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The fiscal implications of the low-carbon transition

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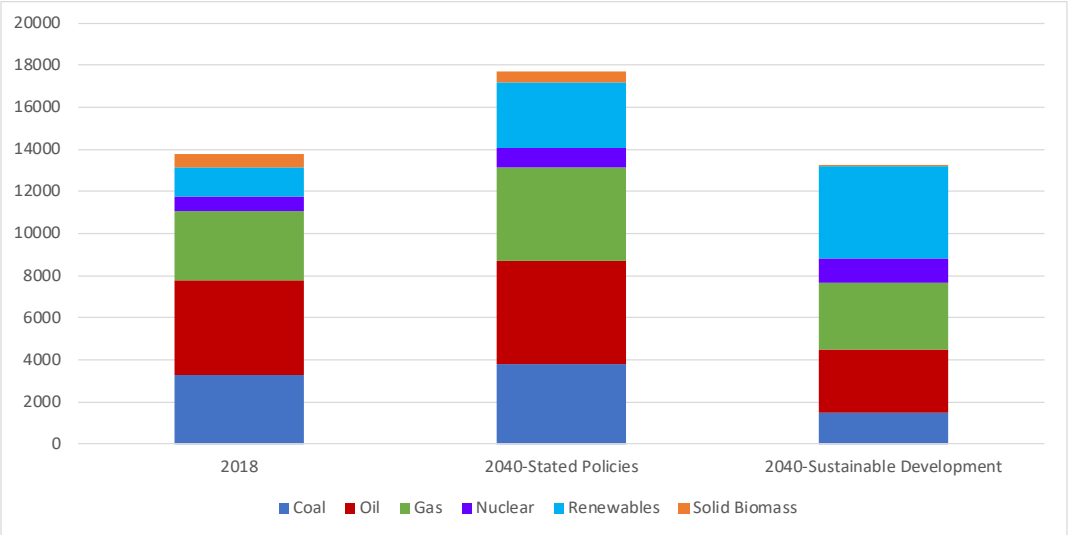
Executive summary

Fossil fuels play an important role in the budget of several governments. On the one hand, half of the countries identified as resource-rich derived 50% or more of their government revenue from fossil-fuel resources.1 On the other hand, fossil fuel consumption in road transport is an important tax base for several countries, accounting on average for 5% of fiscal revenues in OECD Countries in 2016. At the same time, considerable amounts of funds are spent to subsidise their production and consumption (around USD 340 billion in 2017) (OECD/IEA, 2019[1]).

This fiscal entanglement creates specific challenges for countries in preparing for a low-carbon future. In addition to the traditional challenges of volatility and unpredictability of resource revenues, resource-rich countries are increasingly exposed to the risk of stranded assets. While energy demand is estimated to grow under current and announced policies, to achieve the United Nations Sustainable Development objectives and the climate targets set at COP 212, a dramatic reshuffle in the world energy mix will need to take place (Figure 1) (IEA, 2019[2]). The rapid penetration of electric vehicles (cars, buses, trucks and two/three-wheelers), which the IEA projects to rise to 30% of the global fleet by 2040 in its "Stated policy scenario", leads to the need to identify alternative tax-base to fossil fuel use in transport.

Figure 1. Energy Consumption Outlook



Source: (IEA, 2019[2])

[1] . Resource-rich countries are those that raise 20% or more of government revenue from fossil-fuel resources (Figure 1.3).

[2] The Sustainable Development Scenario is constructed on the basis of limiting the temperature rise to below 1.8 °C with a 66% probability without the implied reliance on global net-negative CO2 emissions, or 1.65 °C with a 50% probability

In this context, this paper reviews the evidence on the role of fossil fuels in government budget (section 2) and the best practice for the management of resource revenues, including the role of sovereign wealth funds and strategic investment funds (section 3). Section 4 discusses the role of green tax reform in preparing the tax system for the low-carbon transition.

Key points include:

- Government support to producers of fossil fuels has decreased by around 40% between 2013 and 2017 but remains considerable (at least 22 billion in 2017).[3]
- The downward trend in fossil fuels consumption support has reversed in 2017 (USD 310 billion). This was due to the introduction of measures to shield domestic consumers from higher oil prices.
- The low-carbon transition, in combination with technological advancements in fossil fuel extraction, is likely to generate long-term downward pressure on fossil fuel demand and prices. Resource-rich countries would need to build productive capacity in non-resource sectors to mitigate the risk of lower oil prices.
- Well-designed strategies for sustainable economic diversification, fiscal discipline, mobilisation of private capital, and public support would be critical for fossil fuel exporting countries and regions to adapt to the low-carbon transition.
- Climate change creates investment opportunities as well as risks for sovereign wealth funds and strategic investment funds. On the one hand, sovereign wealth funds in resource-rich countries are likely to have their portfolios exposed to increased climate risks. These include both *physical risk* to portfolio assets, arising from extreme weather events, and *transition risk* that can be defined as the risks of sudden asset price decreases due to the unanticipated introduction of climate policy or rapid change in consumer preferences. On the other hand, low-carbon infrastructure and development of low-carbon technology could provide attractive investment opportunities. However, support and guidance of governments is likely to be needed to lead sovereign wealth funds to assume a bigger role as low-carbon investors. At the international level, one important initiative, the One Planet SWF Working Group, provides an incipient yet promising framework for the alignment of SWFs activities with climate objectives.
- A large uptake of electric vehicles may erode the tax-base provided by fossil fuels use in transport, thus suggesting that the low-carbon transition may create fiscal challenges also for importing countries.
- Gradually increasing the taxation of negative environmental externalities would help prepare tax system to the low-carbon transition and, potentially, boost growth. In particular, well-designed distance charges would a deliver superior management

[3] . The OECD total support estimate for fossil fuels is USD 340 billion comprised of USD 22 billion in producer support, USD 310 billion in consumer support, and USD 8 billion in general services support. The last category of support covers measures that benefit "producers or consumers collectively, and those that do not increase current production or consumption of fossil fuels but that may do so in the future. Examples of such measures would include public support for industry-specific infrastructure development, such as public support for the construction of coal or natural-gas terminals, and government funding for sector-wide R&D in relation to fossil-fuel exploration and transformation" (OECD, 2015[80]) .

of most of externalities costs of driving while preparing the tax system for the electrification of vehicle fleet, indicating that there can be synergies between fiscal and climate policies instead of apparent trade-offs.

The review also highlights numerous research gaps, including:

- Lack of sufficiently detailed fossil-fuel resource revenue data makes it difficult to estimate how reliant jurisdictions are on the fossil-fuel industry and therefore their exposure to risk.
- Countries would not only benefit from reporting detailed fossil-fuel resource revenue data and but also from tracking the budgetary cost of their tax incentives and other support measures.
- Further analysis on the distributional implications of broader diffusion of distance charges, and how to mitigate any adverse impacts, would be an important avenue of further research.
- The technology for a large uptake of distance charges (i.e. on-board device to monitor time and distance of travel in a manner similar to existing GPS technologies) seems to be available but may raise privacy concerns. Further analysis on the implications for privacy, and whether existing best practise to manage sensitive data could be adapted to this context may be an interesting venue of research.
- The fiscal consequences of electrification of transport have been analysed in detail for a very limited set of countries.

1. The role of fossil fuels in government budgets

Fossil fuels as a source of government revenues in resource-rich countries

Fossil fuels are a major source of wealth for countries with large domestic endowments. Rents from the exploitation of these resources can amount to 25% of GDP in some resource-rich countries and the government revenues collected can represent a substantial share of total government revenues that in turn can be deployed to create transformative economic opportunities for the host country (OECD/The World Bank/UN Environment, 2018[3]).[4] Governments thus must design fiscal regimes for the fossil-fuel sector to generate revenue streams that adequately help them meet their economic, social and environmental objectives.

The fossil fuel sector combines several characterising features that set it apart from other industries. The sector derives value from an exhaustible asset that delivers above normal returns for investors (in excess of the minimum returns required by investors) and at the same time is subject to various sources of uncertainty, price volatility and various demand and supply-side shocks. Projects in the sector face large sunk costs before production comes online and investors start earning profits. This implies that investment is irreversible and undertaken in a very uncertain environment. The economic weight of the sector for some countries can also have important macroeconomic and intergenerational equity implications. Countries that heavily rely on the resource sector to generate revenue and added value for their economies must accumulate large savings to smooth their income streams. Sound management of the resource endowment is therefore instrumental to how a country performs in the face of short-term business cycle fluctuations and longer-term structural developments in the energy market and the global economy.

The design of a fiscal regime must therefore balance different government objectives. Among these objectives is the need to generate revenue, maximise the net present value of the project, ensure adequate incentives for investment, manage the associated risk while minimising the administrative burden of the scheme. At the same time, the fiscal regime needs to ensure that a government is adequately compensated for the depletion of a non-renewable, the environmental damage and the decommissioning and rehabilitation costs; therein lies the difficulty in determining the "reasonable" compensation.

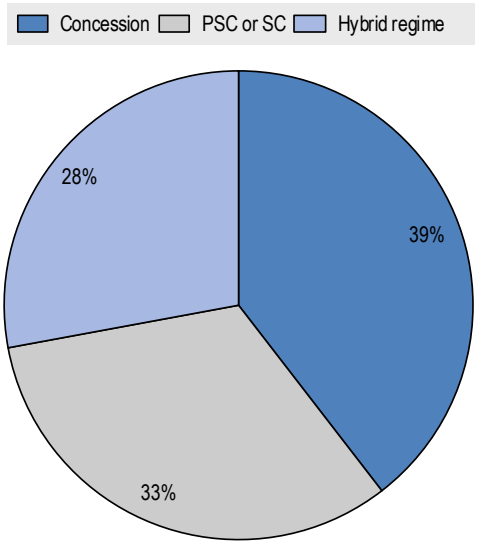
There exist two types of fiscal regimes through which resource-rich countries collect revenue: contractual schemes (i.e. production sharing or service contracts) and concession-based schemes (taxes and royalties). Under a production-sharing contract, the national oil company or the government enters into a direct contract with the private company, whereby the agreement stipulates the amount of production volume that allows the company to recover its costs and which is shared between the company and the government. As they are discretionary by nature, the terms can change from one project to another. In the case of a service contract, the company carries out the exploration and production and then receives a pre-determined fee to cover it costs and ensure a profit margin. The government in this case retains full ownership of both the underground resource and the production volumes. The concession-based regime, on the other hand, extends the right to the company to explore and produce in the concession area and

[4]. According to the World Bank Wealth Accounting, fossil-fuel rents (oil, gas, and coal) are the difference between the value of the fossil-fuel production at world prices and their total cost of production.

grants it ownership of all the oil and gas produced. In return, the government levies profit-based taxes or royalties or both.

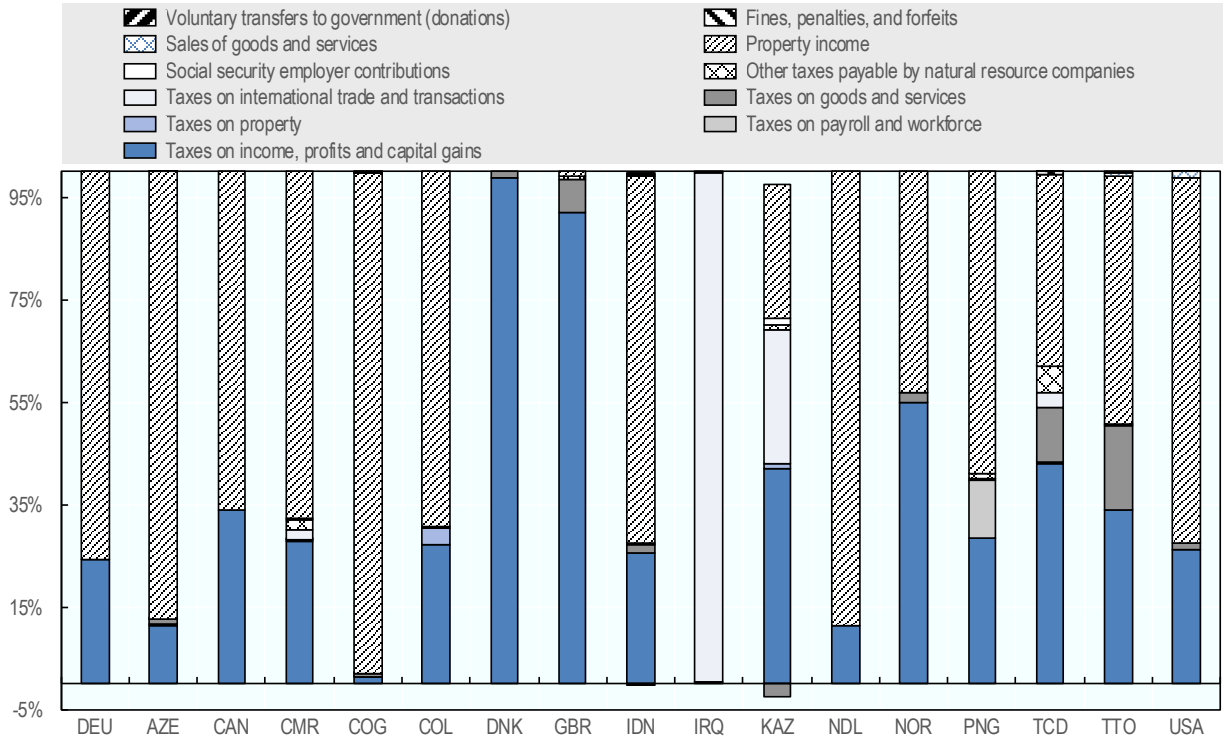
The two regimes are equally frequent in fossil-fuel producing countries and in some countries they are implemented jointly, thus allowing for a hybrid regime (Figure 1.1). Several factors play a role in shaping the design of a fiscal regime in a resource-rich country: the abundance and concentration of the resource, expected resources prices, the prevailing tax system and wider institutional environmental, and number of projects, among others (IMF, 2003[4]) (IMF, 2012[5]). Most European and North American jurisdictions apply concession-based fiscal schemes, with some countries completely phasing out the use of royalties and opting out for resource-rent taxes, such as Norway and the United Kingdom (table 1, appendix). In resource-rich developing countries, the historical importance of sovereignty over resources gave preference to more contract-based designs, whereby the host country retains ownership of the underground resource. While the two broad fiscal schemes are seemingly different, they can be designed to deliver similar outcomes for the host government and the company.

Figure 1.1. Fiscal regimes in fossil-fuel -producing countries 2018



Note: PSC denotes production-sharing contracts and SC denotes service contracts. Hybrid regime refers to an application of both concession-based and production-sharing or service contracts.
Source: Author's elaboration based on information from (EY, 2018[6]).

Figure 1.2. Revenue sources by fiscal instrument in fossil fuel-rich countries (2013-17)



Note: Resource-rich countries are those that raise 20% or more of government revenue from fossil-fuel resources. The figure represents the composition of government revenue generated from different fiscal instruments between 2013 and 2017

Source: Author's elaboration based on EITI Summary Data and government revenue statistics for Canada, Denmark, the Netherlands, and the USA

A mix of fiscal instruments is used in the design of fiscal regimes (Table 2, appendix**).**[5] Revenue either from a contract-based or concession-based scheme can be generated from taxes levied on a firm's profitable endeavours and revenue raised from ownership, quasi-corporate functions, or through services (EITI, 2017[7]).[6] More specifically, taxes are often collected from company profits, rents, the sale of goods and services, and export revenues; fees and royalties are charged either on production volumes or their market value.[7]

Each instrument leads to behavioural responses throughout the life cycle of the project, affecting exploration and development efforts, production trajectories, and government take. For example, OECD countries like the United Kingdom and Norway have moved away from a royalty-based regime to one based on a pure resource-rent tax as the latter is considered to be the least distortive vis-à-vis the investors' investment decisions and one that maximises the rents earned from the project. However, since a resource-rent tax can only be levied on profits, the

[5] . See (IMF, 2012[5]) for a fuller discussion on the effects of fiscal instruments on exploration and production decisions.

[6] . Quasi-corporations are defined as

[7]. A typology of fiscal instruments was developed by the Extractive Industries Transparency Initiative (EITI) in accordance with the IMF Government Finance Statistics (GFS) framework.

government is not protected against downside risk because it would only start receiving revenue once the project becomes profitable. For countries that need revenue upfront, royalties would be preferable as they ensure a revenue stream as soon as production comes online and are also useful in slowing down the depletion of the resource.[8] As shown in Figure 1.2, countries do combine different fiscal instruments, at times levying both royalties and resource rent taxes.

Global data on revenue sources from energy extractive industries have yet to be harmonised to deliver wide global coverage and internationally comparable information for the sector. Preliminary results suggest that resource-rich countries derive most of their revenue from taxes on income, profits and capital gains, property income such as royalties, dividends (from a state-owned enterprise), bonuses, and land sales, and monopoly profits from exports (Figure 1.2).[9] In European countries like Denmark and the United Kingdom, most revenue is generated from taxes levied on corporate income and rents.[10] Countries where state ownership and participation is important, as in the case of the Netherlands and Norway, obtain a large share of revenue from dividend payments and withdrawals from income of state-owned enterprises in the sector. North American jurisdictions, on the other hand, widely use royalties levied on the value or volume of production for revenue generation. For many resource-rich developing countries, the role of the state remains central in the sector and therefore the revenue raised in large part emanates from production sharing or the service contracts established between the host governments and the private company, and profits from state-owned enterprises.

Fossil-fuel dependent countries are exposed to large fluctuations in their government revenue streams. Half of the countries identified as resource-rich in the sample derived 50% or more of their government revenue from fossil-fuel resources between 2010 and 2014 (Figure 1.3).[11] Given that in many countries the revenue base is directly or indirectly linked to the market value of the resource, government revenues tend to largely fluctuate with changes in the resource prices. The scale of the sector for some countries and even regions within otherwise well-diversified countries has important macroeconomic and structural implications for both the domestic and international economy. Following the slump in oil prices that began in 2014, total resource revenues have decreased for several resource-rich countries, in some cases the fall was as dramatic as an 80% decrease.[12] For many resource-rich countries, this translated into shrinking

[8]. While royalties do front-load revenue payments, they can deter marginal projects and shorten production life of viable projects.

[9]. Monopoly profits from exports are categorised under taxes on international trade and transactions in the IMF Government Finance Statistics (GSF) Framework.

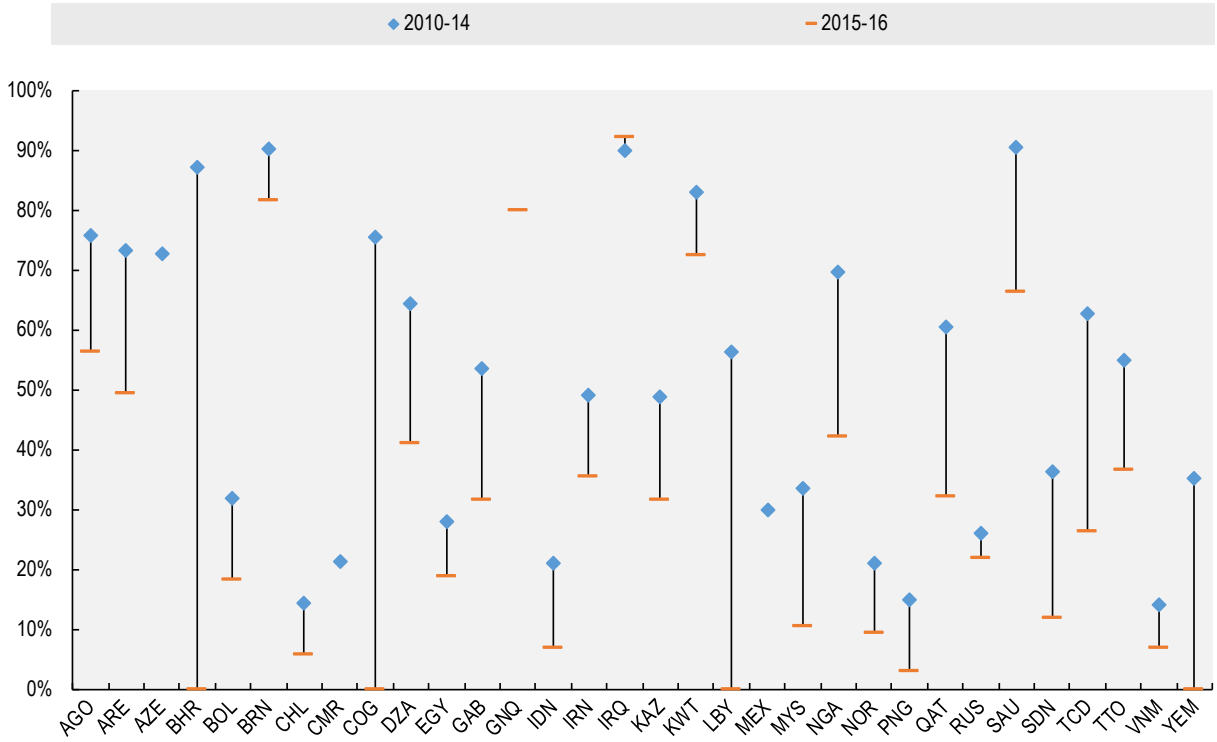
[10]. The distinction between corporate income tax and rent tax levies goes back to the relevant tax base for each tax. In these countries, the tax bases can differ according to the cost deductions and allowances covered. Also, rent taxes are applied once the project returns reach a certain hurdle rate of return, thus capturing part of the "excess" returns generated by the project.

[11]. Data on resource revenues is compiled from different data repositories (OECD Revenue Statistics and Latin American Tax Statistics, the IMF Government Finance Statistics (GFS) and Article IV Staff Reports and the Economic Commission for Latin American and Caribbean (CEPALSTAT) Revenue Statistics in Latin America). These datasets are merged under a single framework to provide a harmonised data set of government revenue with specific allocation of revenues to resources revenue by the International Centre for Tax and Development (ICTD) in its Government Revenue Data (GRD).

[12]. Other factors besides oil prices can affect government revenues, particularly geopolitical instability and other sources of uncertainty can deter investment and thus revenues from the sector.

current account surpluses or widening deficits, and domestic policy reforms focused on paring government spending and increasing taxes.

Figure 1.3. Government revenue from fossil-fuel resources decreased in most countries after the commodity price shock in 2014.



Note: Countries included in this graph are those for which fossil-fuel resource revenue represents 20% or more of total government revenue.
Source: Author's elaboration based on (ICTD/UNU-WIDER, 2018[8]).

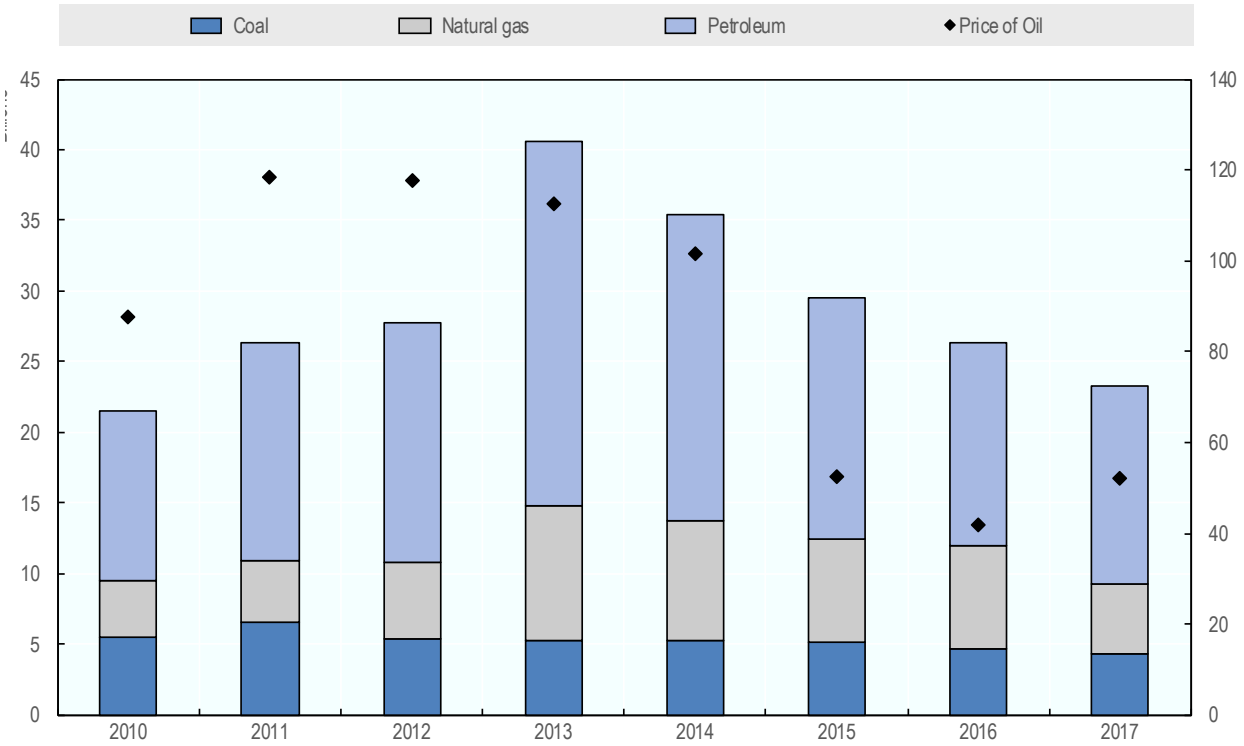
Governments use fiscal resources to support fossil-fuel extractive industries

Countries use tax incentives and other forms of government support, such us cheap capital or direct budgetary transfers, to attract domestic and foreign investment. Investments in the fossil fuel sector have the potential to be important drivers for economic growth, but when not managed properly, they can fail to deliver the desired outcomes and instead cause economic, social and environmental harm. Government support, such as tax incentives, to the sector can be designed to effectively and efficiently deliver benefits to its economy, but it can erode a government's ability to generate the requisite revenue to fund other public services and investments. Government support can also be distortive as it may tilt the playing field towards fossil-fuel energy sources locking in carbon-intensive assets, slowing down the uptake of less carbon-intensive technologies and crowding out investments in other industries.

Government support to producers of fossil fuels has declined but considerable data gaps remain. According to the OECD *Inventory of Support Measures for Fossil Fuels,* over the period between 2010 and 2017, OECD countries and selected economies transferred at least a total of USD 230

billion either through direct budgetary transfers or tax expenditures (Figure 1.4).[13] Estimates of support show a steady downward trend since 2013, in part due to the fall in oil prices. However, less than half of tax expenditure measures in the *Inventory* have not been quantified, due to a lack of government reported estimates, therefore current estimates for producer support provide only a lower bound estimate of support and may overemphasise the decrease in support over the recent years. Additionally, the *Inventory* has yet to report government support in some of the larger oil and gas exporting countries such as OPEC member countries, thus leaving a large knowledge gap in this area.

Figure 1.4. Total producer support in OECD and eight select economics has been steadily decreasing (in 2017 USD)



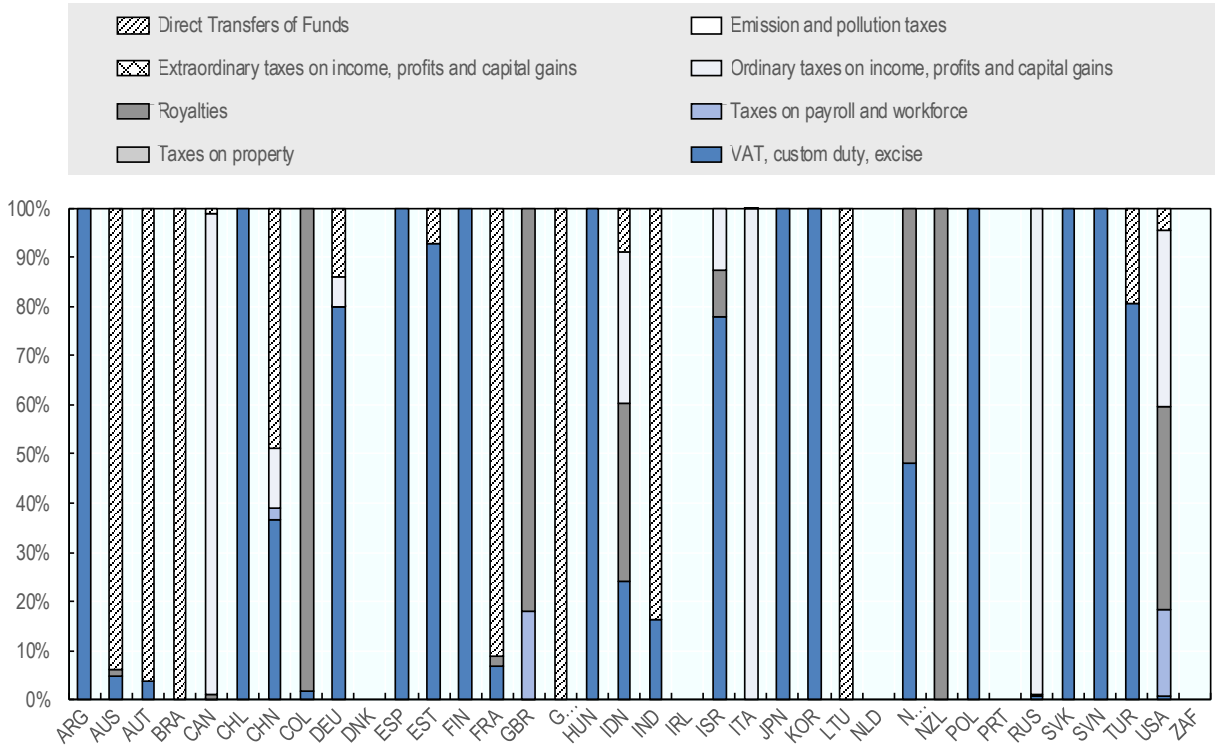
Note: Government transfers to fossil-fuel producers are express in billions on the left axis at constant 2017 USD. The price of oil is based on the IEA's average import cost of crude oil on the right axis.
Source: Author's elaboration based on the OECD Inventory of Support Measures for Fossil Fuels database (OECD, 2019[9]).

Available data suggest that governments deliver most producer support through the tax code. The bulk of government support documented in the *Inventory* is delivered through tax relief that reduces or defers the tax liability for firms in the sector. Tax expenditures, measured as the revenue forgone against countries' select benchmark tax system, represent 40% of the total value of support and to the largest extent come in the form of tax allowances, credits, and accelerated depreciation schemes and tax relief on inputs, customs duties, and VAT. Direct budgetary transfers are a second source of support, representing 30% of the total value, and they are granted

[13] . The OECD *Inventory of Support Measures for Fossil Fuels* takes stock of government support for producers (and consumers) of fossil fuels in its member states and eight emerging economies: Argentina, Brazil, People's Republic of China, Colombia, India, Indonesia, the Russian Federation, and South Africa.

to boost investment in the sector, compensate producers for their environmental and decommissioning programmes, and encourage research and development in fossil-fuel-based technologies (Figure 1.5). Revenue foregone due to reductions in or exemptions from royalties follows in third position, totalling 20% of the estimated total value.

Figure 1.5. Government support to fossil-fuel producers is largely delivered through direct spending programmes and reductions in corporate income tax liabilities.

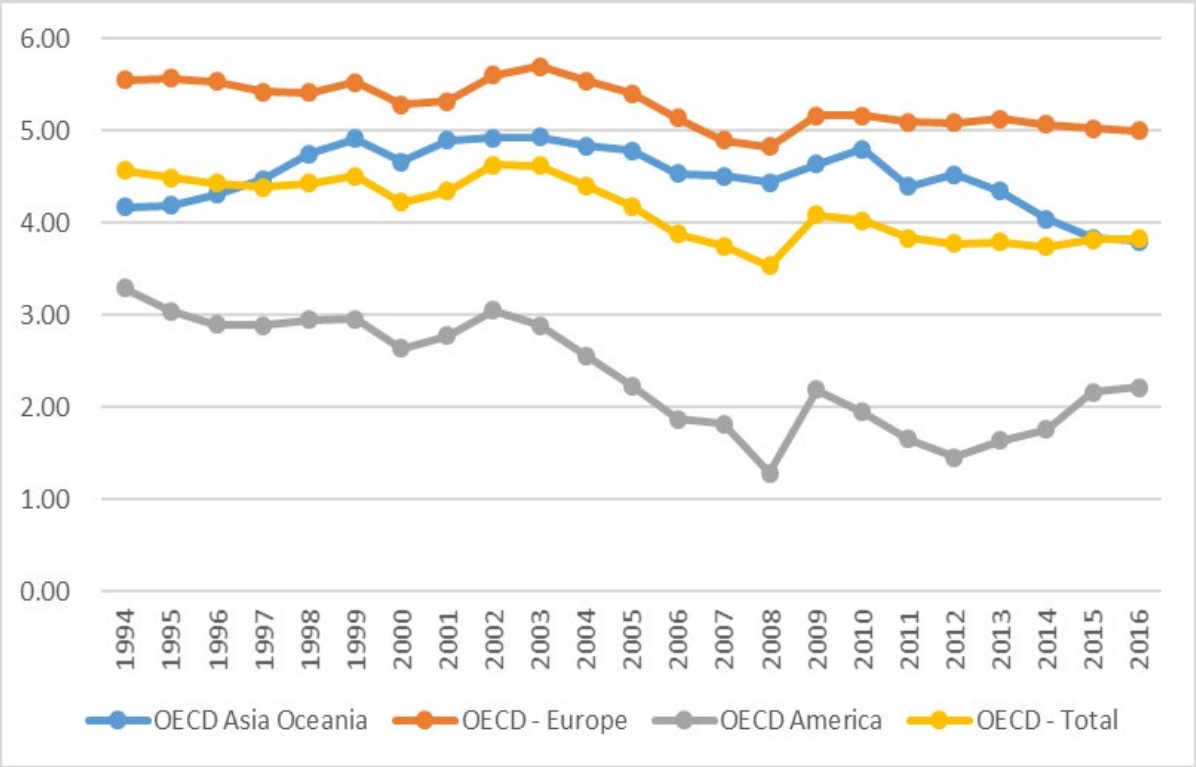


Note: Government support provided to fossil-fuel producers is classified according the fiscal instrument to which it is applied. Countries with missing data are still reported in this figure as they do provide support to the sector but do not quantify its fiscal cost.
Source: Author's elaboration based on the OECD Inventory of Support Measures for Fossil Fuels.

Fossil fuel consumption as a tax-base

Taxes on fossil fuel consumption accounted on average for 5.3% of fiscal revenues in OECD Countries in 2016. While total revenues from energy taxes have been increasing, their share in the total tax revenues is declining across most OECD countries (Figure 1.6).

Figure 1.6. Energy related taxes as percent of total tax revenues

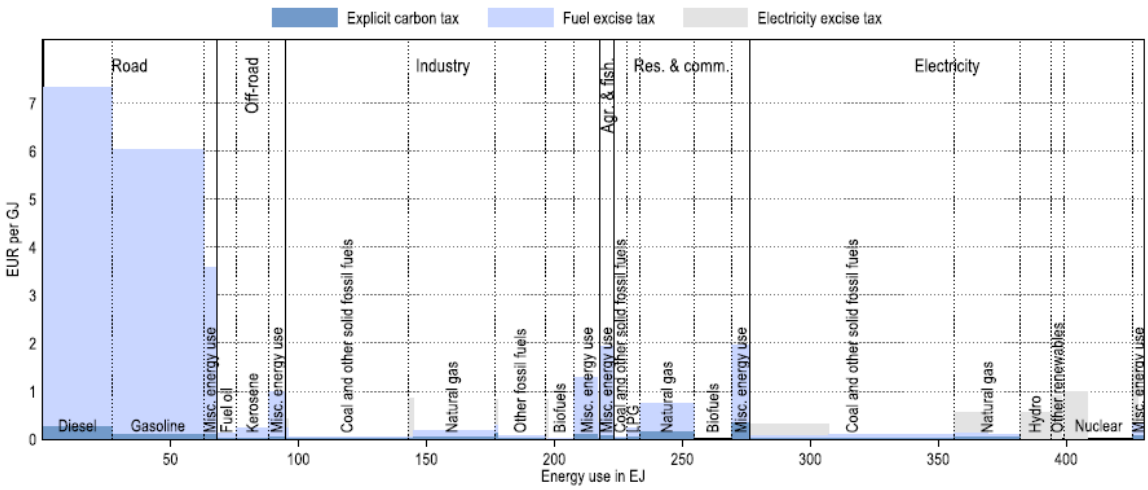


Source: OECD Statistics

Use of fossil fuels in road transport accounts for the bulk of fossil fuels tax revenues. This is due to the fact that, except for road transport, most of fossil fuel energy uses are either untaxed or taxed at low rates. International aviation and sea transport are not taxed. Off-road transport (including agricultural transport) is usually taxed at lower rates (Figure 1.7).

Figure 1.7. Effective energy tax rates across sectors

Average by sector, energy category and end-use energy (electricity or other).



Note: Tax rates applicable on 1 July 2018. The energy use is for 2016 and adapted from IEA (2018[1]), World Energy Statistics and Balances. The energy base includes all 44 countries as well as energy use in international transport. The energy base does not include electricity and heating imports to avoid double-counting. The figure groups energy categories that represent less than 1% of the horizontal axis into "miscellaneous energy use".
Source: (OECD, 2019[10]).

Box 1.1. Why the consumption of fossil fuels is a good tax base?

The relatively low own price elasticity of demand for energy use is one of the reasons that led countries to rely on this tax base. The own price-elasticity is measured by the extent to which a percentage increase in the price of a good leads to percentage decrease in the demand for it. For example, a price-elasticity of -0.3 means that an increase of 6% in the price of a good would lead to a drop of 2% in demand. Most of studies on the price elasticity of fossil fuels focus on gasoline or transport related fuel, but a meta-analysis of studies on price elasticity of all important energy products[14] find an average elasticity between −0.77, and −0.19 in the long term and -0.29 and –0.02 in the short-term. (Labandeira, Labeaga and López-Otero, 2017[11]).

Importantly, current taxation of fossil fuels in most cases is well-below the social cost of carbon emissions. The carbon price gap, defined as the difference between the sum of current taxes on fossil fuel consumption (e.g. specific taxes on fossil fuels, carbon taxes and prices of tradable emission permits) and its estimated climate costs[15,] is at 76.5% across all combustion of energy in 44 OECD and G20 countries[16] (OECD, 2018[12]). Reflecting the very limited taxation of energy use in industry, in the residential and commercial sector, the carbon pricing gap is highest for industry (91%), decreasing to 80% in the electricity and the residential and commercial sectors,

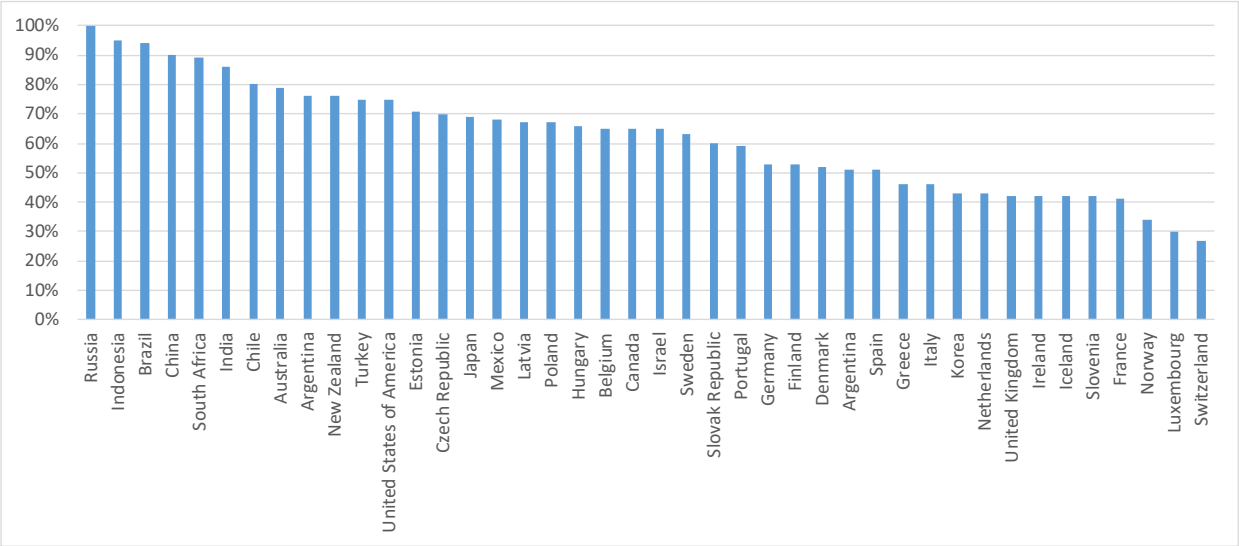
[14] Electricity, natural gas, gasoline, diesel and heating oil

[15] estimated at EUR 30 per tonne of CO2

[16] Benchmark EUR 30 per ton of CO_2 low end estimate for carbon price today and EUR 60 per ton of CO_2 a midpoint estimate for carbon price by 2020-2030

and to 21% for road transport (Figure 1.8). Recent data show that the carbon pricing gap has been reducing but at a very slow rate.

Figure 1.8. Carbon pricing gap at EUR 30 (2015)



Source: (OECD, 2018[12]).

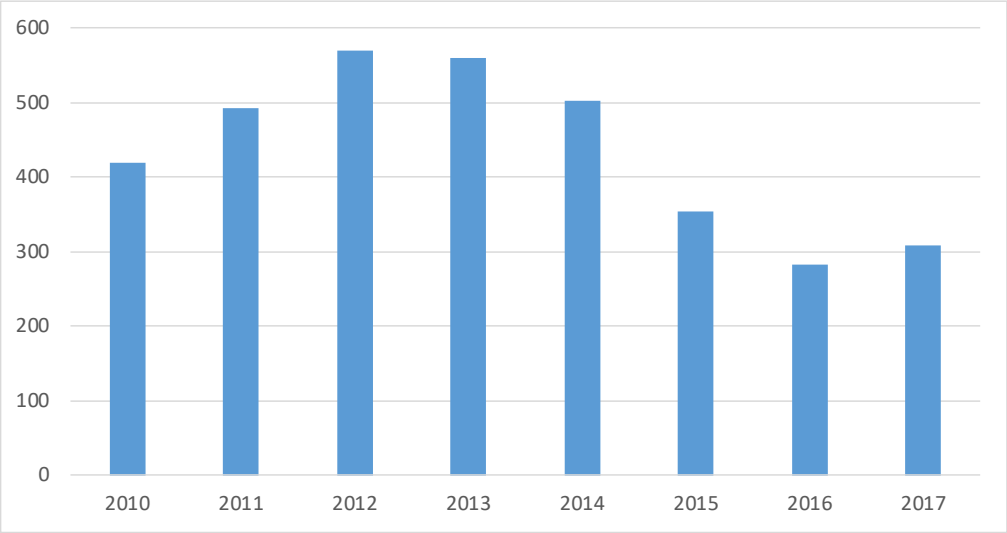
Considerable funds are used to support fossil fuel consumption

In addition to taxing fossil fuels consumption well below its social cost, governments strongly subsidise their consumption. Consumer support represents 80% of the total support for fossil fuels industries (or USD 110 billion in 2017). This is particularly concerning since untargeted fossil fuel subsidies are widely considered to be economically inefficient, to aggravate local pollution, drain fiscal resources that could be invested in, e.g., education and infrastructure, and undermine efforts to tackle the climate crisis. In addition, they are often regressive benefitting richer households proportionally more than lower-income consumers (Arze del Granado, Coady and Gillingham, 2010[13]).

Combined IEA-OECD estimates show that the downward trend in fossil fuels consumption support has reversed in 2017.[17] After several years of a decreasing trend, subsidies to consumption have increased by 11% in 2017 (Figure 1.9). This was mainly due to an increase in oil price that led governments regulating end-user price to increase spending to maintain domestic prices constant in order to shield consumers from price spikes. The previous downward trend was driven in part by a reduction of international oil prices and, in part, by the ambitious reforms introduced by several countries, including China, India, Indonesia, and Mexico and several MENA region countries (OECD and IEA, 2019[14]).

[17] The OECD partner countries include: Argentina, Brazil, China, Colombia, India, Indonesia, Russia, and South Africa

Figure 1.9. IEA-OECD combined estimate of support for fossil fuel consumption



Note: Support to fossil fuel consumption include direct budgetary transfers and tax expenditure that provide a benefit or preference for fossil fuel consumption and induced transfers resulting from government price controls below reference prices.
Source: OECD-IEA combined estimate of fossil fuel subsidies.

Main takeaways:

1. Governments deploy a mix of instruments to raise revenue from the extractive fossil fuel sector, with different degrees of complementarity and risk-sharing opportunities. There is a stark difference between the design of fiscal regimes between Northern European countries, North American countries, and developing economies. Several reasons can explain the design choice, but one of the main reasons remains whether the ownership of and sovereignty over the national resource is a priority.
2. As momentum strengthens for climate change policy and structural reform, resource-rich countries face severe risks in their fiscal systems. Policy prescriptions often point to diversifying resource-dependent economies and revenue systems when planning for a potential decline in the fossil-fuel industries. Recent studies show that efforts to diversify away from fossil-fuel revenues have fallen short in MENA oil exporting countries despite increase pressure to do so due to changing market dynamics (Mazarei, 2019[15]) and have increased the vulnerability of coal-dependent regions (Morris, Kaufman and Doshi, 2019[16]).
3. Governments should design fiscal regimes for the fossil-fuel sector that can generate revenue streams, which adequately help them meet their economic, social and environmental objectives. Sound management of the resource endowment is therefore instrumental to how a country performs in the face of short-term business cycle fluctuations and longer-term structural developments in the energy market and the global economy. Strategies to leverage their resource wealth to the benefit of the current and future well-being of their population will be decisive for how they will weather the global transition to a low-carbon economy. Section 3.

4. The downward trend in fossil fuels consumption support has reversed in 2017. This was due to the introduction of measures to shield domestic consumers from the higher oil prices recorded in the last year.

Knowledge gaps:

1. One key step towards making progress is to develop and publish detailed budget data that reveal the extent of dependency on the fossil-fuel resource. Lack of sufficiently detailed data makes it difficult to parse out just how reliant jurisdictions are on the fossil-fuel industry and therefore their exposure to risk. Thus far, resource-revenue data is dispersed among several data repositories with differing levels of granularity. International revenue data is regularly collected by the OECD Revenue Statistics and Latin American Tax Statistics, the IMF Government Finance Statistics (GFS) and Article IV Staff Reports and the Economic Commission for Latin American and Caribbean (CEPALSTAT) Revenue Statistics in Latin America. [18] Under these frameworks, seldom are resource-sourced revenues reported separately. The EITI aims to fill this gap by applying the IMF GFS framework for reporting revenues from extractive industries. Though several resource-rich developing countries are signatories to this initiative, global coverage remains sparse.
2. The lack of revenue data thus presents a challenge for assessing the extent to which fiscal conditions would deteriorate in a transition to a low-emissions future and deriving policy recommendations to mitigate the adverse consequences, particularly for the communities reliant on the economic activity brought about by their region's resource endowments. These distributional aspects of the transition must be considered alongside policies and investment efforts that can limit the economic and social impacts of a dwindling fossil-fuel industry.
3. Countries would not only benefit from reporting detailed revenue data and but also from tracking the cost of their tax incentives and other support measures. More guidance is needed to pin down the reference tax system against which to measure the cost and effects of government support to the sector given its specific characteristics. Countries should regularly evaluate the cost-effectiveness (i.e. to what extent the objectives of the measure are achieved at a low social cost) and the effectiveness of such support policies (i.e. whether the objective of the measure is achieved and the project would not have happened without it). Already a guidance note has been produced by the OECD and the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF) to inform countries' decisions when granting tax incentives in the mining sector (IMF et al., 2015[17]) (IGF and OECD, 2018[18]). While these guidelines are a good starting point and can be mapped in large part to the hydrocarbons sector, a more comprehensive toolkit that encompasses a wider scope of government support to the fossil-fuel sector and that also embeds sustainable development considerations remains to be developed.

[18] The International Centre for Tax and Development (ICTD) Government Revenue Data (GRD) is another initiative that aims to meet the needs of researcher by providing a harmonised dataset combining different revenue statistics databased.

2. Managing fossil fuels extraction revenues

Introduction

Resource-rich countries face the challenge of managing oil, gas, and mineral revenues that are volatile, finite, and uncertain. In the short term, these countries need to protect their budgets from fluctuations in the price of oil, gas, and minerals. In the long term, they need to decide how much of resource revenues to invest or consume at home, and how much to save abroad for future generations. To manage these challenges, resource-rich countries have sought to adopt fiscal policies that take account of the volatility and uncertainty of resource revenues, of intergenerational equity, and of the broader political economy challenges that are frequently associated with natural resource dependency. The actions include the establishment of fiscal frameworks and practices that seek to enhance countercyclical fiscal policy and foment resource-based economic development, and the establishment of stabilisation funds and sovereign wealth funds (SWFs) to foment inter-generational saving, as well as fiscal and macroeconomic stability (OECD, 2019[19]).

In addition to the traditional challenges of volatility and unpredictability of resource revenues, resource-rich countries are increasingly exposed to the risk of a fall in global demand for fossil fuel. Solano-Rodriguez et al. (2019[20]) find that stringent global climate action could reduce fiscal revenues from oil to $1.3-2.6 trillion in Latin America and the Caribbean, down from $2.7 -6.8 trillion if oil reserves were strongly exploited. McGlade and Ekins (2015[21]) estimate that a third of oil reserves, half of gas reserves, and more than 80% of known coal reserves would need to be left unused if we are to meet the Paris 2 degree target. The combination of this decline in demand, and supply side changes in energy markets (including fracking in the oil sector), makes it likely that prices for hydrocarbons will stay low (Venables, 2016[22]), and could well continue falling (BNP Paribas, 2019[23]). The result could be a very significant decline in the fiscal revenues of fossil fuel exporters.

The impact of rapid technology development in the clean-energy sectors could make oil reserves economically non-viable earlier than expected. According to a recent study published by BNP Paribas, it is already far less expensive to produce energy for car and heavy vehicle transport from solar and wind than from oil (BNP Paribas, 2019[23]). According to the report, it is mainly a question of scaling renewable energy supply capacity before all except the lowest-cost oil reserves become economically non-viable.

Although the global speed of adjustment to climate change is uncertain, climate change is likely to affect developing resource-rich countries severely. Many resource-rich developing countries have high physical exposure to the effects of climate change, but very limited capacity to mitigate these effects. If the transition happens slowly, and climate change is not mitigated, increased frequency and severity of weather events is therefore likely to affect developing countries disproportionately. However, if there is a fast transition away from fossil fuels, then oil-exporting developing countries could see a precipitous fall in their fiscal revenues. Unless there are major breakthroughs in carbon capture technology the reduction in fiscal revenue will be permanent (Manley, Cust and Cecchinato, 2017[24]). Either way, whether the low carbon transition happens slowly or rapidly, resource-rich developing countries need to prepare for the fiscal implications of climate change.

Resource-rich countries' success with transitioning to a low-carbon economy will depend on their ability to diversify their economies and build productive capacity in other sectors.

Countries rich in oil, gas, and coal should manage their resource revenues to build productive capacity in non-resource sectors. Some countries that are currently fossil fuel exporters may be able to become significant exporters of renewable energy, thereby replacing fossil fuel as a source of fiscal revenue. Countries that let oil and other fossil fuels remain the mainstay of their economy for too long face the risk of an abrupt and precipitous decline in fiscal revenue, and a reduction in economic growth. In other words, for fossil fuel exporters, economic diversification is more important than ever before (Manley, Cust and Cecchinato, 2017[24]). To be sustainable, this diversification must take place in a way that is consistent with a low-carbon economy.

To be able to diversify successfully and in a sustainable way, resource-rich countries need to mobilise private capital in addition to their own public investment. In the infrastructure sectors, global needs compatible with low-carbon and climate resilient development amount to USD 7 trillion per year for the next 15 years, of which USD 3.9 trillion in developing countries. The investment gap for developing countries, or difference with the current level of around USD 1.4 trillion, is estimated at USD 2.5 trillion per year (UNCTAD, 2014[25]).Much of this investment will need to come from private sources.

When adjusting to a low-carbon economy, resource-rich countries need to protect the value of their SWF portfolios from climate risk, and invest in way that contribute to fulfilling their nationally determined contributions[19]. To protect SWF portfolios from climate-related risk, including physical risk and transition risk, countries will need to build the capacity to understand and act on this type of risk. By aligning their activities with low-carbon objectives, SWFs can also become important instruments to achieve the low-carbon transition - while remaining independent and commercial investors. Similarly, strategic investment funds (SIFs), described in further detail below, can support the de-carbonisation of their domestic economies.

This section first considers countries' previous experience with investing resource revenues and diversifying their economies: why have so few resource-rich countries diversified successfully? Secondly, it discusses the fiscal management of resource revenues. Next, the use of resource revenues to mobilise private capital, and the role of strategic investment funds (SIFs) in supporting such mobilisation is considered. Finally, the section discusses how climate change affects the risk exposure of SWFs, and how these funds can contribute to accelerating the low-carbon transition.

The challenges of investing resource revenues productively

The high volatility and uncertainty of resource revenues are challenging to manage. So is Dutch disease, the tendency of resource export revenues to put upward pressure on prices in non-tradables sectors such as construction. The resulting appreciation of the exchange rate reduces the competitiveness of the non-resource export sectors.

The management of expectations is another important challenge. Citizens' expectations of immediate wealth have generated pressures on governments to spend rather than invest these revenues. The idea of resource abundance has also affected resource-rich countries' ability to mobilise non-resource taxes. On average, the share of tax revenue in GDP is 0.2 percent lower for each percent of GDP that the government earns from resource exports (Bornhorst, Gupta and Thornton, 2009[26]). On the other hand, countries with the ability to create a strong narrative of

[19] The Paris Agreement requires each country to prepare, communicate and maintain successive nationally determined contributions (NDCs), which reflect the planned actions to mitigate CO2 emissions

what can (and cannot) be done with resources have found such citizen expectations to be self-fulfilling. Examples are Botswana and Malaysia (Venables, 2016[22]).

Furthermore, resource revenues can make it difficult to maintain fiscal discipline, as political factions, ministries, or regional authorities compete for a share of these revenues (Tornell and Lane, 1999[27])**).** The result is that governments may not allocate revenues to their most efficient use, but rather to the most influential faction. Governments may seek to buy support, for example by increasing public sector employment, or public sector salaries, beyond sustainable levels (Robinson, James, Ragnar Torvik, 2005[28]) (Robinson, James A., 2005[29]).

Weak institutions can lead to high levels of government recurrent expenditure and in some resource-rich countries have resulted in lower rates of investment than in other countries at similar income levels (Bhattacharyya, 2014[30])Although resource-rich countries do not on average have poorer fiscal discipline than other countries, some resource-rich countries have performed poorly by most fiscal indicators (Bleaney and Halland, 2016[31]). For example, capital expenditure in Ghana declined from an average of 12 percent of GDP before oil, to 4.8 percent in 2014, after oil revenues had started flowing. This drop in public investment happened simultaneously with a large increase in recurrent government expenditure, with compensation to public sector workers increasing from 46 percent to 72 percent of tax revenue. Since oil revenues were insufficient to fund the increase in recurrent expenditure, there was during the same period a massive increase in sovereign debt (Bawumia and Halland, 2017[32])

Resource-rich countries have often invested poorly, and need to strengthen their ability to direct capital to projects that contribute to economic productivity or growth. Resource-rich countries have low scores on the IMF's index of public investment management efficiency (Dabla-Norris, Brumby, Kyobe, Mills, 2010[33]) and there have been many white elephant projects. In order to maintain wealth and build strong foundations for economic growth, resource-rich countries should have high enough levels of investment to offset the depletion of their natural resources by commensurate levels of investment in produced capital—primarily infrastructure and human capital (Hamilton, 2005[34]). If fiscal revenues from resource exports fall due to lower demand for fossil fuels, resource-rich countries will have less time to undertake the capital investments required for sustainable, long-term economic growth.

Strong fiscal management: even more important in the low-carbon transition

The traditional recommendations on the management of resource revenue volatility and fiscal discipline, remain equally relevant as resource-rich countries face the low-carbon transition. To manage highly volatile, insecure, and finite resource revenues, countries need stabilisation mechanisms to prevent volatility being transmitted to the government budget and expenditure. To this end, many resource-rich countries have established policies for short-run stabilisation, including stabilisation funds (OECD, 2019[19])Economic diversification can also help reduce macroeconomic volatility, since it reduces a country's exposure to sector-specific external shocks (Giri, Quayyum and Yin, n.d.[35]) (Haddad, Mona, Jamus Lim, Cosimo Pancaro, 2013[36])

Fiscal discipline is particularly relevant as countries need to channel capital into diversification, and adapt to climate change in the face of dwindling resource revenues. This includes the control of recurrent spending and of fiscal risks, and the implementation of strong public investment management frameworks. Institutional mechanisms that countries have used to help fiscal management include medium-term fiscal frameworks, fiscal rules, and fiscal

councils.[20] However, the formal adoption of fiscal frameworks and rules has frequently been insufficient to maintain fiscal discipline (Villafuerte, Mauricio, Rolando Ossowski, 2008[37]) unless there is also a broad based political commitment to such discipline (Sharma, N., 2013[38]) (Bawumia and Halland, 2017[32])).

To face the challenge of climate change, resource-rich countries need to strengthen their capacity in public investment management. This is particularly important in countries whose vulnerability to climate change is compounded by a constrained fiscal space and large investment requirements. Frequent weaknesses include capital allocation (particularly project selection and appraisal), as well as in project management and monitoring (IMF, 2019[24]). Strengthening of public investment management systems typically focuses on: a) the implementation of transparent and accountable systems for guiding, appraising, reviewing, and selecting projects that will underpin the low carbon transition and strengthen countries' resilience to climate change; and b) mechanisms and procedures to adjust, operate, and evaluate these projects (Rajaram, Anand, Tuan Minh Le, Kai Kaiser, Jay-Hyung Kim, 2015[39]).

Developing countries need a strategy that includes fiscal as well as financial elements. According to the IMF (IMF, 2019[24]), such national strategies should comprise the integration of climate risk, fiscal buffers, and climate finance into a sustainable macro-fiscal framework; and inclusion of climate investment into national budgeting procedures, as well as risk diversification across a range of different assets and financial instruments.

To reconcile long-term development and intergenerational equity objectives with the need to manage the volatility and uncertainty of exhaustible resource revenues, policy makers in resource-rich countries should consider the following actions (OECD, 2019[19]):

- Despite the vast risks that loom in the medium term, the fiscal discussion and planning in resource-rich countries is often unduly focused on the short term. Fiscal planning and annual budgets need to incorporate longer-term perspectives for a more sustainable economic outlook (Ossowski and Halland, 2016[40]) or the low-carbon transition, this outlook needs to include the likelihood of dwindling oil revenues, and the costs of diversifying away from fossil fuels and adapting to climate change.
- Adoption of a clear and consistent fiscal policy and macroeconomic management framework that counters price volatility and helps insulate the economy from price, production, or other external shocks, while smoothing public expenditure over time in the support of long-term development objectives.
- Ensuring budget stability and fiscal sustainability over time, including through the establishment, where appropriate, of properly sized stabilisation and savings funds as an integral part of the fiscal policy and macroeconomic management framework. (Van den Bremer, Thon, 2013[41]) discuss the different types of oil funds, and the relationship between them.
- Managing the trade-off between investing in the domestic economy or abroad, and saving for future generations. In order to do so, to consider: 1) the country's capital stock and level of development, and 2) whether resource revenues are long lasting or temporary with regard to the resource depletion rate.

[20] For an overview of fiscal management in resource-rich countries, see (Ossowski and Halland, 2016[40]).

Using resource revenues to mobilise private capital: Strategic Investment Funds

To finance the sustainable development goals, most countries will need to mobilise significant amounts of private capital.

To this end, they will need to continue strengthening their investment framework. This includes the general investment environment policies, and specific policy areas such as competition, trade, land-use planning, and tax.

In addition, the use of novel types of financial institutions such as green banks and strategic investment funds could be instrumental. To mobilise private capital efficiently, countries need to be able deploy a diversity of financial instruments, including equity, different types of debt instruments, and credit guarantees. Development banks, the traditional development finance institutions, focus overwhelmingly on the provision of debt. Some also offer credit guarantees and other products for risk mitigation. However, new projects need equity investment to get off the ground. Contrary to banks and other debt providers, which are largely passive financiers, equity investors frequently take an active role in the technical and financial structuring and development of new projects. If the private sector does not provide initial equity, then such equity may need to come from public sources for example in the form of cornerstone stakes or co-investments.

Strategic investment funds (SIFs) are becoming increasingly popular for governments that seek to mobilise private finance for priority sectors. This includes renewable energy infrastructure, as well as -to a lesser extent - small- and medium-sized enterprises (SMEs). SIFs invest with a "double bottom line" of commercial returns, as well as economic, social, or environmental impact. SIFs are mainly equity investors, although some also provide debt and credit guarantee schemes. Contrary to sovereign wealth funds (SWFs), state-owned funds that invest mostly abroad and in financial assets, SIFs invest mainly in real assets in the home economy.[21] At least 30 countries have established SIFs, while several others are in the process of setting up such funds.[22]

SIFs can contribute to the low-carbon transition by providing equity and other forms of investment capital to sectors and stages of the investment process where the private sector does not invest by itself (OECD, 2018[42]) To be useful as instruments of economic and climate policy, SIFs' investments should be additional to the investments that the private sector would undertake on its own, and should *crowd in* rather than *crowd out* private investment. For example, the European Marguerite Fund provides equity for the development and construction stages of infrastructure projects. Since private investors generally prefer to invest in de-risked, completed infrastructure projects that are already generating revenue, private capital is frequently not forthcoming at the development and construction stages. This lack of early-stage private capital can delay or inhibit the implementation of clean-energy and other low-carbon infrastructure projects that in the medium term have a competitive risk-adjusted rate of return.

For SIFs to be efficient instruments for low-carbon finance, they need to have a well-defined investment policy that balances commercial and policy objectives, and governance that ensures independence of investment decisions. To implement their role as policy-driven yet commercial investors, SIFs need the capacity to take investment decisions independently and on commercial terms, within their policy-defined mandate. SIFs seek this balance at different levels (Halland et al., 2016[43]).

[21] For a definition of SIFs, see (Halland et al., 2016[43]).

[22] For a list of SIFs, see (Halland et al., 2016[43]).

i) *Through the formulation of the mandate.* SIF mandates need to be targeted to the specific function that the SIF is meant to fill, and should ensure complementarity with private investment. For example, the Marguerite Fund, as discussed above, has a mandate to invest only in new "greenfield" infrastructure,[23] including the development and construction stages.

ii) *By legislation and regulation.* Some SIFs, such as the Nigeria Infrastructure Fund,[24] are established by dedicated law or act of parliament, whereas others are set up under standard company legislation or legislation for investment funds. The use of standard legislation may make it easier to ensure that the SIF's legislative foundations are sound, especially if the SIF is established in a financial centre where financial legislation is well developed. On the other hand, the establishment of special legislation for the SIF allows for greater flexibility.

iii) *At the ownership level.* Whereas some SIFs are fully publicly owned, others combine public and private capital at the level of the fund itself. An example of this is India's National Investment and Infrastructure Fund (NIIF), where the Indian government has a minority 49% investment.

iv) *At the governance level.* Well-functioning SIFs have governance structures that closely resemble those of private investment organisations, with high requirements for independence of boards and board committees, limits on government representation on boards, and a high share of independent directors recruited based on their investment and sector experience.

v) *At the management and staff level.* Well-functioning SIFs recruit their management and staff mainly from the private financial sector, based on financial sector skills and experience, as well as backgrounds in the sectors where the SIF will invest.

vi) *At the project level.* SIFs seek private sector co-financing at the level of each individual investment. A high level of private sector co-financing helps ensure that the invested project is commercially viable, and SIFs frequently act as significant minority investors.

Whereas most SIFs invest mainly in infrastructure, some SIFs focus on SMEs. For example, Norway's recently established SIF, *Nysnø*, finances firms in the clean technology sectors. Israel's Yozma has been a main contributor to the development of Israel's information technology sector. Yozma has provided a minority share of the capital for otherwise privately financed venture funds that invest in the technology sectors. Yozma has also provided capacity building for these venture funds. In the two decades following Yozma's establishement, Israel developed its venture capital (VC) sector from non-existent to having the highest VC penetration in the world as a share of gross domestic product (GDP) (Druid, 2009[44]) (OECD, Directorate for Science, n.d.[45]).

Several SIFs already invest in renewable energy infrastructure, indicating that these funds can indeed become important instruments for the low-carbon transition. This includes SIFs in high-income countries, such as the Ireland Strategic Investment Fund, as well as in low-income countries, such as Senegal's *Fonds d'Investissment Stratégique* (FONSIS).

[23] Marguerite's mandate includes brownfield expansion, new additions to existing infrastructure.

[24] The Nigeria Infrastructure Fund is one of three sub-funds managed by the Nigeria Sovereign Investment Authority.

Sovereign wealth funds (SWFs)

SWFs collectively hold assets worth about $8 trillion (Sovereign Wealth Fund Institute, 2019[46]) **and control about 8 percent of all listed equities worldwide** (Capapé, Javier, and Marta Santivañes Capapé, Javier, n.d.[47]). The sheer magnitude of SWF's capital, and their role as investors in companies across the globe, means that these investment funds are necessarily significant actors in the low-carbon transition. Many resource-rich countries have established sovereign wealth funds to protect the government budget from resource revenue volatility, and to save a share of resource revenues for future generations. Fifty-seven percent of SWFs are capitalised from natural resource revenues, with the remaining 43 percent being funded from non-commodity source such as foreign exchange and fiscal savings rules . (Javier Capapé, 2017[48])The SWFs of natural resource-rich countries will be significantly affected by the combination of increased climate risk and declining resource revenues, and could conversely also help mitigate climate change through their investments (OECD, 2019[49]).

SWFs have so far played a very limited role in climate finance. There are exceptions to this rule, and SWFs are at different stages of climate alignment. For example, Norway's Government Pension Fund Global (GPFG) – managed by Norges Bank Investment Management (NBIM) – undertakes a broad engagement with portfolio companies on climate-related issues, and the United Arab Emirates' Mubadala fund invests directly in clean energy through its fully owned subsidiary, Masdar. NBIM also operates according to an exclusion, or negative screening, policy. In accordance with this policy, certain investments are excluded from NBIM's remit, based on ethical, ESG, and climate considerations. Reflecting these criteria, as well as expectations of low financial return, NBIM has divested from mining companies that derive 30 percent or more of their revenue from thermal coal production, and power companies that derive 30 percent or more of their revenue from coal-based power production. However, in general terms SWFs' role is minimal. The share of low-carbon assets in SWFs' portfolios is by existing estimates below 1 percent, and is not systematically reported or recorded. The value of SWFs' divested high-carbon assets is about 0.04 percent of the value of total SWF assets under management (Javier Capapé, 2017[48]).

SWFs, as universal owners, hold portfolios that are exposed to climate risk in a broad range of markets and sectors. SWFs are universal owners, in the sense that they have highly diversified and long-term portfolios that are reflective of global capital markets. Although vulnerability to climate change varies considerably between geographies and sectors, climate change generates increased risk across sectors and asset classes. As universal investors, SWFs are likely to be progressively affected by these risks. The risks take three main forms (Caldecott and Harnett, n.d.[50])

i) *Physical risk* is the risk of physical damage to real assets, caused by changing precipitation patterns and increased frequency of extreme weather events such as floods, draughts, storms, and heat waves. Weather-related damage to real assets could cause portfolio companies to cease or modify operations, affecting their valuation.

ii) *Transition risk* refers to the likelihood of significant changes in asset valuations during the transition to a low-carbon economy. This includes the risk of stranded assets in high-emissions sectors. The low-carbon transition cold shift the competitive advantage of entire regions and sectors, affecting portfolios and broad financial stability (Carney, 2015[51])

iii) *Liability risk* could arise from failures to disclose and manage climate risk, and if victims of climate change seek compensation from sectors and companies that have contributed significantly to carbon emissions.

Climate change creates not only risks but also opportunities for SWFs. Climate change will create winners as well as losers, as the low-carbon transition generates investment opportunities across geographies, sectors, and asset classes. Opportunities will arise in low-carbon infrastructure, and in low-carbon technology, as indicated by the recent growth in renewable energy investment and venture finance (International Energy Agency, 2019[52]). This is likely to increase global demand for capital (Carney, 2015[51]) (Caldecott and Harnett, n.d.[50]). Companies that contribute to the low-carbon transition, or are otherwise able to position themselves in the context of a changing climate, are likely to see their valuations rise – in turn impacting SWF portfolios (Mats Andersson, Patrick Bolton, 2016[53]) (Park et al., n.d.[54]).

SWFs can engage in different ways with the low-carbon transition, either directly vis-à-vis portfolio companies or through the SWFs' asset managers. Types of engagement include: i) direct investment in low-carbon assets, ii) engagement with portfolio companies to incite and support these companies to reduce their carbon footprint, iii) inclusion of low-carbon performance objectives in the selection and monitoring of asset managers, and iv) divestment from high-carbon asset or the application of exclusion criteria for certain sectors or types of assets from the reference portfolio. Professional asset management firms manage a large share of SWF assets. If SWFs are to engage more with the low-carbon transition, it will be essential to bring the asset managers on board. This has been recognised by the One Planet SWF Working Group, which recently established the One Planet SWF Asset Manager Initiative.

It is important to ensure that SWFs' and SIF's procedures, governance, and management frameworks are aligned with the funds' sustainability objectives. These frameworks underpin SWFs' operations, including direct investment, engagement with portfolio companies and with asset managers. Several international initiatives now support investors in that regard. First, the recommendations of the Task Force on Climate-Related Disclosures (TFCD, 2017[55])represent an opportunity for SWFs and SIFs to develop and disclose their climate-related practices in the areas proposed by the TCFD: governance, strategy, risk management, and metrics and targets. Second, whereas the "greenness" and carbon intensity of an asset has until now been a matter of interpretation according to several competing standards, the EU's new classification system, or EU Taxonomy, for environmentally sustainable activities, is an attempt to provide a legislative standard, albeit voluntary. China proposed a taxonomy for green finance in 2013, and other jurisdictions have also adopted legislative standards for financial products. There is an emerging institutional dialogue on the consistency of sustainable finance definitions in various jurisdictions, with involvement of the OECD. Third, the recently established One Planet Sovereign Wealth Fund Working Group represents a framework for SWFs that wish to engage more closely with climate finance. As mentioned above, One Planet now also includes an initiative for SWFs' asset managers.

SWFs are unlikely to integrate climate considerations in their investment process unless specifically mandated to do so by their governments. Governments can encourage their SWFs by:

- Adjusting mandates to take account of climate change, while remaining on commercial terms;
- Setting broad targets for the achievement of climate objectives;
- Provide their SWFs with funding to implement changes to staffing and investment process, and
- Provide the SWF's staff and management with incentive structures that takes account of climate-related objectives, or mandate the board to design such an incentive structure.

Incentives for asset managers, as well as for the SWFs' own staff should be based on the SWFs' interests as long-term investors, rather than on short–term financial objectives as is frequently the case (Bachher, Dixon, 2016[56]) Like pension funds, SWFs have few short-term liabilities, and are therefore well placed to take advantage of the stable, inflation protected returns commonly associated with infrastructure investment. Many climate-related investment opportunities, such as clean infrastructure, are attractive above all in the long term–with risk being concentrated in the early stages.

SWFs could become essential contributors to the low-carbon transition without compromising their role as commercial investors, but this would require investments in capacity building in each of the areas discussed above. Even when it makes financial sense, the integration of climate considerations has costs. These costs includes those arising from investments in new skills, governance structures, and procedures; from the additional effort of engaging with asset managers and portfolio companies on climate-related issues; and from climate-related reporting and disclosure. To align their SWFs with climate-related objectives, governments need to allow their SWFs the budgetary space to implement reforms.

Key conclusions:

This chapter has sought to clarify the main challenges and possible approaches that resource-rich countries can consider to adapt to the low-carbon transition. Key points include:

- The low-carbon transition, in combination with "fracking" is likely to generate long-term downward pressure on fossil fuel demand and prices.
- As fossil fuel exporters seek to adapt to climate change, they need to define and implement well-founded strategies for sustainable economic diversification and low-carbon growth. These strategies should seek to take into account the experiences of other resource-rich countries that have sought to diversify in the past.
- To implement diversification strategies, and the associated investments, fiscal discipline will be critical. As will the establishment of fiscal and financial buffers to prepare for extreme weather events and long-term climate changes.
- The management of expectations will be critical for fossil fuel exporting countries to adapt to the low-carbon transition. For necessary reforms to be widely accepted and enjoy citizens' support, the citizenry needs to understand the long-term implications of successful or failed adaptation.
- To achieve sustainable, low-carbon growth, resource-rich countries need to increase their capacity to mobilize private capital. This may include measures to strengthen the legal and regulatory framework for investments, as well active measures such as the establishment of strategic investment funds.
- Countries that are able to build productive capacity in non-resource sectors may be able to transition relatively smoothly. Some countries that are currently fossil fuel exporters may be able to become significant exporters of renewable energy, thereby replacing fossil fuel as a source of fiscal revenue.
    - Countries that let oil and other fossil fuels remain the mainstay of their economy for too long face the risk of an abrupt and precipitous decline in fiscal revenue, and a reduction in economic growth.
    - There is a risk that vested interest in the fossil fuel sectors exert pressures to continue investing in these sectors beyond what can be justified in financial terms.

- Sovereign wealth funds in resource-rich countries are likely to have their portfolios exposed to increased climate risk, at the same time as revenues from fossil fuel exports dwindle. Sovereign wealth funds will need to build their capacity to mitigate such risks.
- Climate change represents investment opportunities as well as risks for sovereign wealth funds and strategic investment funds, and these funds could acquire an important role in accelerating low-carbon investments. To take advantage of these investment opportunities, sovereign wealth funds and strategic investment funds need to invest in building the capacity of their organisations, management, and staff.
- Sovereign wealth funds are on their own unlikely to assume a bigger role as low-carbon investors. For this to happen, they need the support and guidance of their governments.

Knowledge gaps:

It is not yet known how much SWFs (and other institutional investors) invest in each carbon-relevant sector, and which form these investments take – whether direct, indirect, and which type of financing is provided.

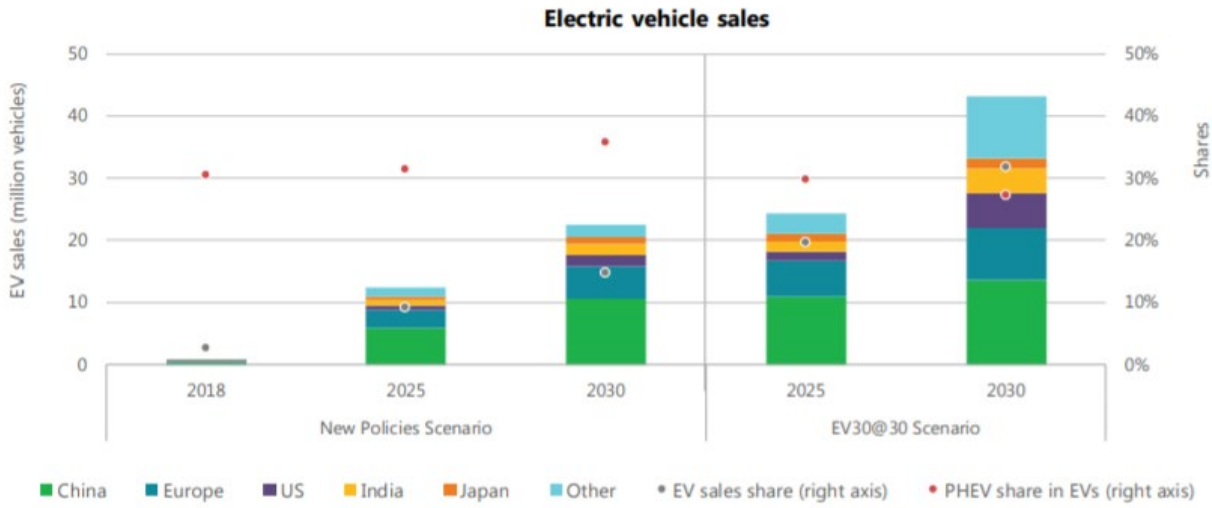
There is limited knowledge on the nature of the factors that impede SWFs from more active climate-alignment.

3. Green fiscal reforms for the road transport sector: designing tax systems for a low-carbon future

Electrification of transport and green fiscal reforms

A large uptake of electric vehicles may erode the tax-base provided by fossil fuels use in transport, thus suggesting that the low-carbon transition may create fiscal challenges also for importing countries. The IEA New Policies Scenario, which captures the consequences of announced policy ambitions to address the concern of air pollution and climate change, estimates that the share of electric light duty vehicles in new vehicle sales would increase to around 15% by 2030, excluding two/three-wheelers. A much higher penetration is estimated in the EV30@30 Scenario, which accounts for the pledges of the EVI EV30@30 Campaign (IEA, 2019[57]). In this context, it should be noted that several countries (e.g. France, India and Norway) are discussing or have announced bans on the sales of vehicles running on fossil fuels (sometimes including hybrids) starting in 2025 or in 2040 (ITF, 2019[58]).

Figure 3.1. Global share of light duty electric vehicles by scenario, 2010-50



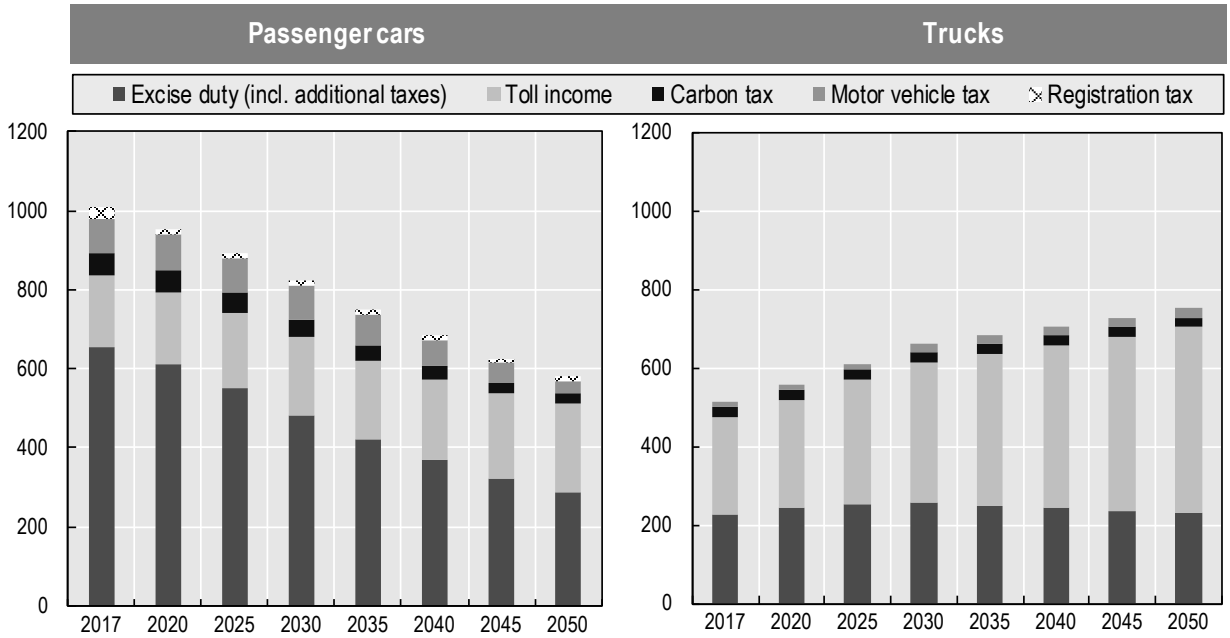
Source: (IEA, 2019[57])

The fiscal implications of decarbonising transport have been recently analysed for Slovenia. The country is particularly exposed since excise duty and carbon taxes on fossil fuels used in road transport accounted for 14.6% of total tax revenue at the central government level in 2016. The OECD/ITF (2019) examines the possible impact of the decarbonisation of road transport on tax revenue for this country by assuming that the uptake rates of alternative-fuel vehicles are in line with the International Energy Agency's 2°C scenario for Europe (IEA, 2017[59]); (OECD/ITF, 2019[60]). The 2°C scenario (2DS) is consistent with a 50% chance of limiting the average global temperature increase to 2°C by 2100 and assumes that alternative fuel technologies will account for 25% of passenger car purchases in 2030 and 62% in 2050 (compared to a 2% share in 2017). The authors note that this scenario can be interpreted as a lower bound for the penetration of alternative fuel vehicles when compared to other studies or scenarios, such as the IEA's

2017 "EV30@30" scenario that assumes that almost all new vehicle sales (96%) would be electric by 2050. The differences in behavioural responses of people using personal cars and commercial vehicles are considered.

The modelling exercise suggests that revenues from "road transport taxes[1]" would be 13% lower in 2050 compared to 2017 level under the 2DS scenario. Revenue from excise duties from passenger cars is expected to decrease by 56% due to increased fuel efficiency and adoption of alternative fuel technologies. In addition, the continued subsidisation and exemption of alternative fuel technology vehicles from registration and vehicle tax would put additional stress on government revenues. The increase in toll revenues from both passenger cars (in the form of vignettes) and trucks (respectively by 25% and 89%) due to increases in the overall vehicle stock and vehicle activity would not be enough to compensate such decrease.

Figure 3.2. Tax revenue implications of IEA 2DS scenario - Slovenia



Source: (OECD/ITF, 2019[60]).

Gradually increasing the taxation of negative environmental externalities would help to prepare tax systems to the low-carbon transition and, potentially, boost growth. Environmental tax reforms are generally defined as the introduction of market-based instruments to reflect the cost of environmental damage and the use of these revenues in a socially beneficial manner (Arlinghaus and Van Dender, 2017[61]) . In many countries, such reforms are introduced in order to make the tax system more growth- and employment-friendly by reducing highly distortive taxes (e.g. labour and corporate income taxes). In the context of the low-carbon transition, such unpriced negative environmental externalities could represent an alternative tax-bases to fossil use.

The list of negative externalities of road transport is long and includes (van Dender, 2019[62]):

- Carbon emissions. These are proportional to the type and volume of fuel used.

[1] Road transport taxes include taxes from passenger cars and trucks (whether levied on fuel use, vehicle registration or ownership, or road use)

- Local air pollution. Fuel combustion is also responsible for the emissions of several pollutants, such as fine particulates, sulphur dioxide and nitrogen oxides. Emission of fine particulates are particularly concerning since they are linked to a number of diseases (e.g. heart and lung diseases). In addition, International Agency for Research on Cancer has classified diesel exhaust as carcinogenic (IARC, 2012[63]). While the electrification of the vehicle fleet would eliminate exhaust, non-exhaust PM emissions (e.g. brake and tyre wear) would still be present.
- Traffic congestion. These can be broadly defined the extra time spent travelling.
- Road damages. These are generally the costs of road wear and tear due to its usage and depend on mainly on the weight of the vehicle (i.e. they are higher for trucks than for passenger cars).
- Noise. This category includes the discomfort and, in case of long exposure, the adverse health effects on health due to noise. Such impact is larger for combustion engines compared to EVs that are often less noisy.
- Parts of the social costs of traffic accidents.

Well-designed distance charges, as enabled by technology, would allow better pricing these externalities than vehicle or fuel taxes. This is because the costs of these externalities depend on three key factors, such as place and time of driving, and type of vehicle used. For instance, costs associated to air pollution and noise depend on the place, time and vehicle used (i.e. people exposure varies according to place, time and vehicle type), the extent of road damages depend on the type of road (i.e. place) and vehicle weight, and all three factors jointly contribute to determine traffic congestion. Carbon emissions are the only externality where time and place of driving are not important variables given its global nature. Well-designed distance charges could be relatively easily designed to vary according to these three factors.

Furthermore, gradually phasing-in distance charges would introduce new tax-bases that are resilient to transport electrification. As the vehicle fleet electrifies, the role of fossil fuels as tax-base would decrease but the distance travelled by vehicles would be a reliable alternative. Importantly, the transition towards more fuel-efficient and alternative fuel technologies will take time to affect the car fleet and, consequently, tax revenues. However, reform implementation also takes time and a gradual approach would be required to decrease disruption risk.

The technology for a large uptake of such distance charges seems to be available but may raise privacy concerns. If distance charges were to be widely adopted, vehicles would need to mount an on-board device to monitor time, distance and place of travel in manner similar to existing GPS technologies. However, such technology may raise concern about privacy if mobility data are not subject to appropriate privacy and data protection rules. Similar electronic distance charging systems currently exist for trucks and differentiate the road use fees according to the vehicle type and distance travelled (See Box 3.1).

Box 3.1. Distance charges in Switzerland

The Swiss "road user charging" (or RUC) scheme charges trucks for the distance driven leveraging the European global navigation satellite system (GNSS). The project started in 2001 and has had a revenue of 1.42 billion/ € by 2014 (GNSS Agency, 2015[64]). Heavy Goods vehicles (HGV) are required to install an "on board unit" (or OBU) that measures the distance driven leveraging the data provided by the vehicles tachograph[1] and the GNSS. The OBU is mounted behind the windshield, so enforcement personnel can observe lights indicating whether the device is operating and trailer information has been entered. It is automatically switched off by a microwave beacon at the border if the vehicle leaves Switzerland, and it is automatically turned on in the same way when the vehicle re-enters.

[1] A tachograph is a device that records a number of information, including the distance travelled, and the speed of the vehicle

In the case of Slovenia, OECD/ITF simulations (2019[60]) **suggest that distance-charges are the most promising long-term strategy to collect stable revenues.** The authors evaluate the ability of three different tax bases to counteract the drop in fuel tax revenues, namely distance based charges, carbon tax and vehicles ownership. Increasing conventional fuel taxes on diesel and petrol (i.e. carbon tax) can delay the revenue loss from tax base erosion. However, the price of carbon content of fuels should reach EUR 340 per tonne of CO_2 in 2050, thus creating important distributional implications. Alternatively, the tax charged on the purchase of a vehicle would need to increase from EUR 40 in 2020 to EUR 306 in 2050 per vehicle registered under assumption of no behavioural response. However, vehicle taxes appear not to be a particularly equitable tool to raise revenues (Chatterton et al., 2018[65]) (Eliasson, Pyddoke and Swärdh, 2018[66]) and are not an efficient tool to manage externality costs in contrast to fuel taxes and distance-based charges. Distance-based charges would represent a stable source of revenues and could be designed to appropriately reflect the externalities of driving. Model simulations suggest that the loss of revenue from taxing fuel in passenger cars can be covered by increasing the existing km charge from 0.0025 EUR to 0.0182 EUR.

Importantly, the authors note that the distributional impacts of larger use of distance charges are not considered in their model. For examples, households living in areas with limited transport alternatives (e.g. public transport) will be most adversely affected. Further analysis considering such aspects would be important to better understand such implications and identify policy to mitigate them.

Key takeaways:

- A large uptake of electric vehicles may erode the tax-base provided by fossil fuels use in transport, thus suggesting that the low-carbon transition may create fiscal challenges also for importing countries.
- Well-designed distance charges would a deliver superior management of most of externalities costs of driving while preparing the tax system to the electrification of vehicle fleet
- Recent modelling on Slovenia, one of the countries where taxes on fossil fuel consumption account for the highest share in government revenues across OECD countries, suggest that "road transport taxes" would be 13% lower in 2050 compared to 2017 level assuming that

the uptake of alternative-fuel vehicles is in line with the International Energy Agency's 2℃ scenario.

Knowledge gaps:

- The fiscal consequences of electrification of transport have been analysed in detail for a very limited set of countries.
- More broadly, the fiscal and budgetary consequences of electrification can affect prevailing energy tax and electricity pricing structures in various ways. Electricity generation and network investments need to be paid for, and the distribution of this burden, e.g. between different types of users and taxpayers, is a key policy concern with broad fiscal ramifications. Improved mapping of current energy pricing structures and evaluation of alternatives would be of great practical relevance.
- While distance charges appear to be an interesting solution for erosion of the tax base provided by fossil fuel, their distributional implications have been limited studied.
- The technology for a large uptake of distance charges seems to be available but may raise privacy concern. Further analysis on the implications for privacy, and best practise to manage such data may be an interesting venue of research.

References

(n.a.) (2019), "Clean energy shares streak ahead of fossil fuel stocks", *Financial Times*. [86]

- Central bankers, B. (2016), *BIS central bankers' speeches Mark Carney: Resolving the climate paradox*, http://www.berkshirehathaway.com/letters/letters.html. [85]

Arlinghaus, J. and K. Van Dender (2017), *Environmental Fiscal Reform - Progress, prospects and pitfalls, OECD Report for the G7 Environment Ministers*, OECD, Paris, http://www.oecd.org/tax/tax-policy/tax-and-environment.htm. (accessed on 8 March 2019). [61]

Arze del Granado, J., D. Coady and R. Gillingham (2010), "The Unequal Benefits of Fuel Subsidies: A Review of Evidence forDeveloping Countries", *Working Paper*, IMF, https://www.imf.org/external/pubs/ft/wp/2010/wp10202.pdf (accessed on 25 September 2019). [13]

Bachher, Dixon, A. (2016), *The New Frontier Investors.*, Palgrave McMillan. [56]

Bawumia, M. and H. Halland (2017), *Oil Discovery and Macroeconomic Management The Recent Ghanaian Experience*, http://econ.worldbank.org. [32]

Bhattacharyya, S. (2014), "Public Capital in Resource-Rich Economies: Is there a Curse.", *Oxford Economic Papers*, Vol. 66. [30]

Bleaney, M. and H. Halland (2016), *Do Resource-Rich Countries Suffer from a Lack of Fiscal Discipline?*, http://econ.worldbank.org. [31]

BNP Paribas (2019), *Wells, Wires and Wheels: Eroci and the Tough Road Ahead for Oil*, BNP Paribas Asset Management, https://docfinder.bnpparibas-am.com/api/files/1094E5B9-2FAA-47A3-805D-EF65EAD09A7F. [23]

Bornhorst, F., S. Gupta and J. Thornton (2009), "Natural resource endowments and the domestic revenue effort", *European Journal of Political Economy*, Vol. 25/4, pp. 439-446, http://dx.doi.org/10.1016/j.ejpoleco.2009.01.003. [26]

Caldecott, B. and E. Harnett (n.d.), "One Planet Sovereign Wealth Funds: Turning Ambition into Action", https://www.smithschool.ox.ac.uk/research/sustainable-finance/publications/One-Planet-Sovereign-Wealth-Funds-Turning-Ambition-into-Action.pdf. [50]

Capapé, Javier, and Marta Santivañes Capapé, Javier, A. (n.d.), "Sovereign Wealth Funds: Sustainable and active investors? The case of Norway.", https://sites.tufts.edu/sovereignet/files/2018/06/SustainableActiveInvestors_Capape.pdf. [47]

Capape, J. (n.d.), "Financing Sustainable Development: The Role of Sovereign Wealth Funds for Green Investment", UNEP. [88]

Capapé, J. (2018), *Sovereign Wealth Funds 2018*, IE Sovereign Wealth Research, http://www.investinspain.org/invest/wcm/idc/groups/public/documents/documento/mde5/ode3/~edisp/doc2019817367.pdf. [84]

Carney, M. (2015), *Breaking the tragedy of the horizon-climate change and financial stability*, BIS Central Bankers Speeches, http://www.pwc.com/gx/en/ceo-agenda/ceo-survey.html. [51]

Chatterton, T. et al. (2018), "Financial Implications of Car Ownership and Use: a distributional analysis based on observed spatial variance considering income and domestic energy costs", *Transport Policy*, Vol. 65, pp. 30-39, http://dx.doi.org/10.1016/j.tranpol.2016.12.007. [65]

Dabla-Norris, Brumby, Kyobe, Mills, A. (2010), "An Index of Public Investment Efficiency", No. 11-37, IMF. [33]

Davis, J., R. Ossowski and A. Fedelino (eds.) (2003), *Fiscal Policy Formulation and Implementation in Oil-Producing Countries*, International Monetary Fund, https://www.imf.org/external/pubs/nft/2003/fispol/index.htm (accessed on 30 August 2019). [4]

Dressler, L., T. Hanappi and K. van Dender (2018), "Unintended technology-bias in corporate income taxation: The case of electricity generation in the low-carbon transition", *OECD Taxation Working Papers*, No. 37, OECD Publishing, Paris, https://dx.doi.org/10.1787/9f4a34ff-en. [79]

Druid (2009), *VC Policy: Yozma Program 15-Years Perspective. Paper presented at the Summer*, Paper presented at the Summer. [44]

EITI (2017), *Using summary data, Part 1 - using the goverment finance statistics framework to compare EITI country contexts*, EITI, https://eiti.org/sites/default/files/documents/eiti_brief_using_summary_data_print.pdf. [7]

Eliasson, J., R. Pyddoke and J. Swärdh (2018), "Distributional effects of taxes on car fuel, use, ownership and purchases", *Economics of Transportation*, Vol. 15, pp. 1-15, http://dx.doi.org/10.1016/j.ecotra.2018.03.001. [66]

Eunomia (2016), *Study on assessing the environmental fiscal reform potential for the EU-28*, EC, Brussels, http://dx.doi.org/10.2779/86822. [71]

EY (2018), *Global oil and gas tax guide 2018*, https://www.ey.com/Publication/vwLUAssets/ey-global-oil-and-gas-tax-guide/$FILE/ey-global-oil-and-gas-tax-guide.pdf (accessed on 4 April 2019). [6]

Giri, R., S. Quayyum and R. Yin (n.d.), "Understanding Export Diversification: Key Drivers and Policy Implications", *IMF Working Paper* WP/19/105, p. 29, https://www.google.com/search?q=understanding+export+diversification%3A+key+drivers+and+policy+implications+WP%2F19%2F105&rlz=1C1GCEA_enFR818FR818&oq=understanding+export+diversification%3A+key+drivers+and+policy+implications+WP%2F19%2F105&aqs=chrome..69i. [35]

GNSS Agency, E. (2015), "GNSS ADOPTION FOR ROAD USER CHARGING IN EUROPE", http://dx.doi.org/10.2878/55987. [64]

Haddad, Mona, Jamus Lim, Cosimo Pancaro, A. (2013), "Trade openness reduces growth volatility when countries are well diversified", *Canadian Journal of Economics*, Vol. 46/2, pp. 765-790. [36]

Halland, H. et al. (2016), *Strategic Investment Funds Opportunities and Challenges*, http://econ.worldbank.org. [43]

Hamilton, K. (2005), "Investing Exhaustible Resource Rents and the Path of Consumption.", *Canadian Journal of Economics*, Vol. 38/2, pp. 615-621. [34]

Head, K., T. Mayer and J. Ries (2009), "How remote is the offshoring threat?", *European Economic Review*, Vol. 53/4, pp. 429-444, http://dx.doi.org/10.1016/j.euroecorev.2008.08.001. [77]

IARC (2012), *Diesel Engine Exhaust Carcinogenic – Press Release No. 213, 12 June 2012, International Agency for Research on Cancer, Lyon,*, http://dx.doi.org/10.1093/jnci/djs034. [63]

ICTD/UNU-WIDER (2018), *Government Revenue Dataset*, https://www.wider.unu.edu/project/government-revenue-dataset. [8]

IEA (2019), *Global EV Outlook 2019*, https://webstore.iea.org/download/direct/2807?fileName=Global_EV_Outlook_2019.pdf (accessed on 24 September 2019). [57]

IEA (2019), *World Energy Outlook 2019*, IEA/OECD, http://www.iea.org/weo (accessed on 14 November 2019). [2]

IEA (2018), *Outlook for Producer Economies*, International Energy Agency, I.E.A/ Organisation for Economic Cooperation and Development, OECD, http://www.iea.org/t&c/. [78]

IEA (2017), *Energy Technology Perspectives 2017: Catalysing Energy Technology Transformations*, International Energy Agency, Paris, https://dx.doi.org/10.1787/energy_tech-2017-en. [59]

IGF and OECD (2018), *The hidden cost of tax incentives in mining*, https://www.oecd.org/tax/beps/hidden-cost-of-tax-incentives-in-mining-draft-toolkit-oecd-igf.pdf (accessed on 30 August 2019). [18]

IMF (2019), "Fiscal Policies for Paris Climate Strategies - from Principle to Practice", *IMF Policy Paper*, No. 19/010, International Monetary Fund, Washington D.C. [74]

IMF (2012), "Fiscal Regimes for Extractive Industries: Design and Implementation", IMF Policy Papers. [5]

IMF et al. (2015), *Options for low income countries'effective and efficient use of tax incentives for investment*, https://www.oecd.org/tax/options-for-low-income-countries-effective-and-efficient-use-of-tax-incentives-for-investment.pdf (accessed on 30 August 2019). [17]

International Energy Agency (2019), *World Energy Outloook 2019*. [52]

ITF (2019), *ITF Transport Outlook 2019*, OECD Publishing, Paris, https://dx.doi.org/10.1787/transp_outlook-en-2019-en. [58]

Javier Capapé (2017), "Financing Sustainable Development: The Role of Sovereign Wealth Funds for Green Investment", UNEP. [48]

Keith, D. et al. (2018), "A Process for Capturing CO2 from the Atmosphere", *Joule*, Vol. 2/8, pp. 1573-1594, http://dx.doi.org/10.1016/J.JOULE.2018.05.006. [75]

Labandeira, X., J. Labeaga and X. López-Otero (2017), "A meta-analysis on the price elasticity of energy demand", *Energy Policy*, Vol. 102, pp. 549-568, http://dx.doi.org/10.1016/j.enpol.2017.01.002. [11]

Manley, D., J. Cust and G. Cecchinato (2017), "Stranded Nations? The Climate Policy Implications for Fossil Fuel-Rich Developing Countries", *OxCarre Policy Paper*, No. 34, University of Oxford, Oxford, https://www.google.com/search?q=Stranded+Nations%3F+The+Climate+Policy+Implications+for+Fossil+Fuel-Rich+Developing+Countries+OxCarre+policy+paper+34&rlz=1C1GCEA_enFR818FR818&oq=Stranded+Nations%3F+The+Climate+Policy+Implications+for+Fossil+Fuel-Rich+Deve. [24]

Mats Andersson, Patrick Bolton, A. (2016), "Hedging Climate Risk", *Financial Analyst's Journal*, Vol. 72/3. [53]

Mazarei, A. (2019), *Efforts of oil exporters in the Middle East and North Africa to diversity away from oil have fallen short*, Peterson Institute for International Economics, https://www.piie.com/system/files/documents/pb19-6.pdf (accessed on 30 August 2019). [15]

McGlade, C. and P. Ekins (2015), "The geographical distribution of fossil fuels unused when limiting global warming to 2 °C", *Nature*, Vol. 517/7533, pp. 187-190, http://dx.doi.org/10.1038/nature14016. [21]

Morris, A., N. Kaufman and S. Doshi (2019), *The risk of fiscal collapse in coal-reliant communities*, Columbia University an Brooking, https://www.brookings.edu/wp-content/uploads/2019/07/RiskofFiscalCollapseinCoalReliantCommunities-CGEP_Report_080619.pdf (accessed on 30 August 2019). [16]

OECD (2019), *INDONESIA'S EFFORT TO PHASE OUT AND RATIONALISE ITS FOSSIL-FUEL SUBSIDIES A REPORT ON THE G20 PEER-REVIEW OF INEFFICIENT FOSSIL-FUEL SUBSIDIES THAT ENCOURAGE WASTEFUL CONSUMPTION IN INDONESIA*. [70]

OECD (2019), "Investing in the Low-Carbon Transition: The Role of Sovereign Wealth Funds and Strategic Investment Funds.". [49]

OECD (2019), "Managing and Spending Extractive Revenues for Sustainable Development: Policy Guidance for Resource-Rich Countries.", *OECD Policy Dialogue on Natural Resource Based Development.*. [19]

OECD (2019), *OECD Green Growth Policy Review of Indonesia 2019*, OECD Environmental Performance Reviews, OECD Publishing, Paris, https://dx.doi.org/10.1787/1eee39bc-en. [69]

OECD (2019), *OECD Inventory of Support Measures for Fossil Fuels*, https://www.oecd.org/fossil-fuels/data/. [9]

OECD (2019), *Taxing Energy Use 2019: Using Taxes for Climate Action*, https://doi.org/10.1787/058ca239-en. [10]

OECD (2018), *Effective Carbon Rates 2018: Pricing Carbon Emissions Through Taxes and Emissions Trading*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264305304-en. [12]

OECD (2018), *Making Blended Finance Work for the Sustainable Development Goals*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264288768-en. [42]

OECD (2018), *Taxing Energy Use 2018: Companion to the Taxing Energy Use Database*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264289635-en. [81]

OECD (2017), *Germany's effort to phase out and rationalise its fossil-fuel subsidies A report on the G20 peer-review of inefficient fossil-fuel subsidies that encourage wasteful consumption in Germany*, OECD. [68]

OECD (2015), *OECD Companion to the Inventory of Support Measures for Fossil Fuels 2015*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264239616-en. [80]

OECD (2015), *Taxing Energy Use 2015: OECD and Selected Partner Economies*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264232334-en. [76]

OECD, Directorate for Science, T. (n.d.), *Venture Capital Policy. STI Working Paper 2003/3*. [45]

OECD/IEA (2019), *"Update on recent progress in reform of inefficient fossil-fuel subsidies that encourage wasteful consumption*, https://www.oecd.org/fossil-fuels/publication/OECD-IEA-G20-Fossil-Fuel-Subsidies-Reform-Update-2019.pdf. [1]

OECD/ITF (2019), *Tax Revenue Implications of Decarbonising Road Transport: Scenarios for Slovenia*, OECD Publishing, Paris, https://dx.doi.org/10.1787/87b39a2f-en. [60]

OECD/The World Bank/UN Environment (2018), *Financing Climate Futures: Rethinking Infrastructure*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264308114-en. [3]

OECD and IEA (2019), *UPDATE ON RECENT PROGRESS IN REFORM OF INEFFICIENT FOSSIL-FUEL SUBSIDIES THAT ENCOURAGE WASTEFUL CONSUMPTION*. [14]

Ossowski, R. and H. Halland (2016), *Fiscal Management in Resource-Rich Countries: Essentials of Economists, Public Finance Professionals, and Policy Makers*, World Bank. [40]

Park, K. et al. (n.d.), *Is 'Being Green' Rewarded in the Market?: An Empirical Investigation of Decarbonization Risk and Stock Returns Is 'Being Green' Rewarded in the Market?: An Empirical Investigation of Decarbonization and Stock Returns*, https://www.researchgate.net/publication/323153666. [54]

Parry, I. et al. (2014), *Getting Energy Prices Right : From Principle to Practice*, International Monetary Fund, Washington, DC., https://www.elibrary.imf.org/fileasset/misc/pdf/getting-energy-prices-right-excerpt.pdf?redirect=true (accessed on 23 September 2019). [72]

Rajaram, Anand, Tuan Minh Le, Kai Kaiser, Jay-Hyung Kim, A. (2015), *The Power of Public Investment Management*, Directions In Development, World Bank. [39]

Robinson, James A., A. (2005), "White Elephants", *Journal of Public Economics*, Vol. 89/2-3. [29]

Robinson, James, Ragnar Torvik, A. (2005), "The Political Foundations of the Resource Curse.", *Journal of Development Economics*, Vol. 79/2, pp. 447-468. [28]

Santos, G. (2017), "Road fuel taxes in Europe: Do they internalize road transport externalities?", *Transport Policy*, Vol. 53, pp. 120-134, http://dx.doi.org/10.1016/J.TRANPOL.2016.09.009. [73]

Sharma, N., A. (2013), *Special Fiscal Institutions for Resource-Rich Developing Economies.*. [38]

Solano-Rodriguez, B. et al. (2019), "Implications of climate targets on oil production and fiscal revenues in Latin America and the Caribbean", No. IDB-DP-00701, Inter-American Development Bank, http://dx.doi.org/10.18235/0001802. [20]

Sovereign Wealth Fund Institute (2019), *Sovereign Wealth Fund Rankings*. [46]

Sovereign Wealth Fund Institute (n.d.), "Sovereign Wealth Fund Rankings.", *2019*. [87]

TFCD (2017), *Recommendations of the Task Force on Climate-related Financial Disclosures*, Task Force on Climate-Related Financial Disclosures, https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-2017-TCFD-Report-11052018.pdf. [55]

Tornell, A. and P. Lane (1999), "The voracity effect", *American Economic Review*, Vol. 89/1, pp. 22-46, http://dx.doi.org/10.1257/aer.89.1.22. [27]

UNCTAD (2014), *World Investment Report 2014*. [25]

UNCTAD (2013), *Promoting low-carbon investment. UNCTAD's Investment Advisory Series*. [82]

UNEP (n.d.), "Financing the SDGs: the Role of Sovereign Wealth Funds for Green Investment", *Green Economy*, p. 4, https://sites.tufts.edu/sovereignet/files/2018/02/Policy-brief-Capape%CC%81-SWF-Green-Investments-2018-1.pdf. [83]

Van den Bremer, Thon, A. (2013), "Managing and Harnessing Oil Windfalls", *IMF Economic Review*, Vol. 61/1, pp. 130-167. [41]

van Dender, K. (2019), "Taxing vehicles, fuels, and road use: Opportunities for improving transport tax practice", *OECD Taxation Working Papers*, No. 44, OECD Publishing, Paris,, https://www.oecd-ilibrary.org/docserver/e7f1d771-en.pdf?expires=1568111049&id=id&accname=ocid84004878&checksum=4BFE8B8CECA49357E15F0ABDF0B1584F (accessed on 10 September 2019). [62]

Venables, A. (2016), "Using natural resources for development: why has it proven so difficult?", *Journal of Economic Perspectives*, Vol. 30/1, pp. 161-184. [22]

Villafuerte, Mauricio, Rolando Ossowski, T. (2008), "Managing the Oil Revenue Boom: The Role of Fiscal Institutions.", *IMF Occasional Papers from International Monetary Fund* 260. [37]

World Bank and IBRD (2017), *Report of the High-Level Commission on Carbon Prices I*, http://www.carbonpricingleadership.org. [67]

Annex A. Data on fiscal regimes in the hydrocarbon and coal sector

Table A.1. Fiscal regimes in resource-rich countries are diverse

	Concession			PSC	SC
	RT	RRT	CIT		
Algeria				■	
Angola	■		■	■	■
Australia	■	■	■		
Azerbaijan				■	
Bahrain			■		
Cameroon				■	
Canada	■		■		
Chad				■	
Chile			■		
Chile			■		
Colombia	■	■	■		
Denmark		■	■		
Egypt				■	
Equatorial Guinea				■	
Gabon	■		■	■	■
Greece	■		■		
Indonesia				■	
Iran					■
Iraq					■
Israel	■	■	■		
Kazakhstan	■	■	■	■	
Kuwait			■		
Lao People's Democratic Rep				■	
Libya	■		■	■	
Malaysia				■	■
Mexico	■		■	■	■
Netherlands	■	■	■		
New Zealand	■		■		
Nigeria	■	■	■	■	
Norway		■	■		
Papua New Guinea	■	■	■		
Poland	■	■	■		
Qatar	■	■	■	■	
Republic of the Congo				■	■
Russia	■		■	■	
Saudi Arabia	■		■		

Syria	■		■	■	
Trinidad and Tobago	■	■	■	■	
United Arab Emirates	■	■	■		
United Kingdom		■	■		
United States	■		■		
Venezuela	■		■		
Vietnam				■	

Note: RT = royalties, RRT = profit-based special taxes (resource-rent tax), CIT = corporate income tax, PSC = production sharing contract, SC = service contract.
Source: (EY, 2018[6]).

Table A.2. Fiscal instruments in extractive industries

Tax revenue	Non-tax revenue
Ordinary taxes on income, profits and capital gains	Social security employer contributions
Extraordinary taxes on income, profits and capital gains	From state-owned enterprises
Taxes on payroll and workforce	From government participation (equity)
Taxes on property	Withdrawals from income of quasi-corporations
General taxes on goods and services (VAT, sales tax, turnover tax)	Royalties
Excise taxes	Bonuses
Licence fees	Production entitlements (in-kind or cash)
Emission and pollution taxes	Compulsory transfers to government (infrastructure and other)
Motor vehicle taxes	Other rent payments
Customs and other import duties	
Taxes on exports	
Profits of natural resource export monopolies	
Other taxes payable by natural resource companies	

Note: The categories used to classify government revenue are based on the EITI GFS taxonomy.
Source: EITI GFS framework.

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