11	2711.12	2711.21
Australia[1]	0%	0%	0%	0%	0%	0%	0%	AUD 0.276/kg	AUD 0.132/L	AUD 0.276/kg
Brazil	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Canada	0%	0%	0%	0%	0%	0%	0%	0%	0-12.5%	0%
Chile	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
China	0%	1%	1%	9%	0%	1%	6%	0%	1-11%	0-6%
Iceland	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
India	0%	5%	5%	5%	0%	2.5-5%	5%	5%	2.5-5%	5%
Indonesia	0%	0%	0%	0%	0%	0%	0%	5%	5%	5%
Israel[2]	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
European Union	0%	4.7%	4.7%	4.7%	4.7%	0-3.5%	3.5%	0%	0-8%	0%
Japan	0%	JPY 934/kL	0-JPY 934/kL	0-3% or JPY 346/kL	JPY 346/kL	0-JPY 750/kL	JPY 0-249/kL	0%	0%	4.1%
Korea	0.5-3%	3%	3%	3%	3-5%	3%	3-5%	2-3%	2%	2%
Mexico	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
New Zealand	0%	0%	0%	0-5%	0-5%	0%	0%	0%	NZD 0.104/L	NZD 3.17/GJ
Norway	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Russian Federation	0-5%	5%	5%	5%	5%	5%	5%	5%	5%	0%

Country	Crude oil and liquid petroleum products							Gaseous hydrocarbons		
	Crude oil	Motor gasoline	Aviation spirit	Kerosene	Jet fuel, kerosene-based	Diesel	Heavy fuel oil	LNG	LPG	Gaseous natural gas
HS (2017) code	2709	2710.12 ex	2710.12 ex	2710.19 ex	2710.19 ex	2710.19 ex	2710.19 ex	2711.11	2711.12	2711.21
South Africa	0%	ZAF 0-0.091/L	0%	ZAF 0.183/L	0%	ZAF 0.183/L	0%	0%	0%	0-15%
Switzerland	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turkey	0%	4.7%	4.7%	4.7%	4.7%	3.5%	3.5%	0.7%	0-8%	0.7%
United States	USD 0.0525-0.105/bbl	USD 0.525/bbl	USD 0.525/bbl	USD 0.105-0.525/bbl	USD 0.525/ bbl	USD 0.105/bbl	USD 0.0525-0.105/bbl	0%	0%	0%

General note to Table A.2: This table shows the range of most favoured nation (MFN) tariffs applied by the listed countries, classified according to the six-digit Harmonized System sub-headings ("HS codes") for major products. HS codes followed by an "ex" are specific to the listed product at the 8- or 10-digit levels, which are unique to each country. The MFN tariffs are those applied by countries to other members of the World Trade Organization (WTO), except for those trading partners with which the country has a preferential trading arrangement, such as a free-trade agreement, in which case the applied tariff is often 0%. A few of the countries listed levy higher rates of import duties on imported goods from trading partners that are not members of the WTO. In the case of petroleum products, those non-WTO countries include Algeria, Azerbaijan, Belarus, Bosnia and Herzegovina, Iran, Serbia, and Turkmenistan.

1. Australia applies excise duties at the point of import, and lists these duties in its tariff schedule. Since these (AUD 0.403 per litre for motor gasoline, kerosene, diesel, heavy fuel oil and crude oil not used as petroleum refinery feedstock, and AUD 0.03556 per litre for aviation spirit and jet fuel) are the same as the normal excise duty applied to domestically produced fuels, the tariffs here are listed as zero.

2. 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.

3. New Zealand applies excise duties on motor spirit (gasoline) and automotive and marine diesel blended with motor spirit at the point of import, and lists these duties (NZD 0.59524 per litre + NZD 0.08 per gramme of lead) in its tariff schedule. Since these duties are the same as the normal excise duty applied to the same domestically produced fuels, the tariffs reported here are listed as zero.

Source: A European Union: Business Link (www.businesslink.gov.uk/bdotg/action/tariff); all other countries: European Commission, Market Access Database (http://madb.europa.eu/madb/indexPubli.htm).

Table A.3. Tariffs applied by OECD countries on imported solid fossil fuels, as of 1 January 2018

Country	Hard coal				Lignite		Peat	Coke and semi-coke or coal, lignite or peat
	Anthracite	Bituminous coal	Other	Briquettes of hard coal	Non-agglomerated	Agglomerated		
HS (2017) code	2701.11	2701.12	2701.19	2701.20	2702.10	2702.20	2703	2704
Australia	0%	0%	0%	0%	0%	0%	0%	0%
Brazil	0%	0%	0%	0%	0%	0%	0%	0%
Canada	0%	0%	0%	0%	0%	0%	6.5%	0%
Chile	6%	6%	6%	6%	6%	6%	6%	6%
China	3%	3-6%	5%	5%	3%	3%	5%	0%
Iceland	0%	0%	0%	0%	0%	0%	0%	0%
India	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	5%
Indonesia	5%	5%	5%	5%	5%	5%	5%	0%
Israel[1]	0%	0%	0%	0%	0%	0%	6%	0%
European Union	0%	0%	0%	0%	0%	0%	0%	0%
Japan	0%	0%	0%	3.9%	0%	0%	0%	3.2%
Korea	0%	0%	0%	1%	1%	1%	1%	0-3%
Mexico	0%	0%	0%	0%	0%	0%	0%	0%
New Zealand	0%	0%	0%	0%	0%	0%	0%	0%
Norway	0%	0%	0%	0%	0%	0%	0%	0%
Russian Federation	5%	0-5%	5%	5%	5%	5%	5%	5%
South Africa	0%	0%	0%	0%	0%	0%	0%	0%
Switzerland	CHF 0.80/ tonne	CHF 0.80/ tonne	CHF 0.80/ tonne	CHF 0.80/ tonne	CHF 0.80/ tonne	CHF 0.80/ tonne	CHF 0.80/ tonne	CHF 0.80/ tonne

Country	Hard coal				Lignite		Peat	Coke and semi-coke or coal, lignite or peat
	Anthracite	Bituminous coal	Other	Briquettes of hard coal	Non-agglomerated	Agglomerated		
HS (2017) code	2701.11	2701.12	2701.19	2701.20	2702.10	2702.20	2703	2704
Turkey	0%	0%	0%	0%	0%	0%	0%	0%
United States	0%	0%	0%	0%	0%	0%	0%	0%

General note to Table A.3: This table shows the range of most favoured nation (MFN) tariffs applied by the listed countries, classified according to the six-digit Harmonized System sub-headings ("HS codes") for major products. HS codes followed by an "ex" are specific to the listed product at the 8- or 10-digit levels, which are unique to each country. The MFN tariffs are those applied by countries to other members of the World Trade Organization (WTO), except for those trading partners with which the country has a preferential trading arrangement, such as a free-trade agreement, in which case the applied tariff is often 0%. A few of the countries listed levy higher rates of import duties on imported goods from trading partners that are not members of the WTO. In the case of petroleum products, those non-WTO countries include Algeria, Azerbaijan, Belarus, Bosnia and Herzegovina, Iran, Serbia, and Turkmenistan.

1. 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.

Source: European Union: Business Link (www.businesslink.gov.uk/bdotg/action/tariff); all other countries: European Commission, Market Access Database (http://madb.europa.eu/madb/indexPubli.htm). The identification of support measures was conducted mainly through searches of official government documents and web sites. In a few cases, unpublished data were requested from, and furnished by, OECD governments.

Figure A.1. Composition of total support by indicator (left) and by fuel (right)

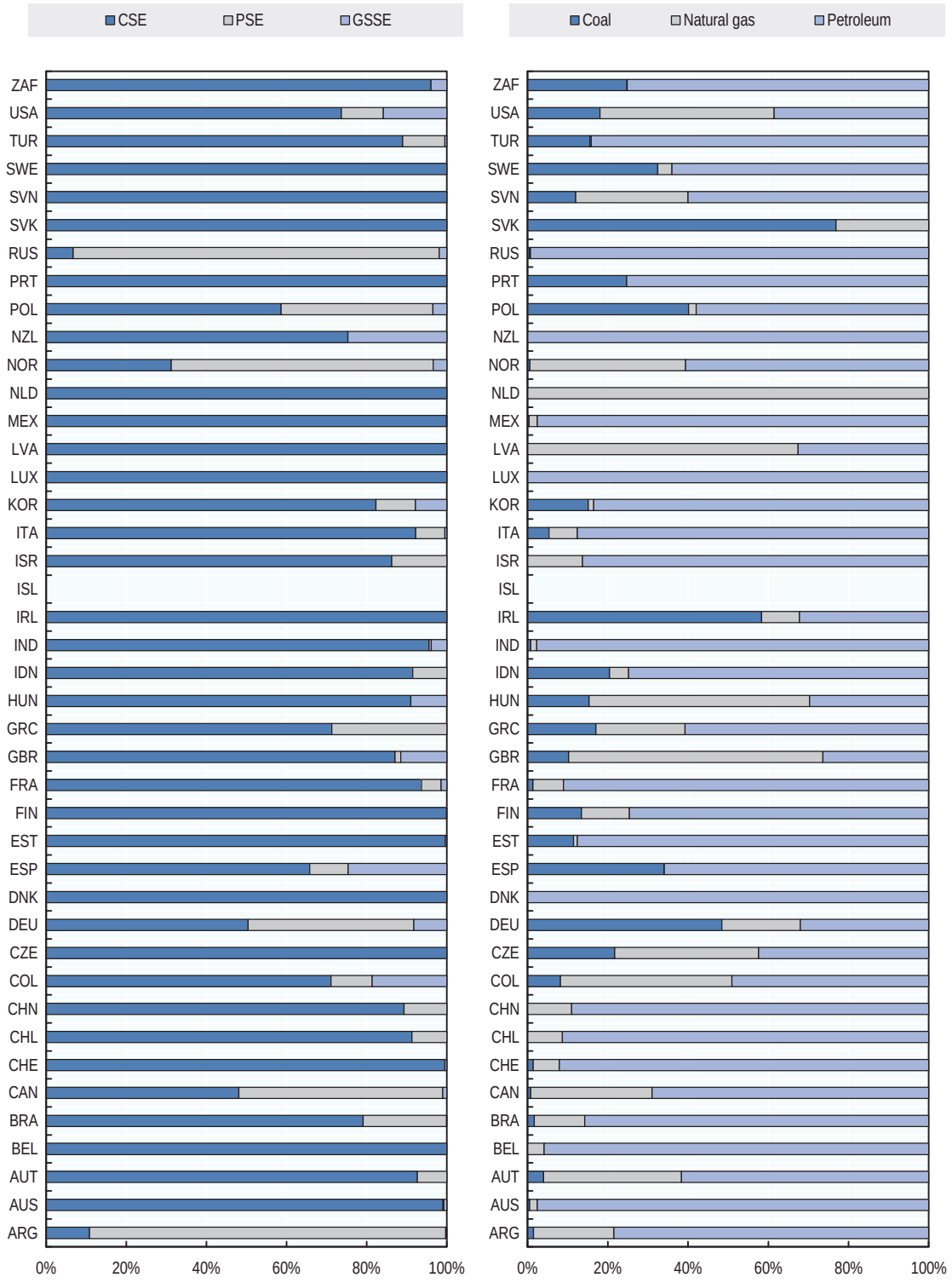

Table A.4. Matrix of support measures with examples

		Statutory or formal incidence (to whom and what transfer is first given)								
		Production							Direct consumption	
					Costs of production factors					
		Output returns	Enterprise income	Cost of intermediate input	Labour	Land and natural resources	Capital	Knowledge	Unit cost of consumption	Household or enterprise income
Transfer Mechanism (how a transfer is created)	Direct transfer of funds	Output bounty or deficiency payment	Operating grant	Input-price subsidy	Wage subsidy	Capital grant linked to acquisition of land	Grant tied to the acquisition of assets	Government R&D	Unit subsidy	Government-subsidized life-line electricity rate
	Tax revenue forgone	Production tax credit	Reduced rate of income tax	Reduction in excise tax on input	Reduction in social charges (payroll taxes)	Property-tax reduction or exemption	Investment tax credit	Tax credit for private R&D	VAT or excise tax concession on fuel	Tax deduction related to energy purchases that exceed given share of income
	Other government revenue foregone			Under-pricing of a government good or service		Under-pricing of access to government land or natural resources; Reduction in resource royalty or extraction tax	Debt forgiveness of restructuring	Government transfer of intellectual property right	Under-pricing of access to a natural resource harvested by final consumer	
	Transfer of risk to government	Government buffer stock	Third-party liability limit for producers	Provision of security (e.g., military protection of supply lines)	Assumption of occupational health and accident liabilities	Capital guarantee linked to acquisition of land	Credit guarantee linked to capital; equity conversion		Price-triggered subsidy	Means-tested cold-weather grant
	Induced transfers	Import tariff or export subsidy; local-content requirements and discriminatory government procurement	Monopoly concession	Monopsony concession export restriction	Wage control	Land-use control	Credit control (sector-specific)	Deviations from standard IPR rules	Regulated price; cross subsidy	Mandated life-line electricity rate

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