Achieving a Fossil-Free Recovery

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May 2021

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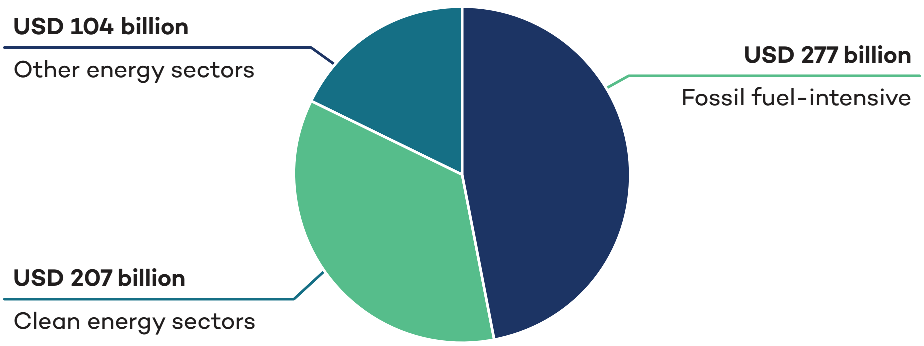
Executive Summary

The COVID-19 crisis has changed the world, creating massive economic global disruption. As a response, governments all around the world have dedicated large amounts of public money to counterbalance the socio-economic effects of the crisis. By February 2021, at least USD 14.9 trillion had been committed to COVID-19 recovery packages, and between 3% and 5% of global COVID-19 recovery money has been designated for energy production and consumption.

According to an analysis of recovery packages in G20 and 11 other economies, the largest share of this support (47% of the total USD 585 billion [1]) has gone to fossil fuel-intensive sectors (such as transport, extractive, and heavy industries) versus 35% destined to clean energy sectors (including renewable energy generation, public transport, electric vehicles, and energy efficiency). The remaining 18% went to other energy sectors (including nuclear, certain biofuels, and multiple energy types) (see Figure ES1). These amounts are in addition to the hundreds of USD billions that governments worldwide already spend subsidizing fossil fuel production and consumption.

This is happening exactly when urgent action must be taken to help prevent locking the world into catastrophic climate change. The first priority for everyone in the COVID-19 context must be health and social protection, followed by getting economies back on track—but it has to be done in a way that is consistent with the Sustainable Development Goals (SDGs) and governments' net-zero commitments.

Figure ES1. New and amended measures of government support to fossil fuel-intensive, clean, and other energy sectors in G20 and 11 other major economies in 2020, USD billion



Source: Authors diagram based on data from Energy Policy Tracker (n.d.).

To achieve sustainability commitments and objectives, countries must aim for a fossil-free recovery from the COVID-19 crisis: that is, boosting economic recovery and creating jobs via a rapid move to clean energy for all while taking steps toward a just transition away from fossil fuels. Energy plays a major role here, not only because it is

[1] Data based on the Energy Policy Tracker (n.d.) by February 28, 2021. See Chapter 2 for details.

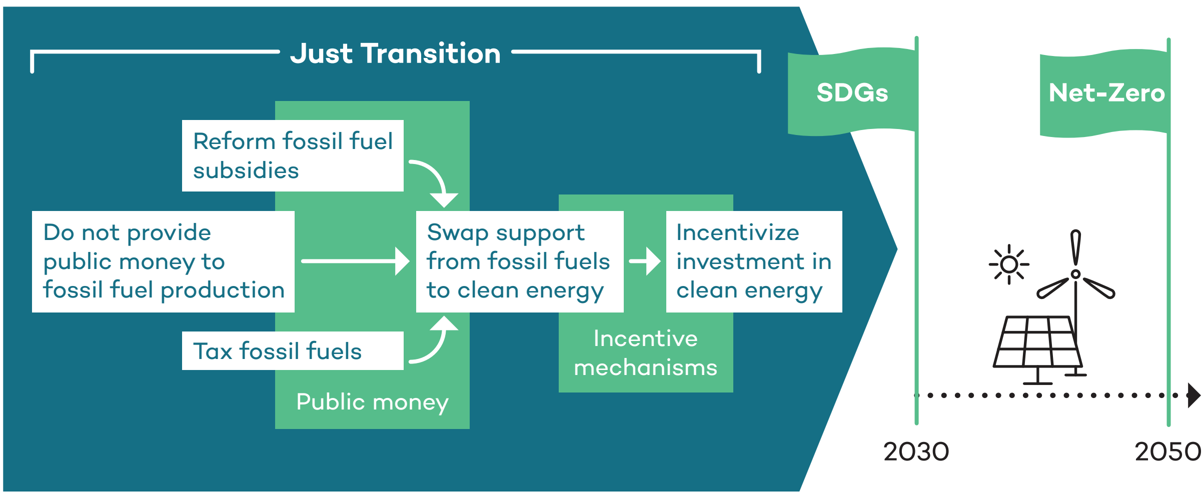
one of the main contributors to climate change but also because it is critical for access to opportunities, jobs, mobility, and welfare.

This report proposes a series of actions that governments can undertake to achieve a fossil-free recovery, following five key principles that countries can apply to transition to a low-carbon economy while using their energy systems to boost their economies, create employment, and meet their climate and development goals. We have the following recommendations for ministers of finance and other world leaders:

1. Do not provide public money to fossil fuel production.
2. Raise money from fossil fuel subsidy reform and taxes.
3. Swap support from fossil fuels to clean energy.
4. Incentivize investments in clean electricity.
5. Ensure the transition is a just one.

These principles are interlinked (see Figure ES2). Principles 1 and 2 can be implemented in parallel as critical first steps, notably to ensure public money is encouraging sustainable development. The funds saved from fossil fuel subsidy reform and raised from fossil fuel taxation can then be “swapped” to clean energy. As clean energy becomes mature and cost competitive, the role of government support will be to leverage private finance and provide other mechanisms to incentivize investment in clean electricity. All these steps should be done under the just transition framework. Depending on the specific country context, there are different options for each of the listed principles, which are presented in this report together with a series of recommendations for their implementation.

Figure ES2. Principles of a fossil-free recovery

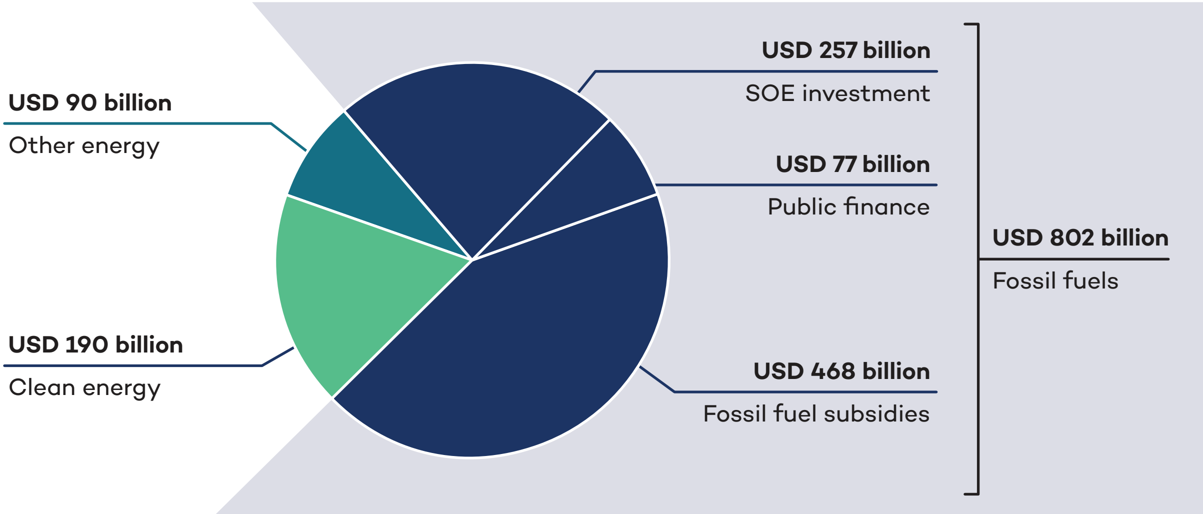


Source: Authors’ diagram.

1. Do Not Provide Public Money to Fossil Fuel Production

Governments worldwide still spend billions of dollars every year to finance fossil fuels. In 2019, global government support to the production and consumption of fossil fuels reached at least USD 802 billion through direct budgetary transfers, tax expenditures, induced transfers, public finance, and state-owned enterprise (SOE) investments (see Figure ES3). This is happening at a time when governments must be taking urgent action to help prevent locking in the world to catastrophic climate change and in the face of several international commitments and calls to end fossil fuel subsidies.

Figure ES3. Government global support to fossil fuels, clean, and other energy in 2019 (before COVID-19 crisis), USD billion.



Source: Geddes, Gerasimchuk et al., 2020; International Renewable Energy Agency (IRENA), 2020a; Organisation for Economic Co-operation and Development (OECD), 2020a; Tucker et al., 2020. See Appendix I for more details.

The first step toward net-zero is to ensure that COVID-19 recovery packages do not provide support to the production of fossil fuels. Instead, recovery packages to the energy sector should support clean energy and assist fossil fuel producers and fossil fuel-intensive sectors in their transition to a low-carbon future, promoting low-carbon diversification and addressing the impacts on workers and communities according to just transition principles.

2. Raise Money From Fossil Fuel Subsidy Reform and Taxation

In order to help support COVID-19 recovery and the energy transition, governments can raise money from the reform of some types of fossil fuel subsidies and taxation. Consumer subsidies to gasoline, diesel, and coal mostly benefit the rich (who consume more) and have important externality costs, as they generate air pollution and worsen climate change, among other effects. Reforming subsidies and taxing these fuels could generate over USD 550 billion globally per year that could be used for post-pandemic recovery and the transition to net-zero, as well as to reduce budgetary deficits and internalize the health, social, and environmental costs of fossil fuels. While this will not be easy, it is a relatively "low-hanging fruit."

At the same time, the political economy of price reform should be carefully considered. Price increases caused by subsidy removal and increased fossil fuel taxation create difficulties for groups that stand to lose out, but targeted measures can compensate those groups according to their needs. These targeted measures can take several forms, such as subsidy targeting, social safety nets, or even improvement of essential public services. Well-communicated plans explaining the reform and using revenues to provide tangible benefits for the population are vital steps to building public trust and confidence—thereby increasing public acceptance of the alternative measures.

3. Swap Support From Fossil Fuels to Clean Energy

Revenues raised via fossil fuel subsidy reform and taxation can be used by governments to support other development purposes, including forms of clean energy with significant potential to support a fossil-free recovery. This is called a "swap," defined in this context as any shift in public funds from fossil fuels to clean energy. A significant characteristic of swaps is that they seek to align fiscal and energy policies with environmental and social priorities.

There are different strategies to deploy swaps that can imply more or less formal ways of earmarking public funds. Which strategy to choose depends on the specific context, as well as the sector to which the swaps apply. In this report, we focus on four areas considered key for the energy transition that at the same time can provide significant benefits as part of recovery packages by creating jobs and generating economic growth:

- **Clean energy access for all:** Swaps can help achieve SDG 7—access to affordable, reliable, and sustainable energy. The focus should be on reforming universal consumption subsidies to electricity and liquefied petroleum gas (LPG) and instead target subsidies to the populations that need it the most (via cash transfers, lifeline tariffs, or other systems most appropriate to the local context) and to promote connections to modern and clean forms of energy. This can also include public support to decentralized renewable generation to rural and isolated areas. These interventions have the added co-benefits of improving health (by reducing air pollution), empowering women, and supporting rural development.
- **Energy efficiency:** Swaps can help de-risk and overcome the high upfront cost of energy-efficiency investments, mostly in buildings and related to thermal isolation. Support for energy efficiency should target homeowners, small and medium-sized enterprises (SMEs), and public buildings such as schools or hospitals. Energy efficiency is particularly interesting in the case of price increases, since reduced consumption results in lower overall energy bills.
- **Decarbonization of private and public transport:** Although there are many alternatives for decarbonizing the transportation sector (including urban planning), immediate swaps should support electric vehicles, related infrastructure, and public transport, considering the broader climate and pollution effects of supporting the

electrification of transportation. Support to fossil fuel-intensive transport sectors (such as the airline industry) as part of recovery packages should only be given to help the sector reduce emissions and contribute to net-zero commitments.

- **Transformation of the power sector:** The power sector will be key for achieving the net-zero commitments and SDGs, and swaps can help to reduce its dependence on fossil fuels by providing funds to help renewables overcome roadblocks and become cost competitive. Swaps can also encourage investment in the electricity grid to make it more dynamic and reliable.

4. Incentivize Clean Electricity Investment

As renewable energy technologies become cost competitive, the role of public money and recovery packages will be to incentivize private investments in clean electricity. Clean electricity is expected to be the backbone of the energy transition, and significant investment will be required: the International Energy Agency's (IEA's) net-zero by 2050 scenario[2] estimates that investment in renewables will need to reach USD 1.1 trillion annually by 2030, and 70% of future finance for renewables will need to come from private sources. There are three main approaches that governments can use to de-risk investments and incentivize private money into the sector: subsidies and other support policies; public finance; and SOEs:

- **Support policies:** Government subsidies and well-designed policies can help bring in private investment for solar photovoltaic (PV) and wind developments. The specific mechanism will depend on the specific context: In countries with underdeveloped renewables sectors and high financing costs, subsidy schemes such as feed-in tariffs (FiTs) and appropriate support policies can help leverage private finance for demonstration and early-stage renewables projects. As countries' renewables markets mature and risks are better identified and mitigated, governments can redesign subsidies toward market-based, price-searching incentives (such as auctions) to help deploy lower-cost generation.
- **Public finance:** Public finance institutions (PFIs) can use recovery funding to mobilize private finance for deploying renewable energy, addressing country-specific risks to these projects. PFIs offer different tools that can be applied depending on the context. In markets with early-stage renewables sectors featuring high risks and high financing costs, grants and concessional public finance are effective de-risking tools. In more developed renewables markets, commercial rate tools can still be effectively used to help address residual country-specific risks but are less likely to crowd out private finance.
- **SOE investment and diversification:** SOEs have a pivotal role to play in achieving net-zero commitments, setting an example to private companies. As majority owners of SOEs, governments can influence and incentivize the SOE to redirect its investment away from fossil fuels and toward renewable energy via mandates or by direct support.

[2] This refers to the net-zero scenario introduced in IEA's World Energy Outlook 2020 (IEA, 2020k).

5. Ensure the Transition Is a Just One

The energy transition is inevitable and will affect major aspects of our economies and societies, including industries, labour, communities, and whole economies. This transition will affect all countries, and fossil fuel producers will be among the most impacted, as achievement of the SDGs and net-zero will imply a diversification of their economies.

There are significant economic, social, and environmental risks to energy transitions, and they thus need to be planned carefully and follow a just transition[3] approach. A just energy transition is a negotiated vision and process centred on a tripartite process based on social dialogue between the partners (governments, industry/employers, and workers) and must involve additional stakeholders, such as energy consumers and communities, through active and meaningful stakeholder engagement. This engagement must be designed with the goal to ensure that those most affected by the transition to clean energy have a voice and defined role in how it takes place. A just transition needs to contribute to decent work for all, social inclusion, and poverty eradication. This includes maximizing positive employment and social gains—and minimizing and addressing potential negative impacts through economic, social, and labour policies.

The pandemic has added additional strain to sectors such as coal mining, where jobs are being changed by digitization, automation, and the low-carbon transition. A just energy transition is a route for governments to achieve their social, environmental, and economic goals while rebuilding their economies around clean energy systems.

[3] The International Labour Organization's *Guidelines for a Just Transition Towards Sustainable Economies and Societies for All* provide a framework for principles and policy entry points: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_432859.pdf

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Abbreviations and Acronyms

BNEF	Bloomberg New Energy Finance
BDEW	German Association of Energy and Water Industries (Bundesverband der Energie und Wasserwirtschaft)
BNDES	Brazilian Development Bank
BRICS	Brazil, Russia, India, China, and South Africa
CEA	Central Electricity Authority of India
CEEW	Council on Energy, Environment and Water
CONECC	Convergence of Energy Policy and Climate Change (Convergencia de la Política Energética y de Cambio Climático)
ECA	export credit agency
ETS	Emissions Trading System
EU	European Union
EV	electric vehicle
FIDE	Trust for the Savings of Electric Energy (Fideicomiso para el Ahorro de Energía Eléctrica)
FiT	feed-in tariff
GDP	gross domestic product
GHG	greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation)
GST	goods and services tax
IDCOL	Infrastructure Development Company Limited
IEA	International Energy Agency
IFC	International Finance Corporation
IGES	Institute for Global Environmental Strategies
ILO	International Labour Organization
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
ITUC	International Trade Union Confederation

JTF	Just Transition Fund
LPG	liquefied petroleum gas
MDB	multilateral development bank
NTPC	National Thermal Power Corporation (India)
ODI	Overseas Development Institute
OECD	Organisation for Economic Co-operation and Development
PFI	public finance institutions
PO	partner organization
PPA	power purchase agreement
PREE	Spanish Building Energy Rehabilitation Program (Programa para la Rehabilitación Energética de Edificios)
PV	photo-voltaic
SDGs	Sustainable Development Goals
SECI	Solar Energy Corporation of India
SEforALL	Sustainable Energy for All
SEI	Stockholm Environment Institute
SHS	Solar Home System Program (Bangladesh)
SOE	state-owned enterprise
WHO	World Health Organization
WTO	World Trade Organization
VGF	viability gap funding

1.0 Introduction

The COVID-19 crisis has changed the world, creating massive economic global disruption. The International Monetary Fund (IMF) estimates that global gross domestic product (GDP) contracted by 3.5% in 2020 due to the pandemic (IMF, 2021), affecting many sectors and economies. As a response, governments all around the world have dedicated large amounts of public money to counterbalance the socio-economic effects of the crisis. By February 2021, at least USD 14.9 trillion had been committed to COVID-19 recovery packages (G20 2020; Vivid Economics 2021).

This is happening exactly when urgent action must be taken to help prevent locking the world into catastrophic climate change. While the first priority for everyone must be ensuring health and social protection as well as getting economies back on track, it is crucial that this be done in a way consistent with sustainable development. The Sustainable Development Goals (SDGs), due by 2030, define a broad set of areas in this direction and many governments are aiming to shift their emissions trajectories to reach net-zero in the coming decades (United Nations Framework Convention on Climate Change [UNFCCC], n.d.).

The energy sector plays a major role in climate change as well as in access to opportunities, jobs, mobility, welfare, etc. Indeed, the energy sector can be used to drive a green recovery. The decisions taken by governments now will determine our energy systems in the future and how these will affect the climate crisis. A radical change in current energy systems is needed, as well as a just transition to a green economy.

This report looks at how governments should design their COVID-19 recovery support to the energy sector in order to achieve a fossil-free recovery that supports the achievement of the SDGs and net-zero commitments. First, it provides a snapshot of how governments have supported the energy sector in their COVID-19 recovery packages over the past year. It shows that while several countries have supported cleaner forms of energy, the largest share of the funding goes to fossil fuel-intensive sectors, adding to the already-high fossil fuel subsidies that governments provide annually. In this context, the following chapters present and elaborate on the five principles that governments should consider to align their support packages for the energy sector with their climate and sustainability targets. These principles should be considered as a series of steps that governments can take to raise money from fossil fuels and spend it in a way that supports the clean energy transition, depending on specific country contexts. This paper focuses on various concepts and options for different country contexts, but the implementation of the principles should also consider the broader aspects of defining the right policies, creating the right skills, and ensuring a just transition away from fossil fuels over the long term, according to the International Labour Organization's (ILO's) *Just Transition Guidelines* presented in this report.

This report is aimed at the world's governments, particularly policy-makers and ministries dealing with COVID-19 recovery packages, energy planning, and climate change mitigation, such as ministries of finance, energy, and foreign affairs working on plans for net-zero and the SDG targets.

2.0 Countries' Energy-Related Responses to the COVID-19 Crisis

Governments have committed significant amounts of money to support their economies, attempting to counterbalance the socio-economic effects of the COVID-19 crisis. **As of February 2021, global stimulus had reached at least USD 14.9 trillion**[4] (G20, 2020; Vivid Economics, 2021). Much of this has been committed by the world's wealthiest economies, while poorer nations have been much more constrained in mobilizing emergency funding and deploying large amounts of stimulus. **Between 3% and 5% of total stimulus is estimated to target the main sectors responsible for energy production and consumption** (resources, power generation, mobility, and buildings), while the rest is industry neutral or aimed at other economic activities (Energy Policy Tracker, n.d.)

To a large extent, COVID-19 response measures linked to energy have mirrored countries' previous climate efforts. Countries that had started decarbonization efforts have tried to accelerate the clean energy transition (Energy Policy Tracker n.d.; Stockholm Environment Institute [SEI] et al., 2020). In particular, jurisdictions with detailed clean energy roadmaps prior to the crisis—for example, the European Union and some of its member states such as Germany and France—have been able to use them for crisis response and recovery purposes. Conversely, countries still entangled in the status quo of fossil fuel dependency have thrown even more money at the sectors producing and consuming oil, gas, and coal. Overall, each of the countries analyzed has provided a certain level of support to fossil fuel-intensive sectors (Energy Policy Tracker, n.d.).

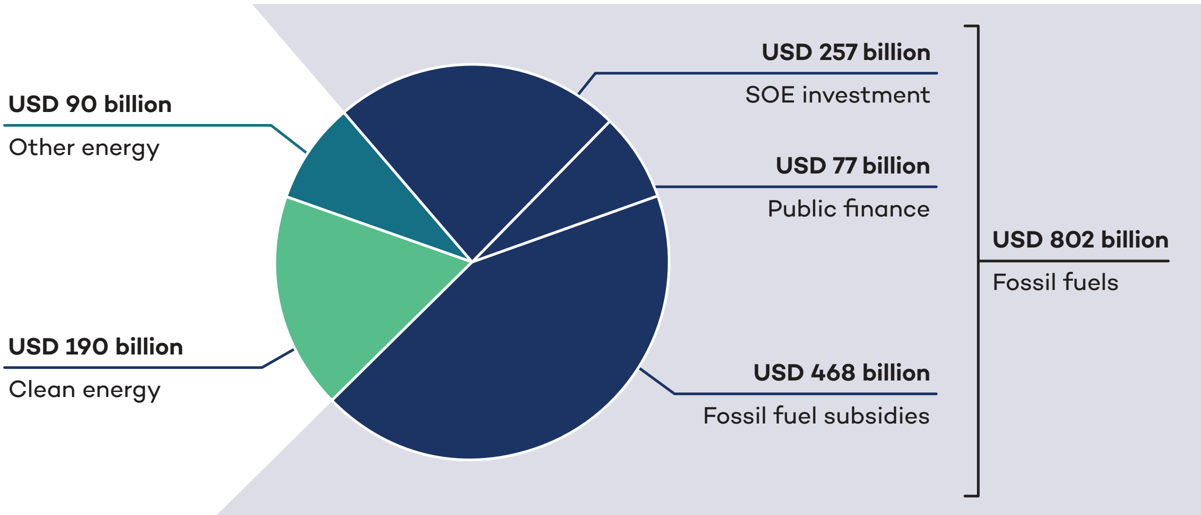
This trend was especially strong at the beginning of the pandemic when countries bailed out airlines and struggling fossil fuel producers as well as fast-tracking some of the "shovel-ready" high-carbon infrastructure (highways, airports). However, on a positive note, many governments—such as those of Canada, China, Japan, and most recently the United States—have started planning for a greener approach, which enabled them to approve more clean energy projects toward the end of 2020 and the beginning of 2021 (Energy Policy Tracker, n.d.; Vivid Economics, 2021). Some of these countries have also announced or defined ambitious net-zero commitments (Bazilian & Gielen, 2020). Further, some countries, such as France, aimed at making support to fossil energy conditional on meeting the requirement to reduce negative climate impacts, known as "green strings"—even if what it means is still not very clear. Applying and perfecting such "green strings" will be critical to making sure that ongoing economic stimulus and recovery efforts support net-zero targets (Corkal et al., 2020).

According to the best available and most recent global estimates, **prior to 2020, the fossil fuel industry was receiving at least USD 802 billion per year via government support in the form of subsidies** (USD 468 billion in the form of direct budget transfers, tax

[4] Since the writing of this report (February 28, 2021), more stimulus funding has been approved, most notably the USD 1.9 trillion package in the United States agreed in March 2021.

expenditure, induced transfers [5]), public finance (USD 77 billion), and investments by state-owned enterprises (SOEs) (USD 257 billion) (Geddes, Bridle et al. 2020; OECD, 2020a; Tucker et al., 2020). Of these, at least USD 398 billion (49%) went to the production of fossil fuels and fossil fuel-based power, and at least USD 404 billion (51%) was for the consumption of fossil fuels and fossil fuel-based power (OECD 2020a, see Appendix I for detailed calculations). In contrast, other forms of energy received much less government support: at least USD 190 billion per year for clean energy (renewables and energy efficiency) and at least USD 90 billion for other energy (particularly nuclear and biofuels) (International Renewable Energy [IRENA], 2020a; Tucker et al., 2020). Figure 1 and Appendix I present more details and highlight the fact that support to critical sectors such as mobility was unknown before 2020.

Figure 1. Government support to fossil fuel, clean, and other energy before COVID-19 crisis: Best available global proxies, USD billion.



Source: Geddes, Gerasimchuk et al., 2020; IRENA, 2020a; OECD, 2020a; Tucker et al., 2020. See Appendix I for more details.

According to the Energy Policy Tracker,[6] **over the course of 2020, new and amended policies in the G20 and 11 other economies have committed at least USD 588 billion**

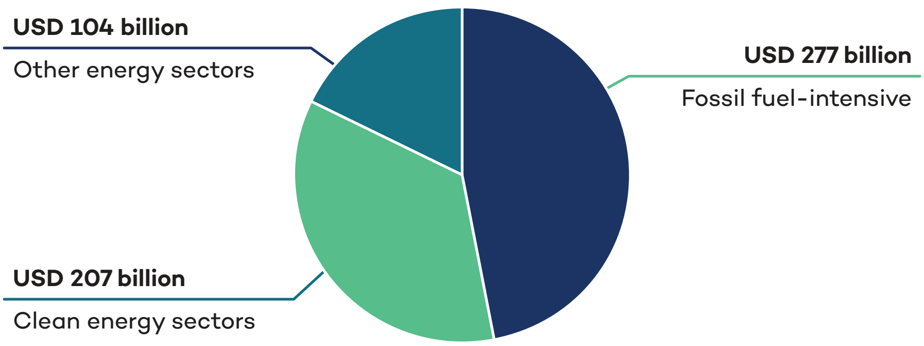
[5] Direct budget transfers, tax expenditures, and induced transfers correspond to the main subsidy types identified and described by SDG indicator 12.c.1. See the corresponding methodology for a definition (UNEP et al., 2019). For details on the total estimate, see Appendix I of this report.

[6] The Energy Policy Tracker is a research network and a database tracking new and amended policies from January 1, 2020, that affect the key sectors responsible for energy production and consumption: resources, power, mobility and buildings. As of February 17, 2021, the Energy Policy Tracker consolidates data on all of the G20 countries as well as 11 other economies (Bangladesh, Colombia, Finland, the Netherlands, New Zealand, Norway, Poland, Spain, Sweden, Ukraine, and Vietnam). The data are collected and reviewed by IISD and 22 other expert organizations. It includes around 1,000 policies (roughly two thirds quantified and roughly one third unquantified). The database is built through a bottom-up approach, collecting data on specific commitments at an individual country level, and then aggregating them. It is updated weekly. For more information, see: https://www.energypolicytracker.org/. The values included in this report are the best available estimates by February 28, 2021, according to that Energy Policy Tracker version.

to the key sectors responsible for energy production and consumption (resources, power generation, mobility, and buildings). Of this, USD 277 billion (47% of the total) went to fossil fuel-intensive sectors (especially airlines, but also transportation, industry, and fossil fuel producers), USD 207 billion (35% of the total) to clean energy sectors (including renewable energy generation, public transport, electric vehicles, and energy efficiency), and USD 104 billion (18% of the total) to other energy sectors (those linked to both fossil and clean energy, or none of them, such as nuclear)[7] (see Figure 2).

These packages are still skewed in favour of fossil fuels (Figure 2) and are largely additional to the baseline support already provided to fossil fuels annually and represented in Figure 1.[8] The oil price drop in 2020 should also be considered, as it caused a significant decrease in fossil fuel subsidies in 2020 (IEA, 2020a). An important number of the fossil and clean measures registered in the Energy Policy Tracker are classified as "unconditional" or "conditional." For fossil fuels, "conditional" means that a policy comes "with climate targets or additional pollution reduction requirements." It should be noted that this only identifies the existence of conditionalities, so it does not assess whether the conditionalities justify the support for fossil energy. For clean energy, "conditional" applies to a policy that is stated to "support the transition away from fossil fuels, but is unspecific about the implementation of appropriate environmental safeguards." This is the case of large hydropower projects, rail, public transport, and electric vehicles (Energy Policy Tracker, n.d.). Figure 3 shows details by country considering this conditionality.

Figure 2.[9] New and amended[10] measures of government support to fossil fuel-intensive, clean, and other energy sectors in G20 and 11 other major economies in 2020, USD billion



Source: Energy Policy Tracker n.d.

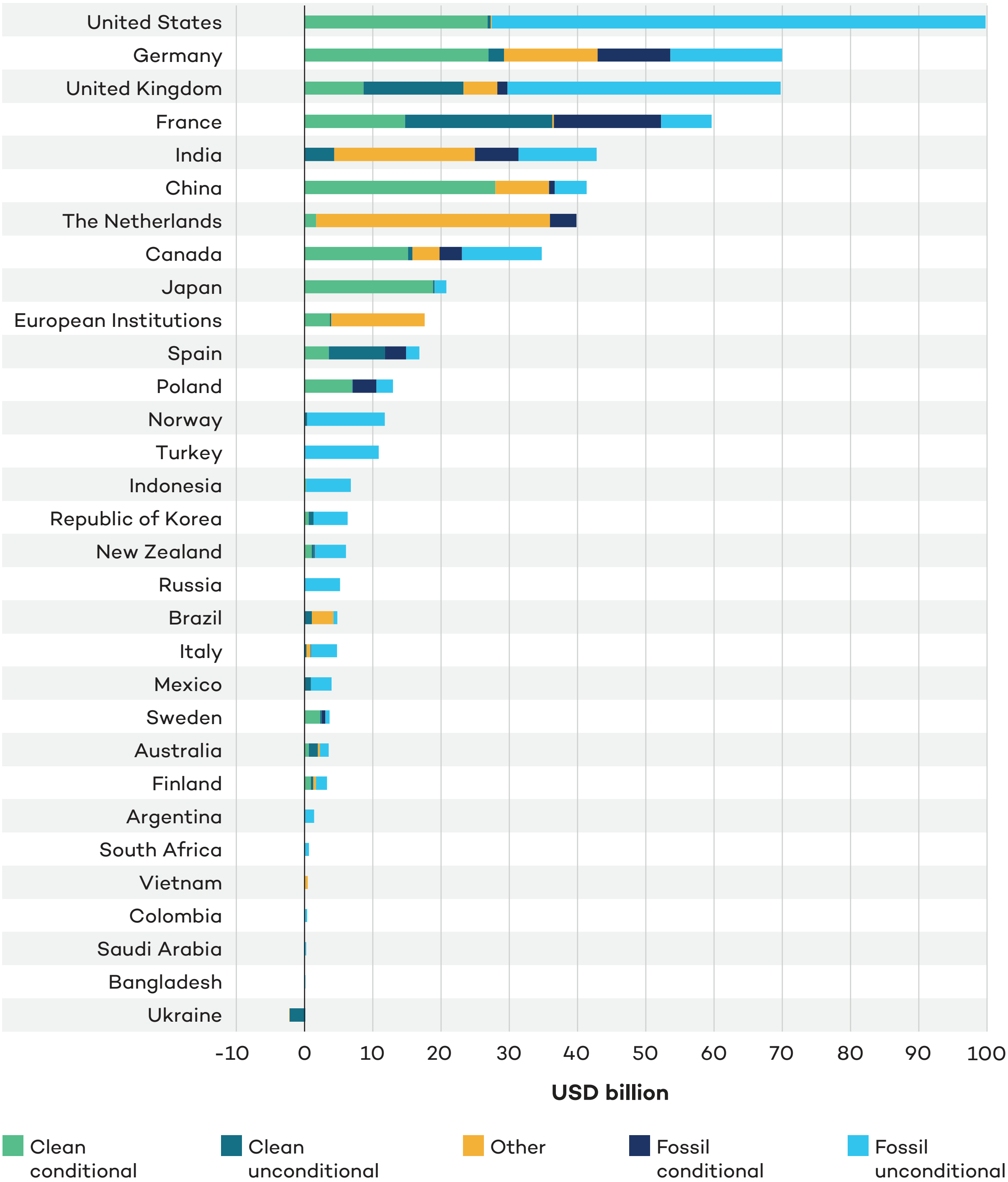
[7] For more details on the classification and methodology, see: https://www.energypolicytracker.org/methodology/

[8] Note that Figures 1 and 2 are not directly comparable due to differences in the scope of what is being measured (all existing support in Figure 1 versus only new and amended policies associated with the response to the COVID-19 crisis in Figure 2; only fossil fuel sectors in Figure 1 versus the inclusion of fossil fuel-dependent sectors in Figure 2). The drop in the price of oil and consequent decrease in fossil fuel subsidies is also to be considered.

[9] Numbers in this figure do not include most existing consumer subsidies in 2020, although they do include investments by SOEs and loans and loan guarantees captured by the Energy Policy Tracker.

[10] By "amended measures," we refer to policies that already existed but were amended as of January 1, 2020.

Figure 3. Public money for fossil fuel-intensive, clean, and other energy sectors in 2020

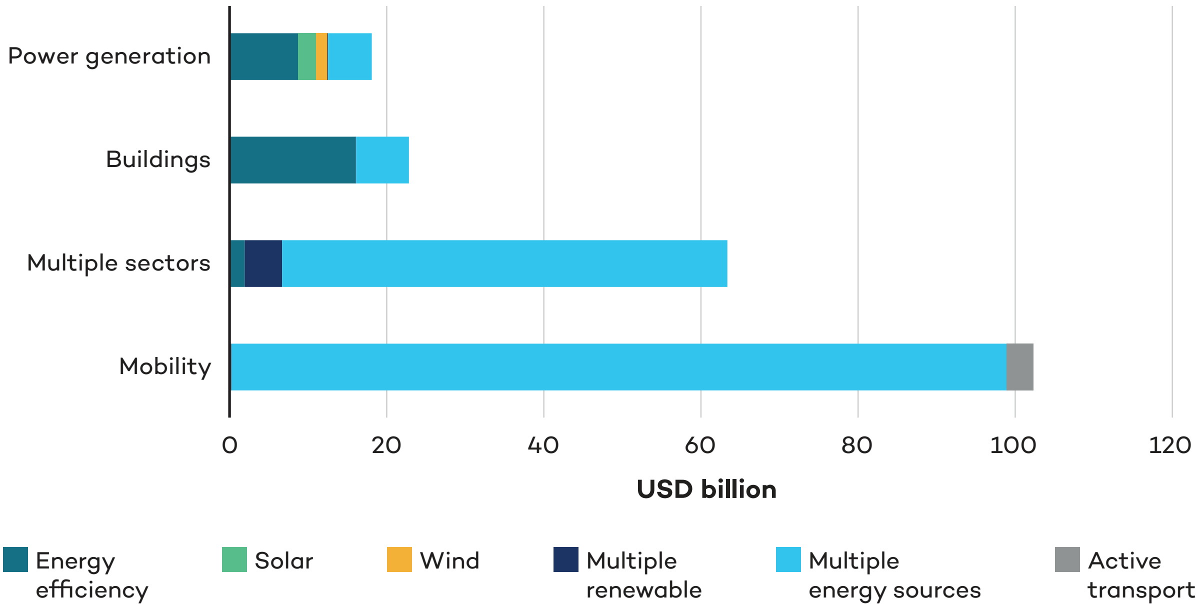


Source: Energy Policy Tracker n.d.

The dominance of pandemic-related support to fossil fuel-intensive sectors in 2020 drives countries in the direction of carbon lock-in since the fossil fuel infrastructure supported with recovery measures will still operate for decades to come. Furthermore, USD 227 billion (82%) out of the USD 276 billion in total new support to fossil fuel-intensive sectors in the G20 and 11 other countries in 2020 was provided without any "green strings" attached—that is, without any conditionality to reduce greenhouse gas (GHG) emissions or energy consumption.

Nevertheless, compared with the pre-crisis baseline, new and amended policies in response to the COVID-19 crisis in 2020 have significantly increased the scale of support to clean energy. In the G20 and 11 other economies in 2020, as a result of new and amended policies in response to the COVID-19 crisis, such alternatives received at least USD 207 billion in government support (Figure 4). This includes USD 102 billion in the mobility sector, i.e., rail, public transport, active transport, zero-emission vehicles, planes, and related transport infrastructure—although some measures included in this group still rely on the use of fossil energy, although the aim is to reduce its dependence on it (as is the case of e-mobility when most of the electricity is generated using fossil fuels). Energy-efficiency and other clean energy retrofits in buildings received at least USD 23 billion. The power generation sector (which includes energy efficiency and renewables) benefited from at least USD 18 billion. At least USD 63 billion went to more than one of the previous sectors at the same time, and to resource extraction (this group is classified as "multiple sectors" in Figure 4). In the case of resource extraction, clean support includes policies supporting clean resources, such as forestry or the decarbonization of the mining sector.

Figure 4. Structure of new and amended measures of government support by clean energy sector in G20 and 11 other economies in 2020, USD billion.



Source: Based on Energy Policy Tracker, n.d.

Note: The big size of the "Multiple sectors" bar (which includes resources extraction) and the big share of "Multiple energy sources" (red bars) are explained by the fact that many government support packages, while unequivocally framed as "green" and supporting clean energy, do not offer enough detail to differentiate between energy efficiency, various types of renewables, and some other solutions. Furthermore, electric vehicles, public transport, trains, and some other measures included in "Mobility" rely on the use of both clean and fossil energy, while overall decreasing the reliance on the latter—hence also the big share of "Multiple energy sources" for Mobility.

While government support to clean energy is critical for the energy transition, these policies might also have risks.[11] Therefore their implementation should be under appropriate safeguards; otherwise, they will not support a sustainable recovery. From a climate and environmental viewpoint, some of the clean energy policies still have significant climate and environmental impacts. For instance, if powered with coal- or gas-based electricity, electric vehicles (EVs) can contribute to GHG emissions. Large hydropower has a negligible carbon footprint but can damage ecosystems. Moreover, even advanced biofuels can have a significant water footprint (Roundtable on Environmental Health Sciences, Research, and Medicine et al., 2014). According to the Energy Policy Tracker data, these types of policies are grouped into "clean conditional," representing the absolute majority (USD 202 billion, or 78%) of total new government support to clean energy sectors in G20 and 11 other economies in 2020 (USD 259 billion) up to February 2021 (Energy Policy Tracker, n.d.).

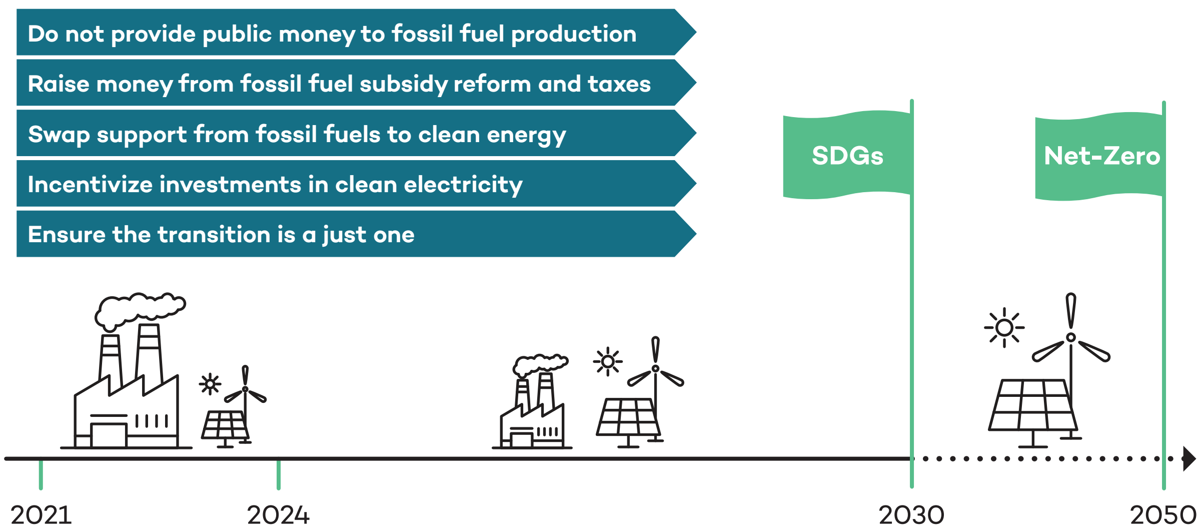
[11] Some other tracking initiatives have tried to capture these cross-cutting effects, such as the forthcoming OECD Green Recovery Database, which assesses the environmental implications of recovery measures across a range of environmental dimensions (OECD, forthcoming).

3.0 Principles for Achieving a Fossil-Free Recovery

The climate crisis is increasingly urgent, and it requires a radical change of our current energy systems as well as a just transition to sustainable and greener economies. The SDGs, due by 2030, define a broad set of areas to achieve this, and energy plays a major role in many of these goals (access to energy, jobs, clean mobility, etc.). At the same time, several countries are aiming to shift their emissions trajectories to reach net-zero, mostly with a target date of 2050 (UNFCCC, n.d.).

The first priority for everyone in the COVID-19 context must be health and social protection, followed by getting economies back on track—but it has to be done in a way that is consistent with the SDGs and net-zero commitments (see Figure 5). While energy commitments related to COVID-19 recovery may be a small share of recovery packages, they will have a significant impact on climate targets (Hepburn et al., 2020). Which sectors are supported will determine outcomes on major sustainable development objectives in areas such as air pollution, climate change, and energy access. However, current recovery commitments in developed and emerging economies are maintaining support for the fossil fuel industry (Energy Policy Tracker, n.d.).

Figure 5. How fossil-free recovery supports the path toward net-zero.



Source: Authors' diagram.

To meet sustainability commitments and objectives, countries must aim for a fossil-free recovery from the COVID-19 crisis: that is, boosting economic recovery and creating jobs via a rapid move to clean energy for all while taking steps toward a just transition away from fossil fuels. Although the situation has changed significantly since the 2009 global financial crisis, its lessons indicate that stimulus packages to clean energy often have advantages over traditional fiscal stimulus in both the short and long terms—for example, in terms of job creation following the crisis and returns for every dollar of expenditure (Hepburn et al., 2020). In contrast, a fossil fuel-powered economic recovery risks creating stranded assets[12] and failure to meet climate targets. To limit global warming to 1.5°C and achieve net-zero emissions by 2050, countries must reduce net emissions by 45% from a 2010 baseline in the next decade (Intergovernmental Panel on Climate Change [IPCC], 2018)—which implies significantly lower fossil fuel use. In addition, pension funds and other financial institutions are currently divesting from fossil fuels. Policies supporting climate change mitigation and reduction of air pollution to improve health are likely to add to this pressure on the fossil fuel industry.

There are five main principles for achieving a fossil-free recovery so that countries can use their energy systems to boost their economies, create employment, and meet their climate goals. We have the following recommendations for ministers of finance and other world leaders:

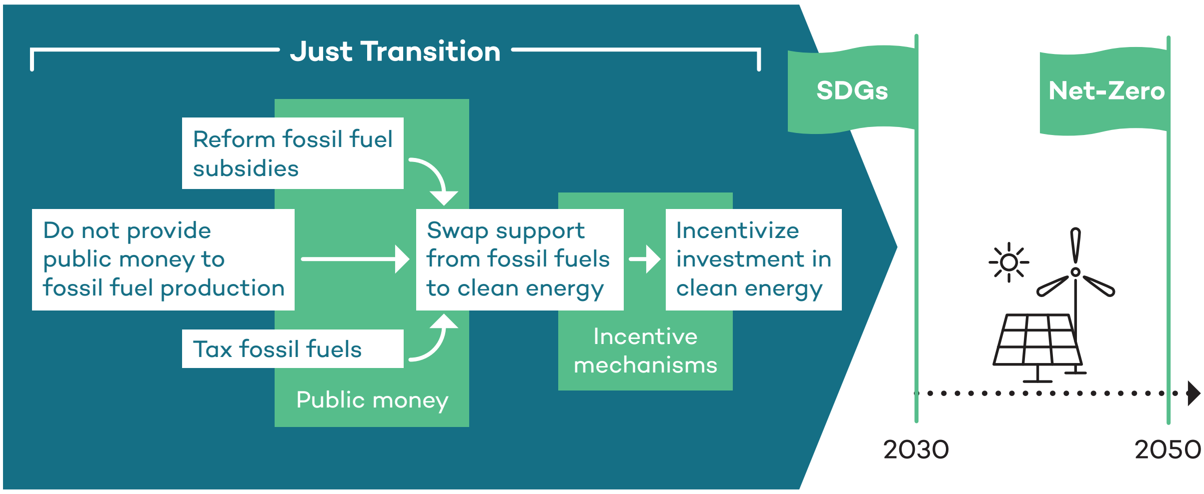
1. Do not provide public money to fossil fuel production.
2. Raise money from fossil fuel subsidy reform and taxes.
3. Swap support from fossil fuels to clean energy.
4. Incentivize investments in clean electricity.
5. Ensure the transition is a just one.

These principles are interlinked (see Figure 6) so that principles 1 and 2 can be implemented in parallel as critical first steps, notably to ensure public money is encouraging sustainable development. The funds saved from fossil fuel subsidy reform and raised from fossil fuel taxation can then be "swapped" to clean energy. As clean energy matures and becomes cost competitive, the role of public support will be to leverage private finance and provide other mechanisms to incentivize investment in clean electricity. All these steps should be done under the just transition framework. Depending on the specific country context, there are different options to apply each of the principles as presented in this report.

This chapter outlines the core ideas underlying these principles. Subsequent chapters delve deeper into why governments should (and how they can) adopt principles 2 to 5, giving practical recommendations on implementation based on international examples.

[12] These are assets that have been devalued well ahead of their anticipated useful life due to policy changes, disruptive innovation, and/or social and environmental conditions.

Figure 6. Principles for a fossil-free recovery



Source: Authors' diagram.

3.1 Do Not Provide Public Money to Fossil Fuel Production

Despite several international commitments and calls to end fossil fuel subsidies, governments worldwide have committed billions of dollars in their COVID-19 recovery packages to finance fossil fuels. Governments from developed and emerging economies committed at least USD 277 billion in support to fossil fuel-intensive sectors in their COVID-19 recovery packages in 2020 alone, which represented at least 47%[13] of the total commitments to the energy sector in that year (Energy Policy Tracker n.d.) (see Chapter 2). This support comes on top of the usual subsidies and other support measures that governments globally offer to the fossil fuel industry. In 2019, government support to the production and consumption of fossil fuels reached at least USD 802 billion through subsidies (direct budgetary transfers, tax expenditure, induced transfers), public finance, and SOE investment (see Appendix I for details). All this support not only gives the wrong signals to the market, but also perpetuates fossil fuels as the main driver of our economies. Some policies that support clean energy (such as subsidies to e-vehicles and large hydropower) might also have risks, as they might still have important climate and environmental impacts, as presented in Chapter 2.

This is happening exactly when we need governments to be taking urgent action to help prevent locking the world into catastrophic climate change. Exploration for and production of fossil fuels (coal, oil, and gas) continue at unsustainable levels globally, as countries plan to produce more than double the amount of fossil fuels in 2030 than would be consistent with a 1.5°C temperature limit (SEI et al., 2020). Offering financial support to fossil

[13] The value for fossil fuel support considers only the quantified policies that explicitly support fossil fuels and fossil fuel-intensive sectors, that is, sectors such as transportation (including airlines), extractive, and heavy industries that depend heavily on fossil fuels. This also includes the power sector when the electricity mix is mostly reliant on fossil fuels. There are other policies—classified as "others"—that also support fossil fuels significantly. These values are the best available estimate by February 28, 2021, according to the Energy Policy Tracker.

fuel producers can aggravate this situation and could result in stranded assets. COVID-19 lockdowns led to an unprecedented decrease in CO2 emissions (IEA, 2020d); however, as the global economy recovers, emissions are expected to bounce back (Tollefson, 2021).

The first step toward net-zero is to ensure that COVID-19 recovery packages do not provide public money to produce fossil fuels. Governments should use recovery packages to support the energy transition. This implies supporting clean energy but also assisting producers of fossil fuel and fossil fuel- intensive sectors in transitioning to a low-carbon future. Recovery should promote low-carbon diversification among fossil fuel producers and fossil fuel-dependent sectors, addressing the impacts on workers and communities and following the just transition principles described in Chapter 7 of this report. Support for fossil fuel-intensive sectors, such as aviation, should only be provided in return for meaningful steps toward reducing emissions and contributing to net-zero commitments.

3.2 Raise Revenue From Fossil Fuel Subsidy Reform and Taxation

As of February 2021, governments worldwide have committed at least USD 14.9 trillion to COVID-19 response and recovery (Vivid Economics, 2021). However, **since the beginning of the crisis, government revenues have shrunk due to reduced economic activity and tax cuts** (OECD, 2020b). The IEA has developed a global recovery plan costing USD 1 trillion per year over the next three years (IEA, 2020i). Government debt and deficits have risen to levels that would have been inconceivable before the pandemic. Debt-to-GDP ratios are expected to rise to 140% of GDP across developed economies (Economist Intelligence Unit, 2020). Developing countries that are already debt constrained need revenue now to fund response and economic stimulus (Estevão, 2020). In the longer term, all countries will need to reduce budget deficits.

Fossil fuel subsidy reform and taxation provide an efficient and effective way to raise government revenue (Estevão, 2020; Sterner, 2007). Government subsidies to fossil fuel consumption totalled at least USD 404 billion per year before the COVID19 crisis (see Chapter 2 and Appendix I for more details). In addition, governments have introduced more support measures to fossil fuels in 2020 (Energy Policy Tracker n.d.). Removing these subsidies can free up significant resources for other public needs. Similarly, increasing the taxation of fossil fuels can generate additional government revenue.

Inefficient fossil fuel subsidy policies heavily favour the rich, and the additional resources from their reform and their taxation can be used for targeted support for the poor and vulnerable. For example, research shows that gasoline subsidies have a regressive nature, with the richest 25% of the population receiving 20 times the subsidy benefit of the poorest 25% (Arze del Granado, et al., 2012). Energy taxes tend to place a much higher cost burden on high-income consumers because they consume more energy. This is particularly true in lower-income countries (Dorband et al., 2019). However, it is important to acknowledge that such taxes would still add some cost burden for the poorest members of society. Directing fossil fuel tax revenues to social safety nets and poverty-eradication programs can achieve progressive outcomes (Pigato & Black, 2018) and support groups affected by COVID-19 crisis .

In addition to improving governments' fiscal positions and allowing for better distribution of public funds, **increasing fossil fuel prices (via fossil fuel subsidy reform or taxes) delivers major co-benefits** by encouraging consumers to lower their use of fossil fuels and promoting investment in energy efficiency and low-carbon technologies (Sterner et al., 2019). This reduces air pollution, GHG emissions, traffic accidents, and vehicle congestion (Parry et al., 2014), with quantifiable benefits to society through lower health costs, higher productivity, and reduced risks (Box 1). The converse is also true: maintaining low fossil fuel prices will further entrench carbon-intensive technologies and their associated social costs (IEA, 2020i). Air pollution is also an important cofactor that increases morbidity from COVID-19 (Wu et al., 2020).

Box 1. Co-benefits of increasing fossil fuel prices

Fossil fuel prices are too low to reflect their costs on society (Coady et al., 2019; OECD, 2020a). The IMF has estimated that the undertaxing of fossil fuels globally costs the world's governments around USD 5 trillion every year in climate change, air pollution, traffic accidents, and vehicle congestion alone (Coady et al., 2019).

Combustion of fossil fuels is the leading cause of outdoor air pollution and climate change (Bruckner et al., 2016; IEA, 2016). Ambient air pollution causes an estimated 4.2 million premature deaths per year globally (WHO, 2018), with costs totalling USD 4.76 trillion in OECD and BRICS (Brazil, Russia, India, China, and South Africa) countries (Roy & Braathen, 2017). According to data from 2017, the annual cost of climate change has been estimated to be between USD 370 billion (Taylor, 2020) and USD 1.3 trillion (IMF, 2018) based on conservative estimates of the social and economic costs of carbon. By 2030, climate change could force 68 million to 138 million people into poverty, more than doubling the 88 million to 115 million people likely to be pushed into poverty due to the COVID-19 pandemic (World Bank, 2020).

Fuel prices are also closely correlated with road accidents, road damage, and vehicle congestion, with costs to society totalling USD 721 billion per year (IMF, 2018). A study of 144 countries found that a 10% increase in pump prices can reduce road fatalities by 3%–6%—therefore, approximately 35,000 road deaths per year could be avoided by the removal of fuel subsidies (Burke & Nishitateno, 2015). Higher fuel prices measurably decrease congestion, which is a significant constraint on productivity in urban areas (Zhang & Burke, 2020).

Fossil fuel taxes are an ideal instrument for reducing climate externalities. Fuel taxes are already the most economically effective climate pricing instrument implemented to date (OECD, 2020a; Sterner, 2007): excise taxes alone resulted in an average carbon price of USD 99 per tonne of CO_2 for gasoline and USD 91 for diesel in 44 OECD and partner economies in 2018 (OECD, 2020a). A carbon price of this level across the entire economy would be within the recommended range to achieve the Paris Agreement (High-Level Commission on Carbon Prices, 2017). Europe's high fuel taxes promoted fuel efficiency and halved its transport emissions relative to the low-taxing United States (Sterner, 2007). Increases to fossil fuel taxes are needed, even in EU countries, to factor in all negative externalities (OECD, 2020a).

For the non-climate externalities, there may be more targeted policy instruments available that should ideally be used. For example, congestion charges have been demonstrated to be effective (Green et al. 2020). Fossil fuel taxes, while they do have a significant impact on non-climate externalities, are often a rather crude instrument. Taxes should be tailored to the externality they are intended to address.

Reforming consumption subsidies and implementing a modest energy tax increase for priority fossil fuels can raise around USD 553 billion per year,[14] which can generate funds to support a fossil-free recovery while meeting the SDGs and net-zero commitments. Chapter 4 describes in detail how to do this. Subsequent chapters discuss some ways these revenues could be reallocated to ensure progressive outcomes following the principles outlined in the next sections.

3.3 Swap Support Toward Clean and Inclusive Energy

Governments can use funds raised from fossil fuel taxation and public budget savings from fossil fuel subsidy reform to support other development purposes, including clean energy forms that have significant potential to support a fossil-free recovery. This concept is called **"swap,"** and in this context is **defined as any shift in public funds from fossil fuels to clean energy.** It includes revenues linked to fossil fuel subsidies and taxation while aligning fiscal and energy policies with environmental and social priorities. In the context of this report, swaps consist of the following principles:

- Fossil fuel subsidies are reduced or fossil fuels are increasingly taxed where possible to liberate fiscal space or generate additional resources
- Negative social impacts are addressed by targeted allocations
- A share of freed-up revenue is reallocated to clean energy and to accelerating the energy transition

These principles are intended to guide policy-makers as they reform energy systems, particularly in response to the COVID-19 crisis. They provide a useful lens to examine proposed energy policies and support areas in both developed and developing countries, helping to prevent the lock-in of fossil fuels.

Swaps must be designed to support the most pressing areas and those with the greatest impact for achieving the SDGs and net-zero commitments—increasing access to clean energy, supporting energy efficiency, investing in the power sector, and transitioning to clean forms of transport. These measures offer the best balance between the core priorities of improving energy and environmental sustainability, boosting economic growth, and addressing social aspects of transitions (as they pertain to workers, employers,

[14] Priority fuels include coal, diesel and gasoline. See Appendix II for details on coverage and the methodology applied.

and communities). They are aligned with the international best practices to build back better (UNEP 2021) and will be further explored in Chapter 5.

3.4 Incentivize Investment in Clean Energy

Electricity is expected to be the backbone of the energy transition because the move away from fossil fuels will imply electrifying many sectors that are today fossil fuel-dependent. Clean power generation will be key to achieving net-zero commitments, and to achieve that, renewable energy investment worldwide will have to be 3.6 times higher by 2030 compared to 2020 (Bloomberg New Energy Finance [BNEF], 2020a; IEA, 2020k).

As renewable energy technologies mature, they become increasingly attractive to private investors and can become an engine for a fossil-free recovery, creating new jobs and economic growth. Clean energy has already become more competitive than fossil fuels in many sectors and jurisdictions without any subsidies (Lazard, 2020). However, there are still situations in which renewable energy project developers and investors face roadblocks.

In this case, the aim of government support to clean energy should be stimulating its development where the incumbent fossil fuel industries still have the advantage and not making clean energy permanently reliant on government support. This can be done by mobilizing public finance to leverage private investments. There are several ways that governments can incentivize private investment in renewable energy depending on specific contexts and existing regulations. Chapter 6 proposes three ways that governments can favour investment in renewable energy: by defining supporting policies and measures, by using public finance institutions (PFIs), and by influencing SOEs.

3.5 Ensure the Transition Is a Just One

Achieving the net-zero commitments following the principles expressed in this report is not expected to be easy, and even less so in the COVID-19 context. A just transition will be essential for countries to move away from fossil fuels and achieve a fossil-free recovery, whereby impacts on workers are addressed, clean energy is expanded, and the needs of the most vulnerable are not only considered but included in a more affordable, reliable, and environmentally sustainable economy. A transition is inevitable and is indeed already under way, driven by the need to address climate change and factors such as the accelerating economic competitiveness of clean energy and increased efforts to move toward "polluter-pays" systems.

At their most fundamental level, energy transitions are about people and communities (Zinecker et al., 2018). The social aspects of energy transitions must be carefully considered so that risks for affected workers, employers, communities, and other stakeholders are minimized and mitigated. Energy transitions also create opportunities to develop fairer, more inclusive societies through innovative ways of doing business and economic development (Beedell & Corkal, 2021). The concept should be applied broadly to the production of fossil fuels but also industries based on fossil fuels (such as the transport sector) and even SOEs.

The just transition offers a "how" of fossil-free recovery—the process to achieve the SDGs and net-zero commitments in an inclusive manner. It offers a model approach to ensure there is a negotiated plan based on social dialogue with affected worker and employer organizations and engagement with consumers in affected local communities. This is not easy but can provide for lasting positive outcomes. The process foregrounds social and environmental imperatives alongside economic concerns by setting out measures to create decent employment and provide social protection. This will be further explored in Chapter 7.

4.0 Taxation and Fossil Fuel Subsidy Reform

Fossil fuel subsidy reform and taxation are efficient and effective ways to raise revenue for the post-pandemic recovery and the transition to net-zero. Phasing out fossil fuel subsidies would generate revenues of 468 billion per year (based on 2019 data for the 81 economies covered by the IEA–OECD, see Appendix I). Fossil fuels could also be taxed at levels that reflect their full negative externalities (see Box 1, Chapter 3.2), whose cost is estimated at around USD 5 trillion per year (Coady et al., 2019) and that could be converted to revenues if taxed accordingly.

This chapter recommends several priorities for fossil fuel subsidy and tax reform in the context of the COVID-19 recovery as the first step toward longer-term energy pricing goals. A staged approach recognizes the political economy and energy access challenges associated with increasing energy prices. **We recommend eliminating consumer subsidies for gasoline, diesel, and thermal coal and modest tax increases for these fuels.** While this will not be easy, it is relatively "low-hanging fruit". These fuels are widely used, and there is scope to raise their prices to better reflect their societal cost. Such reforms would be easy to administrate, generate significant revenues, and have a positive impact on human health and the environment (OECD, 2021). Together, oil and coal represent around 79% of total GHG emissions from fuel combustion (Bruckner et al., 2016) and are responsible for the majority of outdoor air pollution (IEA, 2016).

This does not imply that reform of producer subsidies and price reform for other fuels is not urgently needed and may be a higher priority for some countries. Consumer subsidies and taxes are prioritized because all countries consume fossil fuels, while fewer produce them. In addition, price increases beyond eliminating subsidies incorporate negative externalities (see Chapter 3.2.) and send a signal to consumers to reduce use. Immediate elimination of electricity and liquefied petroleum gas (LPG) subsidies is not recommended because they can be important for energy access for the poor: rapid price increases could cause energy poverty and a switch to more-polluting fuels (such as biomass or kerosene). Ideally, energy subsidies would be replaced with measures that are not conditional on fossil fuel use to support the purchasing power of vulnerable groups. Where that is not feasible, efforts should be undertaken to improve the targeting of electricity and LPG subsidies, which would protect the poor while reducing revenue losses, ensuring the viability of utilities and sending price signals that encourage energy efficiency among better-off consumers (Zinecker et al., 2018). There are strategies that governments can apply to achieve these goals (see Chapter 5.1).

Natural gas is not examined in detail because there is little transparent information available to assess subsidy levels in many gas developments around the world. Nonetheless, independent analysis from specific jurisdictions—for example, British Columbia in Canada (Corkal & Gass, 2019)—indicates that many gas developments currently benefit from strong government support measures (see Box 2). As with other fossil fuels, gas consumption should also reflect the cost of negative externalities (see Box 1).

Subsidies to consumption of fossil fuels totalled over 404 billion in 2019, of which gasoline, diesel, and thermal coal represented at least USD 123 billion. In addition, modest tax increases of USD 0.125 per litre on gasoline and diesel and USD 5 per tonne[15] on coal would generate around USD 430 billion, based on 2019 global consumption and prices (see Appendix II). The taxes would result in a carbon tax price of around USD 40 per tonne CO_2 for gasoline and diesel and USD 2 per tonne CO_2 for coal.[16] These tax levels were chosen to illustrate that a small increase could raise significant revenue and are not based on the cost of negative externalities or other factors. **The approach of selected fossil fuel subsidy reform and modest taxation would raise significant revenues—roughly USD 553 billion per year** (Table 1; Appendix II).

The tax revenue alone (around USD 430 billion) could double the post-pandemic stimulus spending on clean energy sectors (USD 207 billion) by the G20 and 11 other major economies. This means doubling public investments in public transport, renewable energy, EVs, and energy efficiency, on top of existing investments, with a potential to accelerate the clean energy transition. Those funds should also be used to shelter the poor from higher energy prices and facilitate a just transition.

Table 1. Mobilizing government revenue potential of selected fossil fuels, USD billion (2019 data)

	Consumer subsidy elimination*	Tax increase**	Total
Gasoline & diesel	115	400	515
Coal	8	30	38
Total	**123**	**430**	**553**

Notes:
* Calculated from OECD and IEA subsidy data, available for 77 countries for gasoline and diesel, and 81 countries for coal. Numbers have been rounded to reflect the approximate nature of the estimates. See Appendix II for details.
** Tax estimate: USD 0.125 per litre on gasoline and diesel, and USD 5 per tonne on coal. Based on global consumption data. Numbers have been rounded. See Appendix II for details.
Sources: See Appendix II.

Consumer taxes on gasoline, diesel, and coal are among the easiest to collect and are difficult to evade (OECD, 2020a; Parry, 2019). They broaden the tax base and capture revenues from the informal sector, with fewer impacts on employment and output than labour and company taxes (Heine & Black, 2019). Taxes on consumption can also be designed in a way that puts a higher burden on wealthier fossil fuel consumers (Chancel, 2020). Nonetheless, increased fossil fuel consumer prices would also add a cost burden for the poorest members of society. Given the terrible impacts of COVID-19 on livelihoods

[15] A USD 5 per tonne tax for coal is similar to the rate of India's GST Compensation Cess (INR 400, or USD 5.7 per tonne) (Garg et al., 2020).

[16] Based on average emissions of 3 kilograms (kg) CO_2/L gasoline and diesel (Schlömer et al. 2014) and 2.536 kg CO_2 per kg for coal (anthracite) (Freund et al., 2005) (Appendix II).

and the ability of people to meet their basic needs, additional revenues from fossil fuels should be directed to social safety nets and poverty eradication programs, in order to ensure progressive outcomes (Pigato & Black, 2018).

For most countries, increasing existing consumer taxes (such as excise or value-added taxes [VAT]) will be administratively easier than a new tax because they are already part of most countries' tax systems. Revenues could instead be harnessed through a fossil fuel-specific carbon tax. A global carbon tax on fossil fuels averaging USD 70 per tonne CO_2[17] would raise revenue equal to 1%–3% of GDP in most countries and 2%–4% of GDP in major developing economies (Parry, 2019). However, a new and explicit carbon tax on fuel can be politically sensitive and require new legislation to enact, so the choice of instrument should reflect different country circumstances.

Government actions that lower energy prices below market values are a blunt instrument, appropriated by those who consume the most energy, not necessarily those with the highest economic growth potential or welfare needs. Instead, low international fuel prices can be captured by governments through fuel-related taxation and the revenues put to more strategic and productive uses: job creation, infrastructure investments, productivity improvements, reducing taxes that distort economic activity, and wealth redistribution, including essential public services, social safety nets and measures to protect the poor and vulnerable from higher energy prices (Estevão, 2020). For example, removing all energy subsidies in Ecuador could fund an increase in the national cash transfer program of nearly USD 50 per month, which would increase the incomes of the poorest quintile by 10%, and leave more than USD 1.3 billion for other public spending (Schaffitzel et al., 2020).

Fossil fuel taxes and increased revenue from subsidy reform should be viewed as a temporary revenue source. Efficient pricing of fossil fuels (incorporating their negative externalities) will result in a decrease in demand for fossil fuels over the longer term that can affect the revenue base for the governments in two ways: through a drop in fossil fuel prices (affecting revenues for fossil fuel-exporting countries, as well as ad valorem tax revenues) and through the shrinkage of absolute amounts of fossil fuel production and consumption (Gerasimchuk et al., 2019). Governments should not remain dependent on fossil fuel revenues, lest this disincentivize phasing them out. However, fossil fuel taxation should gradually increase to maintain the incentive for consumers and investors to change behaviour and to maintain tax revenues. Over time, revenue streams should be broadened and diversified as fossil fuel consumption declines.

[17] A global carbon price of USD 40–80 per tonne CO_2 in 2020 and USD 50–100 per tonne CO2 by 2030 is estimated as needed to achieve the Paris Agreement (High-Level Commission on Carbon Prices, 2017).

Box 2. The role of natural gas in the energy transition

Since the 1980s, some companies and commentators have argued that, being "cleaner" than other fossil fuels, natural gas can be part of the solution to climate change (Hamilton, 1988; IEA, 2019a). Today, many governments continue to provide fiscal and regulatory support for expansion of gas production and use, including as part of COVID-19 recovery packages (Energy Policy Tracker, n.d.).

For example, Russia has doubled the subsidy for converting vehicles to gas engines to 60% of retrofitting costs, with state-owned Gazprom covering a further 30% (Government of Russia, 2020; Kommersant, 2020). Australia released a strategy for a "gas-fired recovery" including government funding to help unlock new gas basins and flagging significant government investment in gas infrastructure if the private sector does not invest (Prime Minister of Australia, 2020). The U.S. state of Pennsylvania has introduced a new tax credit worth USD 600 million for petrochemicals plants using gas (Pennsylvania General Assembly, 2020). Argentina plans to dedicate 25% of funds raised from its COVID-19 recovery tax on the wealthiest individuals to supporting gas exploration and extraction (Government of Argentina, 2020). Before the pandemic, governments of 81 major economies dedicated at least USD 62 billion in subsidies to gas production and consumption in 2019 (Fossil Fuel Subsidy Tracker, n.d.). According to the Energy Policy Tracker, since the beginning of the pandemic in early 2020, countries have committed at least USD 11.78 billion[18] to support gas and gas products through new or amended policies (Energy Policy Tracker, n.d.). However, it is difficult to fully quantify global support for gas since its production often cannot be disaggregated from oil.

Today, investments in gas production and consumption facilities are looking increasingly financially risky. While gas prices are currently low, which might seem like good news for importers, the global energy transition will likely be characterized by highly unstable prices, as supply and demand are often unbalanced due to rapidly changing energy markets. In this respect, the uncertainties around the future of gas can cost dearly if gas assets become stranded due to global climate action and competition from cheaper alternatives or if countries become more dependent on gas imports and prices rise. Energy security aspects, common to all fossil fuels, also have to be taken into account, as they can create additional burdens and risks for countries and consumers that depend on fuel imports.

While burning gas emits less CO_2 than coal or oil at the point of combustion, life-cycle emissions are less clear, because all gas systems leak methane—one of the most potent GHGs. In some cases, methane has been shown to leak to the extent that the overall climate impact of gas is as bad as that of coal (Howarth, 2015). Furthermore, additional gas tends to displace clean energy as well as coal (McJeon et al., 2014; Shearer et al., 2014). As such, there may be little or no environmental benefit from switching to gas.

As climate impacts worsen, it is clear that the world must decarbonize as quickly as possible. A key question for gas, then, is the availability of alternatives. Natural gas is used primarily for power generation, in industry (for heat and feedstocks) and

[18] Value as of February 28, 2021.

in buildings (for heating and cooking). A smaller portion is used in transport as an alternative to gasoline, often in municipal fleets.

In power generation, which accounts for more than a third of global gas use, clean alternatives are readily available, and in most countries wind and solar generate power at lower cost than gas (BNEF, 2020b). Battery costs, too, are falling rapidly, and in some countries the combined cost of wind or solar plus storage is less than that of gas "peaker" plants (BNEF, 2020b). Meanwhile, the more efficient combined cycle gas turbine plants are often uneconomic when used to balance the system rather than the baseload they are designed for (Stockman et al., 2019). The majority of IPCC scenarios therefore see power generation completely decarbonized by mid-century: there is little or no role for gas power after 2050 in a 1.5°C or 2°C world (IPCC, 2018).

In lighter industry, electric alternatives to gas are commercially available for most purposes, including induction, resistance, infrared, and microwaves for low temperatures, and electric boilers up to about 300°C (Honoré, 2019). For heavy industry, solutions are more nascent, but the technological frontier is advancing fast, especially with growing ambition on green hydrogen (IRENA, 2020b; Philibert, 2017) (see Box 13 in Chapter 5.4) or alternative fuels with lower CO_2 emissions (such as biomass or waste).

With decarbonized alternatives cheaper than gas for the majority of uses—and costs expected to fall below those of gas in the coming years for most other uses—public support for gas risks undermining achievement of the Paris goals. New infrastructure such as power plants, factories, pipelines, and LNG terminals commonly last for 40 or more years and will impede decarbonization due to the problem of carbon lock-in, even as the alternatives become cheaper (Seto et al., 2016; Unruh, 2000). Public support should instead be focused on enabling alternative technologies in the areas where they are not yet competitive with gas.

4.1 Gasoline and Diesel Consumption Subsidies and Taxes

All countries subsidize or tax transport fuels, often both concurrently.[19] A global survey in November 2018, when oil prices were USD 65 per barrel, found that approximately 30% of countries provided price subsidies for gasoline, 46% levied low to moderate taxes, and 24% levied high taxes (Deutsche Gesellschaft für Internationale Zusammenarbeit [GIZ], 2019). Diesel is generally taxed at a lower rate than gasoline. Despite growing concern about climate change, average fuel taxes and subsidies remained largely unchanged at the global level between 2003 and 2015 (Mahdavi et al., 2020).[20] Countries are more likely to subsidize if they are oil exporters and more likely to tax if they are wealthy, but not this is not always the case (Mahdavi et al., 2020). Revenue needs, individual country circumstances, and leadership play a role, indicating that countries can reform prices under the right circumstances.

[19] Some countries fix the retail prices at levels below the international market price of fuel but still levy a tax. Other countries levy net taxes but provide subsidies to specific sectors, such as primary industries (Laan et al., 2021).

[20] Based data from 157 countries between 2003 and 2015 (Mahdavi et al., 2020).

4.1.1 Subsidies

In 2019, subsidies to gasoline and diesel amounted to over USD 115 billion across 77 countries covered by the OECD and IEA data (see Appendix II). These subsidies will be lower in 2020 given the fall in international oil prices and decreased demand, but might reemerge as international prices recover. While low international oil prices result in lower subsidy costs, reducing government incentives for reform, they also present a valuable opportunity to permanently eliminate subsidies. To avoid backsliding into price subsidies once international prices go up again, governments need to put in place independent price setting mechanisms. Introducing price smoothing mechanisms can also help the transition to market prices by reducing volatility (Laan & McCulloch, 2019).

Despite the highly regressive nature of gasoline and diesel subsidies (Arze del Granado et al., 2012), higher energy prices affect all social classes due to their inflationary effects. Therefore, alternative means to assist the poor when energy prices rise also have to be put in place. These social policies can be funded by the revenues from subsidy reform, which would also assist the poor affected by the pandemic.

4.1.2 Taxes

Fuel taxes are a common means of raising revenue (OECD, 2020b) and an effective mechanism for combating climate change and reflecting the cost of other externalities (Box 1). On average, per-litre gasoline taxes rose by 2% per year between 2003 and 2015 (Mahdavi et al., 2020). However, because consumption fell in countries with high taxes and rose in those with low taxes, the effective level of fuel tax fell by over 5% globally.

Even a modest rise in fuel taxes can deliver substantial revenue. As mentioned above, **a tax of USD 0.125 per litre on gasoline and diesel could generate over USD 1 billion per day globally** (Appendix II). To our knowledge, Costa Rica, India, and the Philippines are the only countries to have raised fuel taxes to fund the pandemic response (Box 3). India's excise hikes raised USD 19.4 billion over 9 months, equivalent to 7% of the Atma Nirbhar Bharat special economic and comprehensive package, which in turn was equivalent to 10% of GDP.[21]

[21] Authors' estimates based on PPAC consumption data for gasoline (petrol) and diesel over 9 months, from April to December, 2020 (PPAC, 2020).

Box 3. Taxing transport fuels to fund COVID-19 recovery efforts

When international oil prices fell in March 2020, India and Costa Rica adjusted domestic fuel prices with the explicit purpose of raising funds for their respective COVID-19 responses.

India increased excise on gasoline and diesel twice: INR 3 (USD 0.04) per litre for both in March 2020 and INR 10 (USD 0.13) per litre for gasoline and INR 13 (USD 0.17) per litre for diesel in May 2020 (Gupta, 2020; PTI, 2020). Several state governments also increased their VATs. These hikes were equivalent to a 65% and 101% increase in excise for gasoline and diesel, respectively, and generated additional revenue of INR 1,41,580 crore (USD 19.4 billion) over April–December 2020, despite the drop in total fuel consumption.[22] The central government announced that the excise increase would be used to cover the revenue shortfall caused by the pandemic and support the INR 20 lakh crore (USD 274 billion, or 10% of GDP) Atma Nirbhar Bharat special economic and comprehensive package (Government of India, 2020). In the 2021 union budget, the revised tax revenue estimates were down 18%, or INR 2.9 lakh crore (USD 39 billion) (Government of India, 2021).

Despite fuel demand bouncing back to pre-COVID-19 levels, the Minister for Petroleum and Natural Gas announced that there are no plans to reduce the taxes (ET EnergyWorld, 2021). The slump in global crude oil prices initially enabled the government to raise taxes without substantially increasing domestic prices for consumers. However, with rising international oil prices, India's oil marketing companies have passed on the costs to consumers, resulting in retail prices rising 20% for gasoline and 19% for diesel between April and December 2020.[23]

Costa Rica responded to the price drop by adjusting its fuel pricing mechanism for superior and regular variants of gasoline (RECOPE, 2020). In April 2020, a decree was passed to create a subsidy for protection of workers affected by the national lockdown (SCIJ, 2020). This subsidy was supported by a new component in the fuel pricing formula over a period of three months (a COVID levy). The levy was equivalent to the international oil price drop, which effectively set a floor price of CRC 580 (USD 0.96) for superior and CRC 555 (USD 0.92) for regular gasoline (Gustavo Delgado, 2020). The levy raised CRC 15.2 billion (USD 25.9 million)[24] between April 28 and July 16, 2020. This could have been significantly higher if the levy had been kept in place for the full period in which international oil prices were below pre-pandemic levels.

The **Philippines** imposed a temporary import tax on crude oil and petroleum products between May 5 and June 24, 2020, with the revenues dedicated to the COVID-19 response (Gita-Carlos, 2020; PortCalls Asia 2020). By June 16, the tax increase was reported to have raised PHP 1.49 billion (USD 31 million) in additional revenues (de Vera 2020).

[22] Authors' estimates based on PPAC consumption data for gasoline (petrol) and diesel over 9 months, from April to December, 2020 (PPAC, 2020).

[23] Authors' estimates based on PPAC retail selling prices in Delhi for gasoline and diesel over 9 months, from April to December, 2020 (PPAC, 2021). The retail prices vary across the country depending on the VAT imposed by the state government.

[24] Authors' estimates based on volumes of sale for regular and superior gasoline for the period for which the subsidy was in effect (RECOPE, 2020).

4.2 Coal Consumption Subsidies and Taxes

The growth in new coal-fired power plant investments is slowing at the global level, with reductions particularly visible in the United States and Europe (IEA, 2020k; Jakob et al., 2020).[25] The increasing cost competitiveness of renewables and natural gas, pollution and health concerns, divestment by the financial sector, and rising mining costs have all contributed to a downturn in coal supply and demand in many countries (Gençsü et al., 2019). Coal demand has fallen even more sharply since the onset of the COVID-19 pandemic in response to consumption decreases due to lockdown measures in developing and developed countries alike (IEA, 2020i). Some countries, however, are still opening new coal mines and adding new coal-fired electricity generation to existing capacity. This is striking, given that coal is the most polluting fossil fuel in terms of both air pollutants and carbon emissions.

4.2.1 Subsidies

In 2019, **global coal consumption subsidies[26] were worth at least USD 8 billion**, remaining fairly constant over the past decade. The true figure could be considerably higher, given that coal subsidies are often provided in ways that are hard to quantify, such as below-market access to credit, land, and water; dedicated infrastructure; and non-enforcement of social and environmental regulations. While quantifiable subsidies for coal are modest relative to gasoline and diesel, post-tax subsidies are huge: t**he global health and climate costs of coal are estimated at USD 2 trillion** (Coady et al., 2019). When considering negative externalities linked to global warming and air pollution, the IMF considers that coal subsidies are higher than for all other fossil fuels (Coady et al., 2019).

In addition, **coal has received significant post-COVID-19 support** in countries such as India and China. India has committed to major coal infrastructure investments and rolled back environmental norms (Energy Policy Tracker, n.d.), while China has accelerated the permitting of coal-fired power plants and plans to spend USD 90 billion for coal-to-chemical projects in 2020 (Myllyvirta & Li, 2020). Countries like China, India, Indonesia, Mexico, Russia, and South Africa provide cheap domestically sourced coal to assist the supply of subsidized electricity for households (Gençsü et al., 2019). This perpetuates the use of coal in addition to ignoring the full cost of coal to people and the environment.

Other coal consumption subsidies include the free allocation of emission permits under emission trading schemes (such as the EU Emissions Trading System [ETS], now for coking coal only), motivated by industry competitiveness concerns and to avoid carbon leakage (Gençsü et al., 2019). In practice, this has translated into large support for coal and other fossil fuels, as there is little evidence of competitiveness impacts or carbon leakage (Carbon Market Watch, 2019). Higher carbon prices could increase these risks, but alternatives to free allocation policies are available including carbon border adjustments and consumption charges (OECD, 2020c).

[25] This is the case at the global level, but increases are noticeable in China, India, and other Asian countries.

[26] This includes both IEA price gap and OECD bottom-up support estimates, see Appendix II for the methodology applied.

Subsidies to coal undermine the accurate pricing of coal to reflect its negative health and climate impacts and reduce the amount of government revenues available to ensure a timely and just coal transition. They also lock down investment that could go instead to renewable energy sources. Some positive examples of reform exist at the EU level, where in 2010 state aid rules called for the phasing out of subsidies to hard coal mining by 2018 (Gerasimchuk et al., 2018). This, in turn, led to a significant reduction and phasing out of subsidies to hard coal mining in several member states, including Germany and Spain (IEA & OECD, 2019). In Germany, the 2038 coal phase-out plan has also meant a shift in coal subsidies: instead of sustaining lignite power plants' activities, they are now designed to support the phase-out of coal and the shutdown of plants[27] (Energy Policy Tracker, n.d.).

Phasing out subsidies to coal would not only free up significant public funds, but also reduce the cost of externalities and level out the playing field for clean energy forms. Impacts on the coal industry should be considered under a just transition approach (see Chapter 7).

4.2.2 Taxes

In most countries, coal is currently taxed at very low rates, if at all (Coady et al., 2019). Coal has the lowest effective carbon tax rate of all fossil fuels[28] among 44 OECD countries and partner economies: USD 0.81/t of CO_2 compared to USD 96/t of CO_2 for gasoline (OECD, 2019). The IMF estimates that in 2015 country-level coal prices were well below half their efficient levels (i.e., the price that would reflect negative externalities) (Coady et al., 2019). Taxing coal can incorporate its social costs and shift private sector investment to cleaner alternatives.

A coal tax could also raise significant revenue for COVID-19 response, fund a just energy transition (preparing the phase-out of the sector as needed), and cover any associated health and environmental liabilities (for example, miner's black lung disease or environmental liabilities associated with mines and wells). **A global tax on coal consumption of USD 5/tonne could raise around USD 30 billion per year**, with an equivalent carbon price of USD 2 per tonne CO_2 (Appendix II).

Coal taxes are unpopular, but this can change when the revenues are disbursed transparently and reinvested in local communities. In the Appalachian region of the United States, an excise tax on coal production used to fight against black lung disease has received continuous support from workers, despite industry calls to reduce the tax amid the COVID-19 crisis (Englund, 2020). China's USD 14.5 billion Industrial Special Fund protects coal and steel workers from overcapacity cuts and is partially funded through surcharges on coal-fired power (Bridle et al., 2017). Coal taxation can also be a means of supporting the integration of intermittent renewable energy or increasing energy security, as India and the Philippines have done (Box 4).

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[27] See also text Box 19 in Chapter 7 for more information on the German coal phase-out process.

[28] The OECD defines effective carbon rates as the sum of fuel excise taxes and explicit carbon taxes (OECD, 2019).

Coal taxation poses significant political economy challenges:[29] Resistance to higher taxes on coal can come from workers, communities, and vested interests reliant on coal; the desire to supply cheap coal to keep electricity prices low; and established systems and assets that do not readily accommodate a shift to alternatives in response to price changes. In Vietnam, coal has persisted not so much for economic reasons but due to vested interests, a regulated electricity market, and SOEs that all favour coal (Dorband et al., 2020). Vietnam increased its environmental protection tax on coal (USD 1.3/t for anthracite and USD 0.6/t for lignite), yet these tax rates are still perceived as too low to have an impact on electricity sector decisions (Dorband et al., 2020). Ensuring a just transition for coal workers and communities (see Chapter 7) provides a viable solution to overcoming these challenges, together with the key principles for energy pricing reform mentioned in the following section.

As with taxes on other fossil fuels, **governments must also not become dependent on coal tax revenue.** In 2014, China reformed its coal resource tax to an ad-valorem model, and there are now concerns that rising coal prices (and therefore revenues) in the past created an incentive for local governments to keep coal mines open longer (Kuhne & Roth, 2019). Support for reform can be generated by widely publicizing the negative impacts of coal, the merits of clean alternatives, and a strategy for its managed decline.

Box 4. Taxing coal to fund clean energy in India and energy security in the Philippines

Coal production and consumption play an important role in India and the Philippines, but both countries have implemented coal taxes in recent years.

India's cess (tax) on coal production was put in place in 2010, when around 30% of the revenues were channelled to a National Clean Energy and Environment Fund that supported projects including renewable energy (Shakti Sustainable Energy Foundation & Ernst and Young, 2018). In 2017, the cess revenue was redirected to states to compensate for possible losses arising from the introduction of a goods and services tax (GST). Currently standing at about USD 5.4/tonne of coal produced or imported (or a carbon tax equivalent of about USD 2/tonne of CO_2; see Appendix II), the cess is a significant source of revenue, with USD 3.72 billion collected in 2019 (Garg et al., 2020; Gerasimchuk et al., 2018). India also provides coal subsidies totalling USD 2.3 billion in 2019, derived mainly from a GST that is lower than most other minerals (Garg et al., 2020).

The **Philippines** imports 80% of its coal and recently increased coal taxes with the aim of improving energy security (Ahmed & Logarta, 2017). In 2018, increases in the coal excise were phased in (from USD 0.2/tonne to USD 3/tonne in 2020) as part of a broader fiscal reform package (Castillo et al., 2018). A higher excise is expected to curb imports, reduce the trade deficit (which reached USD 35 billion in 2019, of which coal represents 7%) and lower electricity prices by encouraging diversification into lower-cost renewables (Ahmed, 2020). The electricity price was not affected because

[29] While it is beyond the scope of this chapter to list all challenges to coal taxation, some other noteworthy ones include the underpricing of coal, which limits the revenue raising possibility of taxation, along with other institutional and political barriers such as distrust in government, lower administrative taxation capacity, and a lack of information and awareness about the costs and benefits of taxation (Withana, 2015; IGF, 2020).

generators cannot pass the excise on to consumers (Ahmed, 2017). In October 2020, the government announced a temporary moratorium on new coal power plants that is expected to result in the scrapping of at least 8 GW of planned projects (Farand, 2020).

The Philippines' tax package was accompanied by social compensation measures, including a cash transfer scheme for lower-income groups and a reduction in personal income taxes. Economic modelling projected that the measures would increase employment in the agricultural sector and service sectors, despite drops in the mining and oil and gas sectors (Castillo et al., 2018). Projected impacts on poverty were marginal, with even a decrease in poverty of more than 8% among transport workers. However, inflation increased slightly since the reform and not all cash transfers were disbursed on time (Esguerra, 2018). To be a truly effective mitigation tool, such coal taxes should be accompanied by fiscal and regulatory measures to ensure that coal plants comply with air and water pollution regulations.

4.3 Higher Taxes Mean Higher Energy Prices: How can this be done in a socially responsible way?

Economic crises are hard, but they can be a powerful catalyst for change. In response to a major banking crisis and recession in the early 1990s, several Nordic countries pioneered the use of carbon and pollution taxes to raise revenue for the economic recovery (Roth & Laan, 2020). Contrary to arguments against energy taxation, these measures did not cause an economic slump. The Nordics thrived. By the end of the 1990s, all Nordic countries had turned their budget deficits into surpluses and significantly reduced their unemployment rates (Kangas & Palme, 2005).

A growing body of research highlights the positive consequences of energy taxation, as experienced by the Nordics. In developed countries, carbon taxes have been observed to have neutral or positive impacts on employment and output (Heine & Black, 2019). This is partially because revenues are frequently used to reduce taxes that hinder growth, such as income taxes that can be a disincentive for additional work or investment (Withana, 2015). Developing countries with a narrow tax base (which creates distortions and strong incentives for evasion) particularly benefit from broadening the tax base and reducing formal-sector taxes (Heine & Black, 2019). General equilibrium modelling on the U.S. economy suggests complex positive effects: carbon taxes cause a shift from capital-intensive fossil fuel investments to labour, increasing employment, and generating net progressive impacts, which are likely to occur in all countries (Goulder et al., 2018). Redistribution of energy taxes (such as tax swaps and cash transfers) improves macroeconomic and equity outcomes as well as public acceptance of reform.

Price increases caused by subsidy removal and increased fossil fuel taxation create groups that stand to lose out, but targeted measures can be developed to compensate those groups according to their needs. Attempts to increase gasoline prices resulted in protests in at least 24 countries between 2006 and 2019 (Mahdavi et al., 2020). However, change is clearly possible: at least 53 countries implemented some kind of fossil fuel consumer subsidy reform or increased taxes on fossil fuels between 2015 and 2020 (Sanchez et al., 2020). Measures have to be developed—drawing on the principles of a just transition—to protect groups that cannot afford to pay higher prices for energy and workers. Case studies reveal that reforms have a higher chance of success if there is a clear plan to use revenues to provide tangible alternative benefits for average people, built on inclusive and meaningful consultation and communication (Beaton et al., 2013; Clements & IMF, 2013). Public trust and confidence that revenues will be well spent must also be fostered through improved transparency, accountability, and governance (Custers et al., 2020). Earmarking funds for specific purposes can also improve public acceptance, such as reducing distorting taxes, cash transfer schemes, rural infrastructure development, and a just transition (Hagem et al., 2020; Kallbekken & Saelen, 2011; Sterner et al., 2020). Earmarking funds to support clean energy alternatives, including energy access, are also possible and will be discussed in Chapter 5.

Subsidies should be phased out and higher taxes phased in while international prices are low. Also, a well-planned and phased approach gives time for consultation and communication to reduce political backlash. Time is needed to identify the most productive and progressive options for spending and to put in place the governance mechanisms necessary to ensure funds are well spent. A gradual approach to phase out subsidies should be accompanied by an unequivocal commitment by governments to higher fossil fuel prices.

4.4 Conclusions and Recommendations

Price reform for fossil fuels represents a major opportunity for building back better. Fossil fuels are priced too low to reflect their costs to society. At the same time, governments need revenue to respond to the pandemic. Consumer fossil fuel taxes are a particularly good option, being broad based, inelastic in the short term, and founded in the polluter-pays principle.

By reforming subsidies to the consumption of gasoline, diesel, and coal, and implementing modest tax increases on these fuels, USD 553 billion could be generated per year globally in revenue while reducing negative externalities, which includes costs to governments such as health care. This would be a first step in graduating toward the pricing of fossil fuels that has been recommended by the IMF, which is based on a higher tax that reflects the costs to society of air pollution, GHG emissions, traffic accidents, road damage, and traffic congestion. Such a level of taxation could eventually raise around USD 5 trillion per year (Coady et al., 2019), if designed according to the estimated costs to society. Similarly, producer taxes should be increased to—at a minimum—incorporate legacy and cleanup costs.

Environmental taxes are, by design, a declining source of revenue. As fossil fuel prices rise, consumer behaviour and technological developments will lead to a fall in excise and other tax revenues. Governments must not become dependent on fossil fuel tax revenues. In the short term, governments can protect income streams by gradually increasing fossil fuel taxes to maintain revenue and incentives to reduce pollution while broadening the tax base (such as by expanding taxes from motor fuels—which are common—to all carbon emissions) and developing alternative revenue streams such as vehicle registration fees and electricity taxes (only once the energy transition is complete) (OECD, 2019).

Under these considerations, we conclude with the following policy recommendations:

- **Price fossil fuels so that price reflects their external costs on society, including the labour and cleanup costs associated with transitioning away from fossil energy.** This will require removing fossil fuel subsidies and adding an appropriate level of tax for each fuel in line with all of its external and legacy costs.
- **Consider the political economy of the price reform.** Noting the political challenges associated with increasing energy prices, we recommend removing subsidies while international fossil fuel prices are lower, and implementing and phasing in modest increases in consumer taxes for coal, gasoline, and diesel. Better targeting of electricity and LPG subsidies to the poor and near-poor would reduce subsidy leakage and improve the viability of utilities, which is a necessary step to improve energy access.
- **Recycle the revenue generated in productive ways that are aligned with the fossil-free energy transition**, notably to alleviate the impacts of higher energy prices on the poor, to invest in social and economic development and, under the current crisis context, to finance effective economic stimulus that helps countries achieve the SDGs and net-zero commitments. But governments should not become dependent on fossil fuel revenues—instead they should broaden the tax base and transition to alternative revenue sources.

5.0 How to Spend: Swapping subsidies from fossil fuels to clean energy

A "swap" is any shift in public funds from fossil fuels to clean energy, including revenues linked to subsidies and taxation. Swaps can support government efforts to achieve the SDGs and net-zero commitments—they are one of a few policy mechanisms that can increase public revenue. Previous sections pointed out that USD 553 billion can be raised from fossil fuel subsidy reform and taxation globally.[30] While the money raised can be swapped for several development purposes, including health, education, reduction of taxes that hinder growth, or social protection schemes such as conditional cash transfers, etc., this chapter focuses on swaps to clean energy forms that have significant potential to support a fossil-free recovery and that can benefit from the money raised.

There are different strategies to build swaps into recovery-related tax and subsidy reforms. A swap does not have to involve formal earmarking of revenues from one scheme to another. It can also focus on actively supporting clean energy to reduce expenditure on fossil energy or be a large-scale shift in support at a macroeconomic level. Table 2 provides a non-exhaustive list of strategies.

Table 2. Strategies for swapping support from fossil fuels to clean energy

Strategy	Advantages and disadvantages	Examples
Formal hypothecation (earmarking) revenues from taxes and subsidy reforms	Finance ministries are generally skeptical of earmarking because it reduces flexibility to budget according to changing circumstances and priorities. However, earmarking can help create an explicit link between a tax or subsidy reform and related compensation measures, which can improve social acceptability and acceptance to reform, as well as transparency and accountability.	India's coal cess is a tax on coal where 30% of the revenues were originally channelled to support environmental projects, including research and innovation on clean energy (Gerasimchuk, 2018).

[30] This includes reforming consumption subsidies to gasoline, diesel and coal, as well as implementing a modest tax (USD 5 per tonne of coal, USD 0.125 per litre of gasoline and diesel) to the consumption of these fuels. For more details on this proposal and the methodology see Chapter 4 and Appendix II.

Strategy	Advantages and disadvantages	Examples
Reform and reallocate: Reducing fossil fuel support and increasing renewable energy support, without any formal policy linkages	Sometimes, it can be simpler and equally effective to simply introduce a swap that has no formal underlying linkage between savings from one policy and new expenditure on another. This can be the result of one or two major policy changes or the result of a cumulative impact of individual policies that shift public support for clean transition at a macroeconomic level. In this approach, it is important that the new expenditures are additional and respond to the population's needs, in order to build public trust.	When Indonesia reformed fossil fuel subsidies in 2015 (saving more than USD 15 billion), one of the reasons it was possible was because the reforms were publicly linked to massive new investments in welfare and infrastructure (Bridle et al., 2019). There was no formal reallocation of funds, but analysis of the budget before and after reform clearly shows that increased expenditure in these areas was only possible because of the reduced expenditure on fuel subsidies (Pradiptyo et al., 2016). France's policies to counteract the effects of the COVID-19 crisis are another example of numerous policies that, at a macroeconomic level, represent a swap in support toward clean energy (see Box 5).
Investment led: Subsidizing or supporting[31] clean energy to reduce expenditure on subsidized fossil energy	Promoting a cleaner and less subsidized replacement of a heavily subsidized fossil energy source can be politically or practically easier than attempting to reform a fossil fuel subsidy in isolation. As demand falls for the fossil energy source, there are financial savings. This is particularly relevant for measures linked to the poor and marginalized, where it is critical to ensure that they receive an affordable alternative before any measures are taken to increase fossil energy pricing. When subsidy savings are accounted for, government investments can become highly cost effective.	Bangladesh's Solar Home System Program (SHS) was initiated in 2003 as a means of increasing energy access for off-grid rural households and reducing dependence on subsidized kerosene (see Box 9) (Infrastructure Development Company Limited [IDCOL], 2021).

[31] Depending on the context, other forms of support to clean energy, such as increased public expenditures, can be better policies than subsidies and should be considered instead.

Swaps of support have already been seen in some efforts to promote a green recovery. Box 5 presents an evaluation of the stimulus policies announced by France, which saw fiscal support swapped from fossil fuels and toward clean alternatives. Nordic experience also shows that swaps based on fossil fuel taxes are a powerful tool for green recovery. They adopted a "carrot-and-stick" strategy, where higher taxation of fossil fuels was balanced out by reduced taxes on labour and other forms of social compensation (as described in Chapter 4.3), as well as clean energy solutions to reduce carbon emissions (see Box 6).

Box 5. Swaps in green recovery: Supporting clean energy in France

In the aftermath of the initial wave of the COVID-19 crisis, France introduced sweeping measures to support a green recovery that represented a macroeconomic shift in support toward clean energy. Overall, 61% of France's stimulus has supported clean energy, and only 12% has supported fossil fuels without any climate conditions attached (Energy Policy Tracker, n.d.). Its USD 119 billion recovery program aims to support jobs and industrial competitiveness, and 30% of this has been allocated to green recovery measures, such as support to hydrogen, energy efficiency in buildings, green infrastructure, and public transport (Ministère de l'Economie, 2020). Along with local support for cycling infrastructure, incentives for the purchase of EVs, and the planned reconversion of diesel buses to electric and biogas in the Ile de France region, these measures are all a means of encouraging a switch to less polluting forms of transportation (Le Monde, 2020a). As a result, cycling has increased in many French cities and so has the demand for EVs (Cosnard, 2020; Le Monde, 2020b).

There are still further opportunities for swaps in France. The country's support to fossil fuel consumption by industry, transport, and households is estimated at USD 8.4 billion annually through subsidies in the form of tax expenditures (Roth, 2020). Even in the COVID-19 crisis, France maintained certain fossil fuel subsidies it committed to phasing out. For example, the country postponed until 2021 the cancellation of the fiscal advantage of non-road diesel (Chauvot, 2020). A swap "sense check" of its recovery package would identify measures such as this that could be targeted to help increase revenues for recovery and ensure a climate-aligned stimulus program.

Box 6. A Nordic approach to swapping taxation to clean energy

To help decouple emissions from economic growth, the Nordics also used a "carrot-and-stick" strategy where carbon and other energy taxes were combined with policies to encourage a shift to cleaner energy. In Norway, this included favourable taxation for EVs and subsidies to EV charging infrastructure (Bjerkan et al., 2016). Finland provided subsidies to biogas for road transport and electricity production (Ministry of Economic Affairs and Employment of Finland, 2019). In Sweden, green certificates to promote the production of electricity from renewables have existed since 2003 (Fridolfsson & Tangerås, 2013). Denmark used energy tax revenues to fund the energy transition, where about 40% of carbon tax revenues are used for environmental subsidies (Sumner et al., 2009). Industries were also encouraged to become more energy efficient, such as by reducing charges for combustion plants that were more energy efficient—this was the case in Sweden with its tax on nitrogen oxide (NOx) (Swedish Environmental Protection Agency, n.d.).

Swaps should respond to specific local needs and consider economic activity, climate targets, and jobs when supporting sectors that can maximize benefits from a fossil-free recovery. The following sections focus on specific thematic areas that are key to a fossil-free recovery considering a just energy transition and that require significant amounts of public funding. These include clean energy access for all, energy efficiency, clean transportation, and support for the power sector to achieve a clean electricity mix. They explain why it is important to focus on these areas, giving country examples and noting key things to consider as part of the swaps policy design.

5.1 Support Clean Energy Access for All

SDG 7 looks to "ensure access to affordable, reliable, sustainable and modern energy for all" (United Nations, 2017). **Access to modern, sustainable energy is key to improving lives because it reduces poverty, improves health and education, positively impacts household incomes, and benefits women** (IEA et al., 2020; World Bank & Angelou, 2015). Energy access implies access to a reliable source of energy at an affordable price.[32] These objectives are particularly relevant to helping households get out of the COVID-19 crisis. Energy access is also vital in the provision of community services such as health care facilities, impacting the safety, accessibility and quality of essential health services, and the functionality of health care facilities (World Bank, 2017b).

According to the IEA (2020a), governments would need roughly USD 150 billion over the next 3 years to support SDG 7 in their recovery plans. This would allow 420 million people to gain access to clean-cooking solutions and 270 million people to get access to electricity (IEA, 2020k). Government budgets will be severely constrained for the foreseeable future, which will likely slow down efforts to achieve SDG 7. However, policy-makers can

[32] A multi-tier framework for energy access posits that energy supply should be reliable, affordable, legal, safe, convenient, of good quality, readily available, and adequate in quantity (World Bank & Angelou, 2015).

strategically define the right policies and use swaps in recovery packages to address this financing gap.

Swaps of fossil fuel subsidies to energy access can be particularly beneficial when they target subsidies to those that need them most and support connections to clean electricity along with access to clean cooking fuels. Blanket (that is, untargeted) consumer subsidies to fossil fuels are a blunt instrument for promoting energy access, as they are generally captured by the richest groups in society and have a high externality cost. Instead, implementing swaps to clean energy access can help provide the needed funding to close the access gap and at the same time improve outcomes in two ways: first, by placing an emphasis on replacing fossil fuel-based energy with clean equivalents, improving health and reducing emissions; and second, by creating a demand for new, clean energy products. It can thus become a force for social progress as well as for fossil-free economic empowerment, as some examples in this section show. Both outcomes are especially positive for women, in terms of improved safety as well as increased economic participation.

Affordability is one of the key attributes underpinning individual and household energy access, since poor households can usually afford only basic necessities, with energy often accounting for a large portion of their monthly budgets (Zinecker et al., 2018). The COVID-19 crisis has pushed a large number of families into poverty, and they will have less income available for basic energy needs (IEA, 2020i). As a response, several governments have implemented immediate energy sector COVID-19 responses to help households face the crisis (see Box 7).

Box 7. Government interventions to support energy affordability as a part of African COVID-19 recovery packages

In the initial months of COVID-19, some countries without strong administrative mechanisms to identify poor households used their existing energy services to provide emergency support in the form of subsidized energy.

In the northwestern African country of Mauritania, the government announced a USD 80 million fund to provide (among other things) energy subsidies for the poor, including exempting 174,707 households from paying their electricity bills. Similarly, the Kingdom of Eswatini suspended electricity bills from April 2020 to June 2020. Several other governments in West Africa applied similar measures in response to COVID-19. Countries like Nigeria and Burkina Faso went a step ahead and responded by giving incentives to renewable energy (see Figure 7) (Akrofi & Antwi, 2020).

Several of the measures aimed at relieving households as an emergency aid, but better solutions are needed to promote long-term energy access. While cheaper—or free—electricity can help low-income consumers face the impacts of the crisis, it does not benefit those without grid access and discourages efficient energy use.[33] Furthermore, most countries do not effectively target electricity subsidies to low-income consumers, such that the large majority of consumers receive assistance. As a result, better-off consumers capture a large share of benefits (World Bank, 2018). The same trends are observed with clean cooking fuels like LPG. As countries move from relief to recovery, they need to use public resources in a way that targets those that need it most. In this case, reforming electricity subsidies into more targeted forms, and using savings to promote energy access in other ways (for example, by subsidizing the connections), are more effective for achieving recovery while promoting energy access. Such reforms are sensitive and should not be rushed, but good planning and investments in better administrative infrastructure for social protection can certainly be taken up by recovery programs.

[33] For example, the Free Basic Electricity allocation in South Africa supports the poorest household by providing a minimum amount of free electricity per month. Support such as this is even more crucial during the pandemic as there may be an increase in households with no or little income (Sustainable Energy Africa, 2020).

Figure 7. Measures applied by different African countries to support electricity consumers

Energy relief responses in Africa

Subsidy/electricity bill reduction	Incentives for renewable energy	Suspension of bill payments	VAT exemption on electricity bills
Burkina Faso	Burkina Faso	Côte d'Ivoire	Mali
Ghana	Nigeria	Guinea	
Senegal		Ghana	
		Niger	
		Nigeria	
		Togo	

Source: Akrofi and Antwi, 2020.

Electricity subsidies tend to be highly regressive. An electricity connection is four times more likely in the top income quintile (56%) than for the bottom quintile (14%) in the 20 countries with the largest energy access deficits (World Bank, 2018). Findings from a global study of 32 countries confirm that a large share of energy subsidies accrue to high-income households, reinforcing income inequalities (Coady et al., 2015). Even in countries where most households have a connection, electricity subsidies are often designed in a way that greater benefits go to better-off groups who can afford to consume more electricity. For example, in the Indian state of Jharkhand, the top two quintiles (the richest 40% of households) received 60% of electricity subsidy benefits, and the bottom two quintiles received 25% (Sharma et al., 2020).

Swaps to support energy access should include the reform of blanket subsidies[34] so that resources are focused on extending electricity connections and targeting consumer subsidies to only low-income groups. Most governments' support for energy access aims at lowering consumer energy prices to make modern fuels more affordable for low-income households (see Box 7). However, a common practice in most developing countries is to offer this support as an untargeted energy consumption subsidy. There are several reasons why these subsidies often fail to deliver universal energy access. First, the lack of targeting means that wealthier households capture a large share of subsidies, so the net outcome is highly regressive. Second, they are often paid for by requiring state-owned utilities to absorb the cost of subsidies as a loss, limiting capacity to maintain and extend the grid, or

[34] Blanket or untargeted consumption subsidies are those where most consumers can access subsidized energy independent of their income.

invest in distributed renewable energy, ultimately undermining access. And third, untargeted subsidies are costly: according to global estimates, fossil fuel and fossil fuel-based electricity consumption subsidies in 2019 were USD 404 billion (see Appendix I). Universal or broad-based electricity subsidies, which are inefficient, can undermine energy access goals by taking up resources that could be better clustered on groups most in need (Zinecker et al., 2018). Public resources could also go to other development priorities, such as health, infrastructure, education, etc.

There are many forms of subsidy targeting. **The targeting of subsidies should be tested through a range of measures based on the country settings and household fuel.** Targeting measures include opt-out schemes, volumetric targeting (example: "lifeline" subsidized tariffs that are not available to households who consume above certain thresholds), cash transfers without any explicit link to energy consumption, or the provision of free connections (Sharma et al., 2019). Where feasible, it is ideal to identify beneficiaries through data on household characteristics like income, expenditure, and asset ownership. For example, the improved LPG subsidy policy design in India uses several of these interventions in combination (see Box 8). Governments will have to undertake dedicated research to test targeted interventions in the local context to better inform subsidy policy design—this activity takes time that should be considered in the reform planning timelines.

Box 8. Improving targeting of LPG consumption subsidies in India: A work in progress

The Indian government offers LPG subsidies to encourage households to switch from traditional solid fuels—which are responsible for dangerous levels of indoor air pollution that predominantly affects women and children. LPG subsidies are offered through a broad range of measures of which the most significant is the PAHAL cash transfer scheme—in which consumers pay market prices for the purchase of an LPG cylinder, and the subsidy is credited to their bank account. PAHAL is India's largest single petroleum product subsidy, estimated at 9% of all central government energy subsidies that could be quantified in 2017/18, at INR 12,905 crore (USD 1.9 billion).

Initially the scheme was universal: all households, including the richest, were eligible. The only form of targeting was an annual consumption limit of 12 subsidized LPG cylinders per connection. This had little impact since very few households consumed above this level. The government has experimented with different approaches to improving the targeting of PAHAL by removing wealthier households from receiving subsidized cylinders. In 2015, wealthier households were encouraged to voluntarily "give up" the subsidy. In 2016, income-based targeting was introduced to restrict eligibility to households with an annual income of less than INR 1 million. Together, these two approaches have achieved limited progress in targeting the policy, restricting less than 6% of LPG connection holders (Sharma et al., 2019). The scheme remains largely universal, and a large share of benefits support consumption among better-off households. An IISD study (Sharma et al., forthcoming) found that in the Indian state of Jharkhand, more than half of LPG subsidies benefited the richest 40% households. The strategies that have been adopted to date, however, do represent principles that could be expanded to have a more meaningful impact on targeting.

There is no magic bullet to improving LPG subsidies in India, but to help improve their efficiency in the medium-term, the government may also need to consider building a better administrative system that accurately identifies poor households and maintains an up-to-date registry. It can also consider creating a cooking fuel subsidy that is fuel and technology agnostic that supports a clean cooking transition without locking in a fuel use. Another possible approach to increasing a clean cooking transition is through results-based financing that disburses public spending against results achieved and is used to further drive private sector financing. Pilots from China and Indonesia have shown promising results in using results-based financing to increase the adoption of clean cookstoves (Zhang & Adams, 2015).

Swaps to clean energy can be designed to create additional co-benefits, becoming a force for social progress as well as for fossil-free economic empowerment. Bangladesh's SHS program (see Box 9) is a good example of a successful program to achieve energy access that is transferable to other countries and that has tangible benefits on the ground. This example shows that swapping from kerosene to solar lighting not only increased energy access in off-grid rural regions but also led to a host of co-benefits, including reduced indoor air pollution from kerosene, savings in household expenditure, and local job creation.

Box 9. Bangladesh's swap from kerosene to solar lighting

Through its SHS Program, launched in 2003, Bangladesh sought to increase energy access in off-grid rural regions while encouraging a shift away from kerosene to solar lighting (IDCOL, 2021). This program was initiated by the government-owned Infrastructure Development Company Limited (IDCOL) and supported by numerous international donors (Centre for Public Impact, 2017). The program is unique, as it relies on local partner organizations (POs) based in rural areas where there is a lack of energy access and provides micro-financing solutions to households to purchase SHSs. The main difference with traditional off-grid service models is that instead of a fee-for-service model, households become the owners of the SHSs after repaying their loan, which increases their sense of responsibility and caretaking for the system (Global Delivery Initiative, 2015). POs have also played a key role in installing and maintaining SHSs and are well connected locally with households to follow up on any financial or technical queries they may have—an element missing in other countries for similar types of programs (Global Delivery Initiative, 2015).

Today, Bangladesh's SHS Program is one of the world's largest off-grid SHS programs. It has been credited for creating significant benefits, including increasing energy access, reducing energy costs for households and the government, and increasing local green jobs (IDCOL, 2021). Energy access in rural areas increased from 25% before the implementation of the program to a current 80%, and at least 1.14 million tonnes of kerosene (worth almost half a billion USD) has been saved (IDCOL, 2014; World Bank, 2021). Beyond promoting a shift away from kerosene consumption, the program also led to high local job creation, with jobs emerging for the manufacturing of solar batteries and PV modules (Global Delivery Initiative, 2015). The program itself led to the creation of 75,000 direct and indirect jobs as of 2014 and contributed to Bangladesh's wider renewable energy employment numbers, estimated at 113,000 in 2013 alone (Centre for Public Impact, 2017). A study by Samad et al. (2013) showed that the SHS program has had other co-benefits, including increased household expenditure, improved study time for children, health benefits for households, and increased empowerment for women in household affairs.

In addition to the involvement of local POs, the success of the SHS Program was led by a combination of good policy design and coordination. In terms of design, there was a clear political commitment to increase energy access, even before the implementation of the SHS Program, with a target to achieve universal electricity access by 2020 (Centre for Public Impact, 2017). In terms of coordination, the multistakeholder partnerships built between local and international actors such as Kreditanstalt für Wiederaufbau (KfW), IDCOL, and POs ensured that SHSs were not installed in regions that were already going to be connected to the grid and that robust quality assurance mechanisms were put in place (Global Delivery Initiative, 2015).

Finally, swapping support to subsidize connections is an efficient tool to increase energy access. It reduces how much consumers pay to acquire clean energy, like the price of a first cylinder and stove for LPG or fees associated with a new electricity grid connection. For example, India's Saubhagya scheme achieved near-universal household electrification in India by providing free connections (Government of India, 2020). In Rwanda, electricity connection fees can be paid in instalments (see Box 10). For LPG, India subsidizes start-up costs through the Pradhan Mantri Ujjwala Yojana (PMUY) scheme, and Peru's Fondo de Inclusión Social Energético (FISE) program provides free LPG cookstoves (Zinecker et al., 2018). In addition, and to complement the increased number of connections, policies to improve billing and collection systems are key to maintaining the healthy financial status of utilities.

Box 10. Rwanda's targeted electricity subsidies

Rwanda approved an electricity connection policy in 2017 that eliminates upfront payment of an electricity connection fee and allows the fee to be paid over time. The connection fees, which are subsidized for poor households, can be repaid monthly along with electricity consumption charges. This connection subsidy made grid electricity significantly more affordable for the poor and accelerated Rwanda's electrification program (World Bank, 2018). The country is targeting universal electricity access by 2024, with 52% of the population to be grid connected and 48% accessing off-grid solutions (Energy Sector Management Assistance Program [ESMAP], 2019). This connection subsidy was introduced along with electricity tariff reforms that introduced a "lifeline" tariff for electricity consumption below 15 kilowatt hours (kWh) per month, effectively halving the tariff for low-income households (ESMAP, 2019). Together, these reforms led to a rapid doubling of new connections, from an average of 74,000 per year from 2012 to 2016 to 154,000 in 2017/18 (World Bank, 2018). The government is further improving affordability by focusing on off-grid electrification through solar home systems, mini grids, and solar lanterns, to areas with a higher share of low-income households.

5.2 Support Energy Efficiency

Energy efficiency has been identified by the IEA as one of the key areas to help boost economic growth, create jobs, and build cleaner, more resilient energy systems. Since 2015, global improvements in energy intensity[35] have decreased from 2.9% annually to 0.8% in 2020 (IEA, 2020c), meaning that there is space for more energy efficiency. The most important reason for this decrease in energy efficiency has been the stagnation of regulatory requirements and investments (IEA, 2019b), and low energy prices do not help. The IEA (2020f) estimates that 40% of energy-related emission reductions by 2040 will have to come from energy efficiency to meet climate targets.

Swaps have a role to play in enhancing energy efficiency because the reform of fossil fuel subsidies increases headline energy prices and increases incentives for the efficient consumption of energy. A major benefit of energy efficiency related to fossil fuel subsidy reform or fuel taxation is that it allows for compensation for price increases via

[35] This indicator reflects how much energy is used by the global economy. The IEA measures global energy efficiency improvements, targeting an average improvement of 3% to be consistent with its Efficient World Strategy (IEA, 2019b).

reduced energy bills. At the same time, the reallocation of savings from fossil fuel subsidies can be targeted at specific energy-efficiency schemes helping to overcome investment barriers and addressing knowledge gaps around investment opportunities.

Improving energy efficiency can deliver emissions reductions, create jobs, and deliver savings from reduced energy expenditures. Investments in energy efficiency are also drivers of growth and are very job-intensive (IEA, 2020k), paying off over time. If global improvements in energy efficiency had remained at 3% between 2016 and 2018, the world could have gained USD 4 trillion in GDP by 2018 (IEA, 2019b). Climate co-benefits and multiplier effects can also be expected for stimulus funding to energy efficiency, which the IEA expects will deliver at least 1.8 million jobs between 2021 and 2023 (IEA, 2020c). There are examples showcasing these benefits. Mexico ran a successful energy-efficient appliance program from 2009 to 2018 that aimed to reduce household electricity consumption for low-income households. Under the program, the government offered rebates to poor households to purchase new energy-efficient appliances like refrigerators, air conditioners, and light bulbs. The Mexican government saved USD 22 million through reduced energy consumption, avoided 500 kt CO_2e of emissions annually and created 1,600 permanent and 10,500 temporary jobs (Fideicomiso para el Ahorro de Energía Eléctrica [FIDE], 2019).

Energy efficiency is a particularly interesting tool for mitigating the increase of energy bills following energy price increases due to fossil fuel subsidy reform or taxation, as it allows governments to compensate part or all of the increased bills by reducing total consumption. Swaps can be designed to ensure this compensation or even create savings for households. Ukraine's Energy Efficiency Fund was established after subsidies on heating gas were phased out, and it offers financial support to carry out energy-efficient renovations in residential buildings. The scheme provides grants that leverage investments by the homeowners and reduce heat waste (IFC, 2020). An assessment of options to mitigate the negative effects of potential electricity subsidy reform in Mexico indicated that the reinvestment in energy-efficiency measures together with financial support for rooftop solar PV installations in households would be the most effective combination to help consumers compensate for the increased electricity prices (Enhancing the Coherence of Climate and Energy Policies in Mexico [CONECC], 2018). In these cases, and especially in developing countries, energy efficiency can also help reduce energy poverty by reducing energy inputs needed for the same outcome.

As part of their 2020 recovery packages, several countries have enacted measures to improve energy efficiency with a particular focus on buildings (see Box 11). The IEA reports that while some investments in energy efficiency in 2020 were geared toward industry and material efficiency (about 8%), the majority of recovery funds were geared toward improving the efficiency of buildings (40%), compared to 19% for urban transport infrastructure and new EVs (about 19% each), long-distance transport (about 14%), and new efficient cars (less than 4%) (IEA, 2020c). This type of support has occurred both at the national and subnational levels (see Box 11). Based on analysis of the survey, Hepburn et al. (2020) rank energy-efficient building upgrades (including retrofits) as one of the measures with the greatest potential positive climate impact. Furthermore, scaling up public commitments to energy efficiency for buildings could lead to significant local job creation, long-term emission reductions, and lower energy costs for households (Agrawala et al., 2020; Ranald, 2020).

Investing in energy efficiency will pay for itself, but support is needed to face the upfront costs, and swaps can help overcome the initial barrier of energy-efficiency investments. Energy-efficiency investments are capital intensive and, from a purely short-term financial standpoint, might not make sense in the difficult context of economic recovery. Especially when energy prices are low, businesses themselves are unlikely to seek capital expenditures on energy efficiency. Similarly, energy-efficiency investments in finished products (such as building retrofits) are high, and profitability is normally positive after a number of years. Swaps can particularly help when there is an "agent's dilemma," like in the case of improving thermal envelopes of residential buildings, where not all inhabitants might be able to bear the high initial upfront cost of the investment. Social housing is an area of particular interest, as well as public buildings (such as schools and hospitals). Swaps can provide the initial upfront investment or de-risk private investments in energy efficiency. Box 11 includes some examples linked to COVID-19 recovery.

Box 11. Investing in energy efficiency in buildings as part of COVID-19 recovery packages

Several European countries have supported energy efficiency in buildings as part of their COVID-19 recovery packages. In Denmark, the government has committed to allocating USD 4.8 billion as part of the National Buildings Fund for green renovation of social housing from 2020 to 2026 (State of Green, 2020). This will enable the renovation of 72,000 social housing homes through various energy-efficiency measures, including replacing windows, improving insulation, replacing heating oil, and providing a better indoor climate to lower heating bills for tenants (Ministry of Transport Building and Housing, 2020). Other countries, such as Spain, have taken similar measures both at the national and subnational levels. At the national level, Spain will spend USD 342 million as part of its Building Energy Rehabilitation Program (PREE) to improve the energy efficiency of buildings built before 2007 by replacing oil boilers and changing the thermal envelopes of buildings (Government of Spain, 2020a, 2020b; Ministry for Ecological Transition and Demographic Challenge, 2020).

On the other side of the Atlantic, Brazil has also committed—as part of its National Electricity Conservation Program (Procel)—about USD 6 million to support the National Development Bank's Energy Efficiency Fund. In turn, through various guarantees, this could de-risk the financing of energy-efficiency projects, which could amount to almost USD 40 million, although not specifically in the building sector (BNDES, 2020).

For some countries, these policies have been announced as part of wider green recovery plans (Energy Policy Tracker, 2020). This is the case for Canada, France, South Korea, and the United Kingdom.

While these announcements are encouraging, there is still a window of opportunity for governments to be even more ambitious in announcing energy-efficiency measures in the buildings sector. So far, USD 24 billion has been announced, which represents only about 9.5% of all support to clean energy for the 29 major economies covered in the Energy Policy Tracker (Energy Policy Tracker, n.d.). In Denmark, the Danish Ministry of Housing estimates that the support as part of the National Buildings Fund could reduce up to 47,000 tonnes of CO_2 between 2020 and 2026, while the government of Spain estimates net job-creation potential at up to 48,000 per year from 2021 to 2030 as part of the Building Energy Rehabilitation Program (PREE) (Government of Spain, 2020b; State of Green, 2020).

5.3 Support Decarbonization of Private and Public Transport

The transport sector currently is one of the main sources of air pollution and causes of climate change, contributing to as much as 57% of global oil demand before the COVID-19 crisis and 24% of direct CO_2 emissions from fuel combustion (IEA, 2020j). At the same time, **transportation and mobility play a key role in enabling economic growth and accessibility, but achieving net-zero and the post-pandemic changes will require a rethinking of the sector**. COVID-19 recovery support must be carefully designed to significantly reduce the climate impact of the transport sector and respond to the future transport needs. While there were several large bailouts for conventional automobile companies, many governments around the world have also made clear their determination to move to more sustainable modes of transport with dedicated spending in stimulus packages (Energy Policy Tracker, n.d.). The decisions taken today on public transport and urban design—especially in the cities of emerging and developing economies—will determine how much future urban mobility will depend on fossil fuels. In this case, the alignment of those plans with net-zero commitments and SDGs becomes a priority. At the same time, teleworking and health concerns and other factors related to the COVID-19 pandemic might last for longer, further affecting the use of transport. This section focuses on considerations related to EVs and public transport, as they are the areas that have been mostly supported by governments' COVID-19 recovery packages.

Swaps from subsidies to fossil fuels and fuel taxation to clean and/or public transport can encourage the move toward cleaner transport alternatives and generate funds to support EV infrastructure or subsidized EVs, in addition to significantly reducing negative externalities of fossil fuel-based transport. A long-lasting increase in fossil fuel prices can reduce the incentives to operate internal combustion engine vehicles. As seen in Chapter 4, this measure is usually progressive, since the richest groups tend to own the largest vehicles and use them more. Second, the funds generated by swaps can be reallocated to subsidize clean transportation and public transit and promote the deployment of new low-carbon technologies. Finally, investing in the transformation of transport sectors and making them more sustainable also implies reducing carbon emissions, reducing air pollution, and incentivizing growth sectors, all while helping urban planning in increasingly dense cities and economic hubs (IEA, 2020j).

Encouraging the adoption of EVs can help decarbonize transport while creating sustainable jobs. Electrification would help deal with threatened jobs in the automobile manufacturing sector if retraining is done properly since the jobs are different in nature. For example, EVs reliant on batteries open up a whole new market for EV battery reuse and recycling, whose value chains are not strongly automated and instead rely on a lot of manual labour. These jobs would be sustainable since the EV sector continues to grow, with 2.1 million cars added to the global market in 2019 alone (IEA, 2020e).

Several COVID-19 recovery packages are already supporting EVs (Energy Policy Tracker, n.d.). China led the EV revolution for emerging economies and, as part of its pandemic recovery support, has extended subsidies by USD 1.6 billion, which is estimated to support the sale of an additional 6 million EVs. Germany has committed USD 2.4 billion to double existing premiums for buyers of EVs. As part of a USD 1.4 billion support package, France also increased subsidies to incentivize the purchasing of EVs and electric professional-use vehicles. State governments have also taken similar initiatives, such as the USD 700 million that New York has aimed at higher EV penetration or the policies of some Indian states supporting electric vehicles (see Box 12).

Strengthening existing infrastructure for EVs, particularly recharging infrastructure, is needed to accelerate the transition to electric vehicles, and countries are taking action. Without it, EV supply can accelerate, but demand will be bottlenecked because of a lack of charging and rapid-charging infrastructure, which is required since the range of EV mileage between charges is still not as far as conventional combustion engine vehicles. China pledged USD 1.4 billion to increase its electric vehicle charging network by 600,000 charging points, which would increase its existing capacity by 50%. The German government committed USD 2.8 billion of support to expand EV charging infrastructure and ensure the availability of EV charging stations throughout the country, including a requirement that all petrol stations offer EV charging points. Other countries, such as France and Finland, have also incorporated specific support for charging stations in public areas as well as private houses (Energy Policy Tracker, n.d.).

Support to clean transport should also consider the broader climate and pollution effects of supporting the electrification of transportation. Several countries still rely on heavily polluting fossil fuels to generate electricity, and measures to electrify their vehicle fleets can result in aggravated climate change and pollution conditions. For example, in China, EVs achieve between 2% and 43% of emissions reductions compared to conventional combustion engine vehicles, depending on the electricity used by the EVs (Qiao & Lee, 2019). Hydrogen is also being discussed as a fuel for transport in the form of fuel cells. Also, in this case, the overall sustainability and contribution to net-zero commitments should be evaluated (see Box 13). At the same time, the lifetime emissions of EVs can be similar, or even greater, than hybrid-electric vehicles (Hausfather, 2019; Laan & Jain, 2019). This is because almost half of an EV's life-cycle emissions are related to its production, especially its batteries, which are energy- and pollution-intensive to manufacture (Church and Wuennenberg; 2019; Hawkins et al., 2013). To maximize climate, sustainability, and clean air benefits, swaps to EVs should be accompanied by support for decarbonizing electricity production and by better regulating EV production and disposal.

In addition to the benefits of subsidies to clean private transport, **supporting public transportation is also important to ensure accessibility for citizens, guaranteeing jobs, and decarbonizing transport.** The sector employs around 13 million people globally, and investing in public transport could generate around 30% more construction and engineering jobs than similar investments in roads (IEA, 2020). Public transit operators have strongly suffered during the pandemic, as mobility was strongly reduced, and social distancing protocols favoured individual transport when possible. Public transport use in many of the world's major cities has fallen by more than 90% since the beginning of the pandemic (Sung & Monschauer, 2020). Several countries have already pledged important relief packages to the sector to compensate for losses during lockdown, including the City of London (USD 2 billion) in the United Kingdom, Germany (USD 2.8 billion), and the United States (USD 25 billion). In Canada, the federal government has made USD 1.3 billion available to match investments by municipalities for improving public transit (Energy Policy Tracker, n.d.).

Support for public transport is even more relevant in developing economies, where the cost of private vehicles is too high for important parts of the population, and fuel demand to price elasticity is high. Public transit, both by rail and bus, is expected to be the primary means of transport in Asian and Latin-American cities by 2030 even considering the effects of COVID-19 (Hattrup-Silberberg et al., 2020). Swaps can particularly target public transport as a measure to compensate for higher fuel prices and improve access, particularly in isolated rural areas; it thus has positive effects on economic activity (Berg et al., 2015). In this case, it is particularly important to support clean and efficient public transport instead of older, more-polluting alternatives, leapfrogging to state-of-the-art buses or trains. Support for public transport can also include "last-mile" shared transport, electric two-and three-wheelers, and the expansion of rail transport (see Box 12). For more developed economies, improvements can be made in incentivizing high-speed rail or targeting net-zero carbon emissions from railways, for example.

Box 12. Supporting clean mobility in Colombia, India, and Peru

Cycling has been encouraged across several countries as a way to reduce transmission risk during COVID-19 and to promote its integration in future transportation systems. In Colombia, for example, Bogota has added new miles of permanent bike lanes, while in Peru, Lima announced the development of a temporary network of emergency bike lanes (Rauls, 2020). New Delhi has been developing a system of a public bike-sharing system even before COVID-19, which has been further supplemented after the start of COVID-19 (Ashish Mishra 2020). Reducing pollution and promoting an active lifestyle are the two other benefits that are being promoted by government agencies in introducing cycling infrastructure.

India has seen strong government support to put the country on a path toward decarbonization of its transportation sector, including public transport (Energy Policy Tracker, n.d.). Indian railways, which constitute the fourth largest railway network in the world, have committed to a net-zero carbon target by 2030 by switching to renewable sources of energy and improving energy efficiency (Energy Policy Tracker, n.d.). Further, the key states of Delhi, Gujarat, and Telangana have prioritized the Indian government's target for 30% of all new vehicle sales to be electric by 2030, by announcing state-level EVs policies after the start of the COVID-19 pandemic (Clean Energy Ministerial, n.d.; Energy Policy Tracker, n.d.). The central government has also authorized the rollout of electric buses on a large scale across some states, including Chandigarh, Gujarat, and Maharashtra, while several charging stations were approved for the state of Kerala to address the issue of vehicular emissions (ET EnergyWorld 2020).

5.4 Support the Transformation of the Power Sector

Clean electricity is the backbone of a clean energy transition, and demand for electricity is expected to significantly increase as new sectors electrify. Many sectors, such as cooking, green hydrogen, and transport (see Box 13), as well as heat and industrial decarbonization, will partly or wholly rely on electricity to deliver clean energy. This new demand will add to the growth already anticipated as a result of increased electricity access and growing consumption.

Many of the subsidies allocated to the power sector effectively prop up or bail out existing fossil fuel-based electricity systems. These subsidies would be swapped and instead support the transformation of power sectors. Public money is spent with the purpose of maintaining or expanding electricity supplies but often has the effect of locking in fossil fuels. The implementation of swaps would break this link. Subsidies should be reallocated so that at least they are technology neutral and at best that they are tied to targets and milestones toward decarbonization.

Electricity systems will have to expand and become more reliable and dynamic, and that will require major investments. This implies investing in grid upgrades to accept high volumes of intermittent renewable energy, expand the grid to reach underserved areas (or build renewable-based decentralized energy systems), replace fossil fuel with renewable capacity, and upgrade distribution networks to equip households with smart metering that allows for demand-control options, among others.

In 2019, fossil fuel-based electricity received at least USD 95 billion in subsidies[36] in the form of direct transfers, price support, and tax expenditures, but these are not enough to ensure their financial viability. Despite public support, some electricity sectors still fail to meet their investment needs or even cover their costs. This situation is mostly caused by low collection rates and artificially low tariffs below cost recovery (Burgess et al., 2020). Financial viability requires suppliers to cover all operating costs and capital depreciation. A study of 39 sub-Saharan African countries found that only two (Seychelles and Uganda) had a financially viable electricity sector in 2015, while 19 were just covering their operating expenditures, and five underprice electricity by more than USD 0.25 per kWh (Trimble et al., 2016). In addition to underpricing, this financial performance was influenced by the under-collection of bills, over-staffing, and transmission and distribution losses. In South Africa, below-cost pricing (among other problems) caused the near-collapse of the state-owned electricity provider, Eskom, which produces more than 90% of South Africa's power (Curran & Ahmed, 2020). In 2019, the utility held ZAR 450 billion (USD 34 billion) of debt that it could not service (Geddes, Bridle et al., 2020). Despite government transfers worth USD 8 billion over the 12 years to 2020 (3.7% of GDP), Eskom was not able to undertake essential investments, resulting in capacity shortfalls, power shortages, blackouts, and rising prices (Curran & Ahmed, 2020).

Swaps away from fossil energy toward a clean power sector should focus on achieving the sustainability of the sector, both financial and environmental. In many cases, existing support packages for electricity sectors are not strategic. They are focused too much on short-term efforts to shore up losses without tackling underlying structural problems and pay too little attention to investing in the infrastructure needed for the future of the electricity system. Better targeting of the support received by the sector is critical. Swaps can also be used to help electric utilities close the financing gap for required investments in the grid or renewables, thereby helping them to reduce emissions.

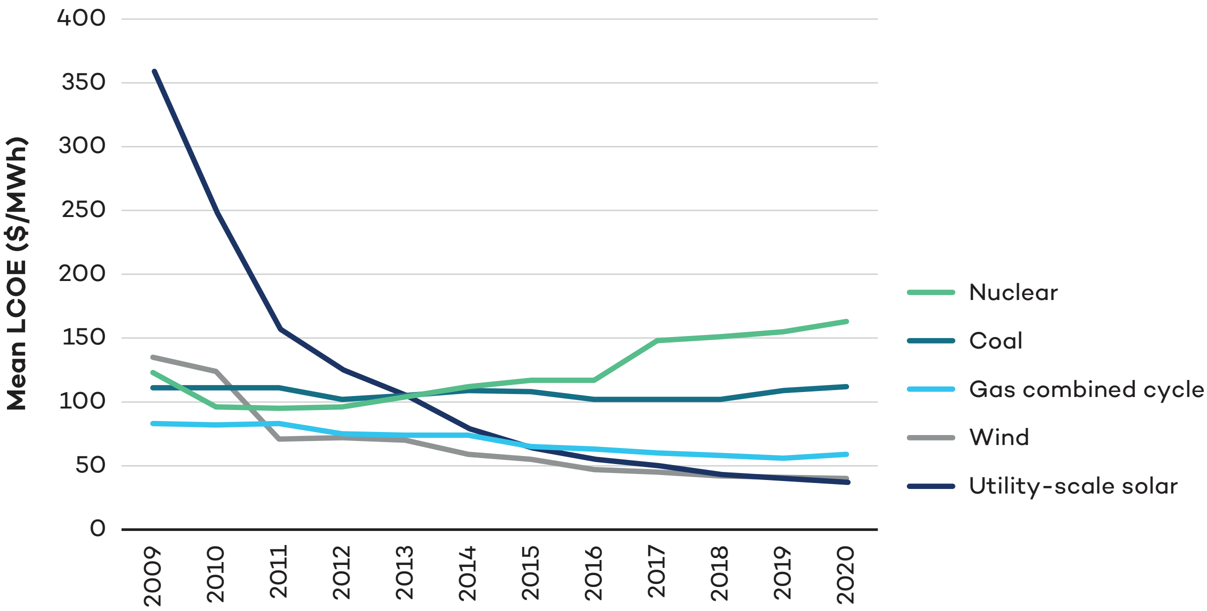
While solar and wind are now the cheapest forms of electricity generation at the global level, as shown by levelized cost of energy estimates (Lazard, 2020) (Figure 8); **at a national level, many countries still have renewable energy levelized cost of energy prices above the cost of fossil fuels, requiring government support to be competitive.** Many countries also need financial help to improve the infrastructure needed to integrate large amounts of intermittent renewables. For example, in Japan, the lack of land availability, grid constraints, and deep coastal waters make costs for solar PV and offshore wind some of the highest in the world (Hall, 2020; Heiligtag et al., 2020). In Indonesia, a mixture of geographical and regulatory constraints put renewable energy at a significant cost disadvantage (Bridle et al., 2018). Even in countries where wind and solar is highly competitive, swaps in government support can help drive the next phase of transition: renewable energy integration through transmission and distribution upgrades, smart meters, and storage infrastructure. Swapping support to the power sector can help promote renewables while technologies become cost

[36] This includes 81 major economies, including developed and developing economies (Fossil Fuel Subsidy Tracker, n.d.).

competitive. This will also increase investor confidence, and, as power sectors resolve financial difficulties and renewables become mature and competitive, public support should instead move to provide the required policy framework to increase the attractiveness of the sector to private investors (see Chapter 6). The example of Ethiopia (Box 14) shows the benefits of shifting government investment to the clean power sector instead of fossil fuel subsidies.

Public support to the power sector will also deliver jobs and economic growth. IRENA estimates that solar PV and wind alone will create 25 million jobs by 2050 under their climate-resilient energy transition scenario (IRENA, 2020c), and an additional 15 million jobs will be created for the necessary balancing grid upgrades (IRENA, 2020d).

Figure 8. Lazard's levelized cost of energy comparison, global average



Source: Lazard, 2020.

Box 13. Should governments swap support to hydrogen?

As countries commit to net-zero economies by 2050, many governments have turned their attention to hydrogen. Hydrogen could play an essential role in decarbonizing hard-to-electrify industries, such as steel, cement, heavy-duty vehicles, and shipping, and could replace many fossil fuels as an industrial feedstock, as a fuel converted to electricity in fuel cells, or as a fuel for heating. BNEF (2020c) estimates that hydrogen could meet up to 24% of the world's energy needs (buildings, power, industry and transport) by 2050.

However, hydrogen is currently produced mainly from natural gas and coal, which leads to significant GHG emissions. A switch would need to be made to either renewable hydrogen made by electrolysis (green hydrogen) or by potentially adding carbon capture and storage to hydrogen production from natural gas or coal (blue hydrogen) (BNEF, 2020c). Government commitments indicate they are preparing to subsidize the sector, with at least USD 19 billion currently pledged in G20 economies (Energy Policy Tracker, n.d.). Swaps from fossil fuels to hydrogen could contribute to this support. But when are subsidies for hydrogen justified?

First, there is a risk of redundancy for subsidies that promote hydrogen-based technologies in sectors that already have cost-effective low-carbon solutions. For example, in many cases, under specific conditions, home heating can be decarbonized with electric heat pumps and low-carbon electricity, eventually at a much lower cost (London Energy Transformation Initiative [LETI], 2021). Second, subsidies for blue hydrogen may be environmentally counterproductive. Blue hydrogen, produced from fossil fuels with carbon capture and storage, reduces emissions at the point of capture but may be less low carbon than it first appears. Directly, this is the result of technical limits on the proportion of carbon that can be captured and the risk of upstream fugitive methane emissions (Chan et al., 2020; Newborough & Cooley, 2020). Indirectly, support for blue hydrogen contributes to continued fossil fuel production at marginal coal mines and gas fields, also leading to increases in emissions. Third, prioritizing subsidies to production of fossil fuel or blue hydrogen over green may risk creating stranded assets due to the price dynamics observed in the sector. The cost of steam methane reforming of natural gas, a mature technology, is expected to remain high and stable, whereas the costs of electrolyzers and renewable technology continue to fall and their competitiveness to increase (BNEF, 2020c). BNEF forecasts that renewable energy-based hydrogen will be competitive with fossil hydrogen using carbon capture by 2030. U.S. President Joe Biden's clean energy plan includes a commitment to "ensure that the market can access green hydrogen at the same cost as conventional hydrogen within a decade" (Biden & Harris, 2020; BNEF, 2020c). Fossil fuel-based hydrogen may risk being stranded if green hydrogen becomes competitive that soon.

Governments need to promote hydrogen carefully. They should target subsidies toward hard-to-decarbonize sectors, including cement, heavy transport, and steel. In addition, governments should avoid subsidizing technologies in areas where sufficient cost-effective, low-carbon options are already well placed to reduce emissions and avoid promoting technologies that have no path to cost reductions and risk becoming stranded assets in the medium term. As with all energy subsidy policies, measures should be time limited and designed to adapt to changing market conditions.

Box 14. Swaps from fossil fuel subsidies to the power sector in Ethiopia

In Ethiopia, the removal of virtually all fossil fuel subsidies in 2008 (worth more than USD 600 million a year) acted as a swap and a strong enabling policy to enhance renewable energy deployment (Wooders, 2018). By investing a further USD 1.5 billion between 2005 and 2010, the country was able to scale up hydro, solar, and wind electricity generation significantly. In the case of wind, it moved from 29 gigawatt hours (GWh) of generation in 2011 to 533 GWh in 2018 (IEA, 2021; Wooders, 2018). Via such policies and its overall political commitment to clean energy, Ethiopia's power sector has also attracted foreign direct investment and financing from several multilateral development banks. The investment of USD 1.26 billion in the Ethiopia–Kenya Power Interconnection project by the Ethiopian government in conjunction with the African Development Bank, the French Development Agency, and the World Bank (Ethiopian Energy and Power Business Portal, 2020) is one example that has significantly reduced the vulnerability of a sector highly dependent on hydropower and subject to droughts (Thomas, 2020).

Through such projects, Ethiopia has been able to increase renewable energy integration and domestic electricity consumption, as well as to export surplus power to neighbouring countries. Electricity access increased from 31% to 45% from 2008 to 2018 (World Bank, n.d.). The country is now prioritizing electricity access in rural regions, including through its National Electrification Program, to reach universal electricity access by 2025 (Federal Democratic Republic of Ethiopia, 2019).

Ethiopia has also seen a growth in interest from foreign investors. China has become the main investor in the sector, investing USD 1.8 billion in 2019 into transmission and distribution and supporting smart grid technology development (Fitch Solutions, 2019; Smart Energy International, 2016). Additional investments in on- and off-grid mini grids could increase energy access in rural regions even further and boost agricultural productivity, with an estimated increase in annual agricultural revenue of USD 4 billion by 2025 (Borgstein, et al., 2020).

5.5 Conclusions and Recommendations

As seen in this chapter, **swaps—i.e., the process of reforming fossil fuel subsidies and reallocating a portion of the savings to clean energy—not only disincentivize the use of fossil fuels but also channel much-needed funds to address other priorities and support the energy transition.** This also applies to the additional resources obtained by taxing fossil fuels. There are several strategies for how to apply swaps, discussed in the chapter.

The concept of swaps can be applied to address priorities in many fields, such as health, COVID-19 recovery, education, etc., according to a country's most urgent needs and development priorities. In this report, we focus on four areas considered critical for the energy transition that, at the same time, can provide significant benefits as part of recovery packages, as they have an important potential to create jobs and economic growth. These areas are:

access to clean energy, energy efficiency, decarbonization of transport, and transformation of the power sector. Countries can focus on their most relevant areas and those with the highest impact to reach net-zero and the SDGs, depending on their specific contexts. We recommend the following swap considerations for each of these sections:

- **To support energy access, reform blanket consumption subsidies for electricity and LPG and instead target subsidies to the population groups that need them most while also promoting grid connections.** This implies understanding which kind of target compensation is most appropriate for each condition (for example: cash transfers, subsidized lifeline electricity tariffs, etc.: see Box 8 for real-life examples) or directly supporting connections to clean energy, also considering the specific context. For example, consider expanding LPG distribution networks to rural areas, offering or subsidizing LPG stoves or electricity connections, or supporting renewables-based decentralized electricity generation in areas with no access to the grid. These interventions have the added co-benefits of improving health (by reducing air pollution), empowering women, and supporting rural development.
- **To support energy efficiency, reallocate revenues from fossil fuel subsidy reform and taxation to help overcome high upfront costs of or de-risk energy efficiency investments, mostly in buildings.** Funds should target homeowners and SMEs, who might have more difficulties when facing related costs in addition to facing an agent's dilemma (see Chapter 5.2). Funds can also be dedicated to improving thermal isolation and reducing electricity consumption in public buildings such as schools, hospitals, or public offices. Energy efficiency is particularly interesting in the case of price increases, since the reduced consumption allows for a decrease in the overall energy bill.
- **To support the decarbonization of the transport sector, swap revenues from the reform of subsidies and taxes on gasoline and diesel to incentivize private purchases of EVs or related infrastructure.** Also, use swaps to support the sustainability of the transport sector over time, including increasing clean public transportation, supporting active transport (such as biking), or planning the cities of the future to minimize CO_2 emissions and air pollution from transportation. Swaps to traditionally low-carbon forms of public transport and innovative new low-carbon technologies can be both progressive and transformative. Finally, support to the fossil fuel-intensive transport sectors (such as airlines) as part of recovery packages should be given only to help the sector reduce emissions and contribute to net-zero commitments.
- **To support the power sector of the future, reform subsidies to fossil fuels for power generation or tax them to support clean energy generation** (mostly to help renewable energy overcome specific roadblocks and make it attractive for private investors) as well as to invest in the electricity grid to make it more dynamic and reliable. This will entail making the grid capable of absorbing large amounts of intermittent renewables and allowing consumers to manage their demand for electricity . This can also mean investing in renewables-based mini grids. Overall, subsidy swaps in this sector should be used to break the traditional link between fossil fuel-based electricity generation and the power sector, helping the sector transition to a low-carbon future.

6.0 How to Incentivize Investment in Clean Electricity

Previous chapters underscored how **clean electricity is critical to the net-zero future and thus a crucial element to consider in the energy transition and the fossil-free recovery**. Today, the electricity sector is the largest CO_2 emitter globally, responsible for about 13.5 gigatonnes (Gt) in emissions in 2019, or 40% of all emissions (IEA, 2020k). As electricity demand is expected to increase, renewable energy will play a crucial role, and solar PV and wind will be critical for decarbonizing the sector. The IEA's Net Zero Emissions by 2050 (NZE2050) scenario sees the share of renewables in global electricity generation rise from 27% in 2019 to 60% in 2030 (IEA, 2020k).

However, investment is urgently needed to decarbonize electricity (Steffen, 2018). The IEA's net-zero by 2050 scenario[37] estimates that investment in renewables will need to reach USD 1.1 trillion annually by 2030 (IEA, 2020k). This is a big leap from the USD 304 billion spent on renewables in 2020 (BNEF, 2021). SE4ALL estimates that investment in developing countries for electricity access to achieve the Sustainable Development Goal 7 by 2030 remains far below what is needed (SE4ALL, 2020). Recovery packages should help to close these financing gaps. So far, these packages have committed USD 207 billion to renewable energies (Energy Policy Tracker, n.d.) (see Chapter 2 of this report).

Solar PV and wind are proven, commercially available technologies and have great possibilities for continued scale up and job creation.[38] Solar is easily and quickly built, wind has many high-quality resources available, and both have mature supply chains[39] that can allow a rapidly growing manufacturing base (IEA, 2020d). The IEA estimates that solar PV will create between 10 and 15 jobs per USD million invested, wind will create between 1 and 3 jobs per USD million invested, and associated grid upgrades will create between 1 and 7 jobs per USD million invested (IEA, 2020k).

While SOEs and PFIs will play important roles, it is estimated that the majority of finance will need to come from the private sector. The IEA estimates that 70% of future finance for renewables will need to come from private sources (IEA, 2020k). However, there remain questions as to whether this finance will materialize: renewables projects require large upfront capital investments compared to other energy projects, and in many countries private investors still perceive renewable energy projects as too innovative and therefore too risky (IEA, 2020k; Steckel & Jakob, 2018).

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[37] The IEA's NZE2050 scenario describes a possible route to put CO_2 emissions on a pathway to net-zero globally by 2050.

[38] Skills shortages can hinder the achievement of renewable energy targets. Governments should ensure appropriate policies are in place to ensure the relevant skills are developed to meet the energy sector's needs (ILO, 2011).

[39] The COVID-19 crisis highlighted that supply chains are geographically concentrated, particularly in the case of solar PV in China. Governments concerned with the risk of future energy supply chain disruption should direct part of their post-COVID-19 public money toward creating more diversified supply chains.

The role of governments will be to define the right policies and eventually allocate public money in the right way to mobilize private investment, ensuring renewable energy technologies reach the scale necessary to achieve net-zero goals. As in other major industrial transitions, governments will have a key role to play in facilitating the needed private investment (Mazzucato, 2011). Despite renewables being proven technologies with rapidly dropping costs, there can still be many roadblocks to their financing and deployment, such as ready access to appropriate land and access to appropriately structured and priced finance (IEA, 2020d; Steffen, 2018). In this case, government support is needed to avoid these. There is also a time dimension that justifies strong government intervention: we need to stimulate enough market activity now, before it is too late to mitigate the impacts of climate change. The role of public money—in parallel with a supportive policy environment—is to help address these barriers, mobilize the necessary investment and, where possible, leverage private finance (Shan et al., 2020). COVID-19 recovery packages can be used for this purpose, as supporting renewables pays back: according to analysis by IRENA (2020e), for each USD of public money spent on renewables, USD 3 to 4 dollars of private investment can be leveraged.

Governments' options for promoting clean electricity in recovery will depend on the national context and each country's enabling environment. The "enabling environment" is made up of factors that influence the ease of financing and running projects, such as regulations and incentives (the policy mix), infrastructure, technical capacity, political will, institutional readiness, and financial system readiness (Mann et al., 2020; World Bank, 2021). In India, for example, an evaluation of the expansion of solar PV found that an enabling environment was created by a range of de-risking policies, including those that addressed off-taker risk, such as via PPA (power purchase agreement) intermediation, improved land acquisition policies, and a stable investment climate that appealed to both domestic and foreign investors (Suharsono, 2020). This helped push down solar prices, contributing to rapid deployment. On the other hand, other countries, like Indonesia, continue to face various roadblocks and have seen little growth in solar despite ambitious targets (Bridle et al., 2018, 2019). In many African countries, financial de-risking will be essential to bringing down the cost of renewables and scaling up their deployment (Sweerts et al., 2010).

Recovery programs can be used to promote clean electricity by developing approaches to support renewables that are appropriate to differing national circumstances. Support for solar PV and wind deployment, and their grid integration, can be provided in a range of ways, such as through subsidies and other support policies (e.g., feed-in-tariffs [FiTs], research and development grants, and tax breaks) and public finance (e.g., long-term concessional debt), both of which can help address risks and leverage private finance into projects. Swaps can be used to provide public funding in this case (see Chapter 5). Governments can also direct SOE investment and activity toward renewables. Different government support mechanisms target different risks and roadblocks faced by renewables, and these usually differ by country, even at a subnational level.

The following sections discuss how governments can support the deployment of solar PV and wind through three approaches: subsidies and other support policies; public finance; and SOEs.

6.1 Subsidies and Other Support Policies

Subsidies[40] and other support policies have been used by governments to signal national priorities and influence investment decisions in the energy sector. In many countries, investments in more "novel" energy technologies are seen to be risky, so strong and consistent government backing for an energy technology is often a prerequisite for investor confidence.

Well-targeted subsidies and other policies can help kickstart solar PV and wind projects, address risks to bring in private investment, and ensure projects are deployed widely enough to eventually bring down prices. FiT subsidies[41] implemented in the early days of solar PV and wind in Germany, Spain, and the United Kingdom, for example, awarded (often generous) long-term tariffs to renewable developers to generate electricity. FiTs gave long-term certainty to developers and helped mobilize the necessary investment to develop renewable projects. FiTs have also been instrumental in driving more recent initial capacity addition in developing and emerging economies, including in China, India, and Vietnam. **FiT schemes, while effective at kickstarting the solar PV and wind sector, may eventually become too costly for both governments and energy consumers alike.**

In more mature renewables markets, competitive reverse auctions that award long-term power purchase agreements have been favoured. Like FiTs, they give long-term certainty to developers and have been very successful at mobilizing private investment, but they are also considered to be a good price-searching mechanism to allow the lowest-cost generation.[42] For example, Mexico saw record low renewable generation prices under its competitive long-term generation auctions at USD 0.0179/kWh (MXN 0.344/kWh) for solar and USD 0.0177/kWh (MXN 0.341/kWh) for wind (Geddes, Gerasimchuk et al., 2020).

Other policies that have been effective at mobilizing investment in renewables include clear, long-term renewable energy targets, implementation of renewable portfolio standards that ensure utilities and generators produce or purchase a minimum share of their generation from renewables, ensuring renewables are prioritized on the grid and that the grid is upgraded to facilitate large-scale deployment of renewables. India has implemented a range of renewable energy subsidies and support policies (see Box 15) and has seen its installed capacity of solar PV and wind grow from 7.7 GW in 2002 to 72 GW in 2020 (Central Electricity Authority [CEA], 2020; Geddes, Gerasimchuk et al., 2020).

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[40] In this section, as in the rest of the report, we use the World Trade Organization's subsidy definition, which can be roughly summarized as "a financial benefit that the government gives, often to specific business, group or industry." (WTO, n.d.) Other forms of support, such as public finance, can have subsidy elements (e.g., the "concessional" element of concessional debt—debt that is provided at below-market rates) but it can be difficult to identify and quantify the subsidy elements in isolation.

[41] The cost of FiTs can be absorbed directly by the government (by paying the generators or electric utilities) or indirectly (via any SOEs that may be paying generators or utilities). In some cases, the costs of FiTs are passed on to consumers, in which case FiTs are not considered a subsidy.

[42] Careful design of auctions is needed to ensure that the winning bids are financially viable, as auctions can encourage under-bidding. If this leads to failed projects, it can raise risk perceptions and increase costs of finance for renewables.

Box 15. India's renewable energy subsidies

India has ambitious renewable targets and has successfully mobilized the private investment needed to increase its renewable energy capacity over a short time period. There are many drivers behind this, but it is partly driven by the range of subsidies and support policies implemented by India's state- and centra-level governments to support clean energy and its investment (Garg et al., 2020).

The Solar Energy Corporation of India's (SECI's)[43] reverse auctions, which award long-term power purchase agreements (PPAs) to power producers, have been crucial for deploying solar and wind project developments. This scheme helps mitigate developers' offtake risk, and SECI's role as a mediator in negotiating the PPA contracts has been important in ensuring this risk has been addressed. Solar parks have also been popular with developers because they greatly improve the ease with which developers can access land and secure transmission grid connections for projects. The Green Energy Corridor that developed greater transmission capacity has also allowed the deployment of projects by facilitating the integration of large-scale renewables into the grid. Accelerated depreciation for wind and solar plants, a type of tax relief to help improve return on investment and decrease payback periods, has also been effective. Alternatively, solar and wind project developers could participate in a generation-based incentive scheme for each unit of power provided to the grid for a fixed period of time. In addition, viability gap funding (VGF) has been offered for a limited number of projects under various schemes, providing a capital subsidy for setting up solar projects.

While these subsidies and incentives have helped mobilize private investment to deploy projects, recent tariff caps (now removed) on reverse auctions and the imposition of a safeguard duty on imported solar module equipment slowed the deployment of solar PV (Garg et al., 2020). In addition, an announced basic customs duty on solar module imports has introduced uncertainty around the future pace of capacity addition and raises questions regarding whether—and by how much—tariffs may increase in the future. Developers and investors have also reported that changing incentive schemes and government policies have led to policy uncertainty, which is a major barrier to mobilizing finance and deploying projects. More positively, recent announcements indicate support for new technology areas (Garg et al., 2020), and India's first offshore wind tender is anticipated in the near future (Prasad, 2020).

6.2 Public Finance

The PFIs that governments own, operate, and fund are very well placed to channel recovery funding toward a clean energy recovery. Investing public money is a PFI's core activity, and many PFIs already have experience supporting renewables through their investment activities. PFIs can be fully or partially owned by governments and therefore

[43] SECI's main role is to enable solar energy in India, although it also enables wind projects. It does so by conducting auctions to get lowest rates and in turn sells those power purchase contracts to state distribution companies. SECI is also responsible for implementing and releasing a range of subsidies for renewables.

often have a policy-driven mandate as well as a commercial remit. PFIs include national development banks (also known as state investment banks), multilateral development banks, bilateral development banks, development finance institutions, export credit agencies (ECAs), and any other national or subnational funds and grant-giving bodies.

PFIs play a de-risking role, which in turn mobilizes private investment. When public finance is channelled to a sector or technology, it signals that governments are prioritizing support for that sector or technology (OECD, 2017; Tucker et al., 2020). Public finance tools and activities play a de-risking role, which in turn leverages private investment (Tucker et al., 2020). Traditionally, PFIs have offered financial tools, such as grants, guarantees, and below-market rate (concessional) debt, all alongside extensive technical support to help project stakeholders meet their requirements for successful project financial close. In particular, grants and concessional public finance have been effective in de-risking projects in countries with early-stage renewable sectors with higher risks and a high cost of finance. More recently, some PFIs have extended the range of tools they offer to also provide market-rate debt and equity (Geddes et al., 2018). These market-rate tools have been welcomed by both renewables developers and investors in countries with more advanced renewables markets that feature lower risks: providing market-rate public finance indicates that projects are "commercial-ready" and bankable, and the commercial terms mean the public finance is less likely to crowd out[44] private finance.

Channelling recovery funds through PFIs is an excellent way of indicating a shift in priorities from fossil fuels to clean energy, while simultaneously using public money to leverage private investment. Green PFIs in particular (see Box 16) have used their green mandates to successfully support the solar PV and wind sectors. They take a range of roles to address country-specific risks and leverage private finance. There has also been some leadership taken by other PFIs that have implemented policies to limit or end their financial support to fossil fuel projects, including the European Investment Bank, the World Bank Group, Commonwealth Development Corporation (CDC) Group, Agence française de développement, Ireland Strategic Investment Fund, Swedfund, and Sweden's ECAs. Others are making green commitments. The European Bank for Reconstruction and Development will dedicate most of its investment activity to green projects by 2025 (Renaud-Basso, 2021). The Asian Infrastructure Investment Bank has announced that at least half of all its financing approvals will be made up of renewables and other projects that address climate change by 2025 (Kawate, 2021). Because PFIs are being given the mandate and finance to help governments' COVID-19 recoveries, it is critical they are used to support renewables and the clean energy transition. Governments can also use PFIs to support a just transition by mandating frameworks for PFIs that prioritize green funding for the regions most dependent on high-carbon sectors like oil, gas, and coal.

[44] Crowding out refers to public finance institutions investing in the place of private financiers, which then displaces and/or reduces private investment participation. This eventually inhibits the development of an effective and robust private sector market for financing.

Box 16. Green PFIs

Governments can look to green PFIs for guidance on how to support solar PV and wind using public finance. Green PFIs, also known as green state investment banks, have been established[45] by some governments to support low-carbon projects and help transition their country to a more sustainable economy.

Green PFIs have played a range of key roles to support the financing and deployment of renewable energy projects (Geddes, 2020; Geddes et al., 2018). By taking a de-risking and capital provision role, they have successfully addressed risks and barriers faced by renewables projects. These risks and barriers vary by technology, project size, and local setting but can include, for example, large upfront capital requirements and construction risks for offshore wind or novel technology risk for a first-of-its-kind large-scale solar PV plant. See Geddes et al. (2018) for detailed mapping of how—and how well—green PFIs have addressed renewable developers' risks). In addition to de-risking and capital provision, other vital roles include educating (themselves, project developers, and other financiers), signalling trust in renewables to the market, taking a first- or early-mover role, and helping to coordinate industry (Geddes, 2020; Geddes et al., 2018).

Green PFIs have a wide range of financing tools and financing channels at their disposal, which has allowed them to be flexible and better meet renewable developers' financing needs—for example, by providing equity needed by some early-stage developers when most commercial and public banks were only providing debt. Some green PFIs, such as Germany's KfW, argue that providing concessional debt, grants, and guarantees[46] is the most effective way of de-risking projects (Geddes et al., 2018). Other PFIs, such as Australia's Clean Energy Finance Corporation, have argued that providing finance at commercial terms sends a greater de-risking signal to investors, reassuring them that projects are commercial-ready and bankable, and that the commercial terms prevent the crowding-out of private finance (Geddes et al., 2018).

By taking greater risks and supporting the deployment of less-proven technologies and more innovative projects, green PFIs are helping accelerate the energy transition. They are an effective way for governments to use their recovery funding to mobilize private finance for deploying renewables (Geddes et al., 2018).

6.3 SOE Investment and Diversification

Governments must move their SOEs further and quicker down the clean energy path. Some countries' energy sectors feature SOEs, which include institutions such as national utilities, municipal utilities, transmission and distribution companies, and electricity generators. Particularly in some developing and emerging countries, SOEs dominate large parts of the electricity sector, both in terms of ownership and investment activity. In India in 2019, 54% of all electricity generation was state-owned (29% at the state level and 25% at the

[45] See the Green Banking Network for a full list of institutions https://greenbanknetwork.org/members/

[46] Concessional debt, grants, and guarantees help reduce the cost of finance for developers for those particular projects where those tools are supplied.

central level) (CEA, 2019). In terms of SOE investment, in 2019, SOEs provided over 35% of total energy investment globally, and, in emerging and developing economies, they provided 90% of grid investment (IEA, 2020k). How SOEs operate and make investment decisions can have a considerable impact on renewables deployment and clean energy transition.

Governments can influence SOEs in two main ways to make them key actors in green recovery. First, their ownership stake can allow them direct influence over SOE strategy, decision making, and investment by mandating SOEs to invest in solar PV and wind. Second, governments can also provide policy support to incentivize SOE investment in renewables (such as through the range of policies suggested in Chapter 6.1).

Some SOEs have taken the lead on investing in renewables and transforming the electricity mix of their countries, setting an example for net-zero commitments. Oersted (Muzondo et al., 2021), a Danish state-owned utility, has transitioned from fossil fuels to mostly renewable generation (85% of its total share of generation). India's largest state-owned coal producer, Coal India Limited, has announced that it will develop 20 GW of solar PV over the next 10 years and plans to invest USD 764 million (INR 5,650 crore) on 3 GW of solar between 2023 and 2024 ("Coal India sets," 2018; "CIL to set up," 2020) while the National Thermal Power Corporation (NTPC) has set a target of making 30% of its power plants renewable by 2032 (NTPC, 2021). Finally, a large number of Germany's municipal utilities have also invested in and sourced their power from solar PV and wind energy (Muzondo, 2021). This was driven by strong renewable policy commitments from municipal governments, engaged municipal utility management teams, and access to appropriate finance through Germany's public development bank, KfW (Muzondo, 2021). In markets where SOEs dominate, they need to diversify and play a central role in supporting the energy transition.

6.4 Conclusions and Recommendations

Recovery funds should be used to incentivize investment in clean electricity, as this will be the backbone of the energy transition. The previous chapter explained how funds raised from fossil fuel subsidy reform and taxation can be swapped to support clean energy. However, public money alone will not be enough to achieve the scale needed. Also, once renewable energy technologies are mature, they become attractive to private investors. In this case, the role of governments is to create an enabling environment that promotes renewables via the right policies and mandates and using public finance to leverage private investment. There are three approaches to do so: subsidies and other support policies; public finance; and SOEs. Based on this, our concrete recommendations are:

- **Define the targeted support policies for solar PV and wind, and related grid-integration projects**, considering the level of renewables market development, the local context, and risks facing the renewables sector in each country. In countries with underdeveloped renewables sectors and high financing costs, subsidy schemes such as FiTs and appropriate support policies can help leverage private finance for demonstration and early-stage renewables projects. The subsidies can be funded according to the swaps principles described in Chapter 5. As countries' renewables markets mature—and risks are better identified and mitigated—governments can redesign subsidies toward market-based, price-searching incentives (such as auctions) to help deploy lower-cost generation.

- **Mandate PFIs to use recovery funding to mobilize private finance** for deploying renewable energy, addressing country-specific risks to these projects. PFIs can employ a range of tools to help de-risk renewable energy projects and leverage private finance. In markets with early-stage renewables sectors featuring high risks and high financing costs, grants and concessional public finance are effective de-risking tools. In more developed renewables markets, commercial rate tools can still be effectively used to help address residual country-specific risks but are less likely to crowd out private finance. Also, governments should alter the mandates of state-backed PFIs to ensure they move away from fossil fuels and undertake green investments and activities. Green PFIs that have financed solar PV and wind projects and leveraged large amounts of private finance can provide guidance on designing PFI mandates and direct investment activities (see Box 16).
- **Add sunset clauses to support policies and public finance activities** that allow for monitoring and necessary redesign to ensure they remain relevant, well-targeted, and do not lead to unnecessary waste of government resources. As solar and wind enter the mainstream and become competitive, support policies and public finance can be redirected toward other emerging clean technologies such as floating solar, offshore wind, battery storage, etc.
- **Make SOEs agents for change to achieve net-zero.** In order to achieve a fossil-free recovery and the energy transition, SOEs have to diversify away from fossil fuels toward clean energy. As the majority owner, governments can mandate SOEs to start adapting their strategies and mandates in order to transition to clean electricity. They can also introduce policy and support mechanisms to incentivize SOEs to redirect their investments toward clean electricity.

7.0 Ensuring a Just Transition

Fossil-free recovery is going to affect several major aspects of our economies and societies, including industries, workers, and communities. This chapter outlines why it is important that energy transitions be just and how to put in place the conditions for this to happen as governments implement recommendations and principles for a fossil-free recovery. While energy transition will affect all countries, fossil fuel producers will be the most affected, as achievement of the SDGs and net-zero will imply a diversification of their economies. Chapter 7.2 focuses on specific recommendations for these economies.

Just transition is a specific concept that has developed over time, pioneered by labour organizations. It has been described by the International Trade Union Confederation's Just Transition Centre as a process, but also a theory of change (Carbon Brief, 2017). The ILO *Guidelines for Just Transition* (ILO, 2015) represent the key reference for a just transition, and they have been developed by representatives from unions, employers, and government. Just transition contributes to decent work, social inclusion, and poverty eradication in the shift toward sustainable economies by maximizing jobs and positive social impacts while minimizing and addressing potential negative impacts.

The main elements of just transitions are:

- **Social dialogue:** Just transition planning and policies need to be based on social dialogue. Social dialogue between or among representatives of governments, employers, and workers plays a crucial role in raising concerns and priorities about the transition and in building broad-based support for policies. Critically, just transition enables parties to "go further and faster together" to establish and plan for jobs and businesses that can thrive under a Paris Agreement-compliant economy (Carbon Brief, 2017).
- **Meaningful and strong stakeholder engagement** with non-tripartite stakeholders affected by the transition. This may include civil society groups, consumer associations, local communities, and non-governmental organizations, who will be affected by a changing energy sector. For example, energy transitions could lead to price impacts and potentially exacerbate poverty if no mitigating actions are taken. In these cases, involving affected stakeholders and communities can ensure policies that support the most vulnerable are inclusively developed.

Energy transitions are strongly driven by local dynamics in the communities, regions, and countries where they take place and where the greatest impacts are felt by those exposed by transitions. While the specific applications of just transition will vary depending on geographic, economic, and social contexts, the ILO (2015) provides a framework to ensure those affected are part of the solutions.

This report highlights fundamental principles for a just transition and key policy areas (see Box 17) (ILO, 2015). In addition to these, it is important to remember that while social dialogue and stakeholder engagement are essential, workers must be involved from the ground level in a just transition. This includes ensuring that there is education on climate change in workplaces through peer training and the establishment of joint committees on just transition. Related to this, it is important to acknowledge the expertise that workers already have and leverage this expertise in the implementation of a just transition to ensure success.

7.1 Why Is Just Transition Needed, and How Can It Be Achieved?

A just transition approach can help mitigate significant risks to energy transitions while also realizing positive impacts and opportunities (e.g., job creation). The decline of the fossil fuel sector and related industries that are unequipped to transition to the emerging global low-carbon world, (along with the resulting spillover effects) present employment and social challenges for the wider economy of a region or country as a whole. Unmanaged changes in industry or business practices can also exacerbate unemployment. However, new and emerging sectors that are consistent with low-carbon development gain strength and can be drivers of employment and social improvement.

Employment and social risks are also prevalent and can be acute in communities that face the shutdown of major employers in key sectors. Poverty can be exacerbated. Without active employment and labour market policies, including the creation of job alternatives in other sectors, retraining for workers, and strong social protection with social insurance, cash transfers, and access to social infrastructure and services, acute challenges can become long-lasting and make it difficult for laid-off workers to re-enter the workforce and maintain their livelihoods, even if new green and decent jobs emerge in the energy sector or other sectors. The mental health impacts of economic crises or industrial upheaval, whether local or national, can further erode community well-being without responsive policies to support those affected (Frasquilho et al., 2016; WHO, 2011).

In addition, **despite the goal of transitioning to clean and lower-emission energy systems, there are still environmental risks if the transition is not just.** One prominent example is the risk that fossil fuel companies go bankrupt and leave abandoned infrastructure and environmental liabilities or waste. Similarly, deployment of renewable and battery technologies can create new socio-environmental risks, including from mining of raw materials, that just transition approaches can help minimize (MiningWatch Canada, 2020; Sharma & Manthiram, 2020; Thies et al., 2019).

In many cases, **the pandemic has accelerated trends or added additional strain to sectors where jobs are being impacted by digitization and automation or the low-carbon transition** (Corkal et al., 2020). It is therefore critical that governments ensure that economic recovery is worker-focused, prioritizing worker health and safety and good working conditions, while aligning support to ensure the labour force is supported for active transition (Canadian Labour Congress, 2020; ITUC, 2020) and that new and emerging job opportunities are quickly seized, for example, through supported skills diversification and development programs.

To achieve a just transition, policy development and social dialogue are critical. Box 17 outlines how to consider these two elements.

Box 17. Achieving a just transition through policy development and social dialogue

Policy development for a just energy transition must cover several areas to mitigate economic, social, and environmental risks associated with energy transitions. The following specific policy areas were identified by the ILO as necessary to address to ensure economic, social, and environmental sustainability during transitions (ILO, 2015):

- Macroeconomic and growth policies
- Industrial and sectoral policies
- Enterprise policies
- Skills development
- Occupational safety and health
- Social protection
- Active labour market policies
- Rights
- Social dialogue and tripartism

Source: ILO, 2015.

Social dialogue is the prerequisite for designing and implementing a just energy transition. It includes all types of negotiations, consultations, or exchanges of information between governments, employers, and workers on economic and social policy issues of common interest (ILO, n.d.). Social dialogue can be tripartite or bipartite (with or without government involvement), with the goal of promoting consensus building among parties (ILO, n.d.). Enabling conditions for social dialogue include political will, respect for rights and collective bargaining, independent worker and employer organizations, and institutional support (ILO, n.d.). Social dialogue can be combined with meaningful stakeholder engagement with other stakeholders affected by transition to ensure a fully inclusive process.

7.2 Just Transition in Fossil Fuel-Rich Economies

Regions that rely on fossil fuels for significant portions of their economic activity face unique challenges for just transition. In particular, oil- and gas-rich economies will need to diversify and plan for transition sooner rather than later in order to achieve a Paris Agreement-compliant scenario and ensure fiscally sound economies for the future. While coal transitions are already underway in some jurisdictions (and there are global models for these transitions that can be looked at), there are far fewer examples of just transition for oil and gas. At the same time, oil and gas represent a large share of global emissions, emissions that will have to drastically decrease to meet global climate goals, necessitating a stronger focus on these transitions going forward. Current pledges under the Paris Agreement (Nationally Determined Contributions) leave an alarming gap between projected levels of GHG emissions by 2030 compared to what is needed to meet agreed-upon temperature limits, as well as goals for net-zero (Climate Action Tracker, 2020). Current plans for fossil fuel production would result in over twice the production by 2030 than is consistent with a 1.5°C scenario (SEI et al., 2020). COVID-19 recovery packages in some fossil fuel-producing countries are exacerbating this trend (see Chapter 2). Countries are lagging on planning a just transition from oil and gas, while just transitions for coal are still in their infancy.

Acting early is critical to minimizing negative impacts and risks from energy transitions (Zinecker et al., 2018). We already have a wealth of knowledge from early coal transitions to inform transitions from oil and gas. Governments are in a unique position to be proactive rather than reactive, but the window within which to do so is rapidly closing.

Fossil fuel-producing economies should prioritize economic diversification as part of their recovery packages, which can make economies more competitive and resilient to shocks while supporting just transition. Funds from recovery packages can help governments proactively manage the transition while ensuring a just recovery. The EU, for example, allocated an additional EUR 10 billion to the EU Just Transition Fund (JTF)—a tool primarily aimed at supporting the transition in coal regions—as part of its Recovery Fund, which more than doubled the funds initially proposed for this instrument to EUR 17.5 billion (European Commission, 2020).

Fossil fuel-producing countries should define ambitious targets and well thought-out industrial policies that would help send strong market signals and lay the foundation for transition. Developing industrial ecosystems, supporting innovation, and driving investment in the sectors and infrastructure of the future are also critical (Task Force for Resilient Recovery, 2020). Industrial policies and regional economic development efforts are required that create job alternatives not only in the renewable energy field but also outside the energy sector. Often, the potential of renewable energy lies in other regions, and there are few readily available job opportunities there for workers from the coal-, oil-, and gas-producing regions. Active employment and labour market policies (e.g., reskilling and retraining) coupled with social protection (e.g., early retirement, unemployment benefits) are an important part of a comprehensive and successful just transition. Equally, investment in institutional capacity and human capital is needed. SOEs can act as agents of diversification, as has been the case with Sweden's Vattenfall and Denmark's Ørsted,[47] who have diversified investments in renewables through divestment from fossil fuels (IISD, 2019). Crucially, effective just transition policies that help diversify fossil fuel-dependent regions while supporting communities and workers can help build political support for climate policies more generally (SEI et al., 2020).

Recovery packages are providing a once-in-a-generation opportunity where major public stimulus is being directed into economies all over the world. Directing these recovery funds in a manner consistent with the just transition framework can create lasting benefits for all parties. If they are directed improperly—to fossil fuel expansion, for instance—we will lose this opportunity and wind up in a much worse position in the long run, having expended limited public funds without long-term transition benefits to show for it.

[47] Ørsted is majority-owned by the Danish state but is not totally state owned.

Engaging with representatives from relevant stakeholders is a good practice to develop a set of just transition recommendations. Although work is still needed, Canada started to follow such an approach in the just transition away from coal (see Box 18). The country can learn from this example for the oil and gas sectors, where a just transition is needed and must be actively planned to meet federal emission reduction commitments for 2030 and 2050.[48] However, the reality is that among global economies dependent on oil revenue, Canada has relatively low dependence combined with a high capacity to plan for and fund a just transition (SEI et al., 2020). Canada's energy sector accounts for around 10% of nominal GDP (Natural Resources Canada, 2020). Germany (see Box 19) also initiated a coal commission that developed a plan for how the country can phase out coal power while mitigating socio-economic shocks in affected regions. With broad representation of representatives from politics and civil society groups, including labour, environmental groups, and academics, a compromise was reached almost unanimously. This process helped foster societal consensus and acceptance for the exit from coal and can serve as a blueprint for building support for other upcoming transitions away from fossil fuels, both domestically (e.g., the transformation of the automobile sector) and internationally.

Transitions in developing countries are in the very early stages, and just transition has not been a clear component of these processes. There has been some progress on coal in the last few years, but oil and gas transitions are in even earlier stages. Despite the urgent need for just transition, in some cases, governments have doubled down on struggling oil and gas sectors by providing fiscal support. Fiscal support perpetuates fossil fuel sector activity and delays much-needed transitions while working against global climate targets. Meanwhile, investments in fossil fuels are becoming increasingly risky and poor performing (Braithwaite & Gerasimchuk, 2019; Erickson & Lazarus, 2020). Financial institutions such as the European Investment Bank, ECAs in France and Sweden, and UK Export Finance, have begun to restrict investments in fossil fuels within their portfolios in response ("European Investment Bank drops," 2019; "France to rein in," 2020; Michaelowa et al., 2020).

These countries should instead use the revenues to support the diversification of their economies under the fossil-free recovery principles. In Indonesia, subsidies for oil and gas production overtake the total amount of revenue collected by the government in these sectors, meaning that the sector is an overall drain on public revenues rather than a benefit (Braithwaite & Gerasimchuk, 2019). This fiscal narrative makes a rapid and meaningful transition even more important to avoid an accelerating problem for the sector as it becomes more dependent on public funds for its continued survival. Overall, consideration of policy implications of just transition in Indonesia has not been fully undertaken for coal transition, let alone for oil and gas (Lontoh & Beaton, 2015a; Syahni, 2017). Civil society groups have been pushing for cleaner energy investments from the Indonesian government—and for reform of fossil fuel subsidies that can free up capital for social benefits—which would be more aligned with fossil-free recovery principles, instead of using public funds to perpetuate a sector that is destined to decline.

[48] Canada's updated climate plan articulates a goal to reduce national GHG emissions by 32% to 40% by 2030 compared to 2005 levels, and to net-zero by 2050 (Environment & Climate Change Canada, 2020).

Box 18. Just transition in Canada: Learning from just transition processes for coal

Canada has undertaken significant efforts to reduce thermal coal use, with a plan to phase out thermal coal-based electricity by 2030. In 2015, coal was used to generate 11% of the country's total electricity but was responsible for 78% of total emissions from Canada's electricity sector (Government of Canada, 2018). Even though coal's share in electricity generation decreased to 7.4% in 2018, four provinces remain dependent on coal to generate electricity. Canada announced in 2016 that it would completely phase out coal-fired electricity by 2030 (Government of Canada, 2018; Harris, 2016).

Because certain workers and communities would directly be affected by such an accelerated phase-out of coal-fired electricity, the federal government launched a Task Force on Just Transition for Canadian Coal Power Workers and Communities in 2018 to provide knowledge, options, and recommendations on how to implement a just transition (Government of Canada, 2019a). The task force had expertise in sustainable development, workforce development, and the electricity sector and represented labour associations, unions, municipalities, civil society, and environmental groups. Its primary activity is visiting affected facilities and communities and engaging with representatives from relevant stakeholders (communities, labour, industry, clean tech, finance, academics, and non-governmental organizations) to develop a set of just transition recommendations. In early 2019, the task force provided two reports, one that included 10 recommendations for a just transition plan, another summarizing the feedback it collected from stakeholders (Government of Canada, 2019a).

The task force results were received very positively by government and stakeholders. However, civil society and labour groups also stressed the need to put these recommendations into action. Although some federal funding was set aside in the 2018 budget (CAD 35 million for the establishment of worker transition centres), the task force had identified that hundreds of millions of dollars would be required to adequately implement its recommendations (Government of Canada, 2019b).

Additional recommendations were later referenced in Canada's 2019 budget and the Prime Minister's 2019 mandate letters to several ministries aimed to advance legislation to support the future and livelihood of workers and their communities in the low-carbon transition (a "Just Transition Act"). However, no such legislation has yet been introduced (Office of the Prime Minister, 2019), and the Canadian Labour Congress considered the budget inclusions insufficiently ambitious (Canadian Labour Congress, 2019).

When the government announced its updated climate plan in December 2020, workers and employment were highlighted, but details on the implementation of just transition were very limited (Government of Canada, 2020). Despite establishing a successful and replicable process through the task force, the approach has not yet been replicated for other fossil fuels.

Box 19. Just transition in Germany: Learning from just transition processes for coal

Coal has long dominated Germany's electricity sector. Even though dependence on coal has been gradually reduced in recent decades, in 2019 almost 30% of the country's gross electricity was still generated using coal. Lignite was the single largest source, with 19% of the total mix (Bundesverband der Energie- und Wasserwirtschaft [BDEW], 2020). This makes Germany one of the largest consumers of coal in Europe (German Federal Network Agency, 2021). Even though Germany stopped producing hard coal in 2018, it remains a large producer of lignite, accounting for 45% of all lignite produced in the EU in that year (Eurostat, 2020). In 2020, about 20,000 people were still directly employed in the lignite sector (mining and power plants) (Statistik der Kohlenwirtschaft e.V., 2020).

In order to meet its climate targets, the German government set up a Growth, Structural Change and Employment commission in June 2018, where various actors from politics, business, environmental associations, trade unions, and the regions concerned would be represented to develop a plan to gradually phase out coal-fired power generation, including legal, economic, social, and structural accompanying measures (German Federal Government 2018).

The final report of the commission—which all but one member accepted as a compromise—calls to gradually phase out German coal-fired power plant capacity by 2038, with the possibility of deciding by 2032 whether the complete coal phase-out can be advanced to 2035 (Federal Ministry for Economic Affairs and Energy, 2019). To mitigate any socio-economic impacts of this policy, the report proposes that affected regions should receive grants worth EUR 40 billion over the next 20 years (EUR 1.3 billion annually for project-related structural policy and EUR 0.7 billion annually for non-specific projects). Moreover, the report suggests setting up new federal and state authorities and investments in the transportation and telecommunication infrastructure in these regions and providing an adjustment allowance to lignite employees aged 58 and over to bridge the gap to retirement.

This compromise was praised for aligning climate protection with social and economic goals, creating fair transition conditions for coal-producing regions and employees. However, some environmental groups—including those represented as part of the commission—raised concern that the phase-out completion date was incompatible with the Paris Agreement (Agora Energiewende, 2019; German Federal Environment Agency, 2019; German Federation for the Environment and Nature Conservation, 2019). In July 2020, the German parliament adopted the legal basis for the coal phase-out and the accompanying measures; however, not all recommendations the commission made were fully addressed (Federal Ministry for Economic Affairs and Energy, 2020; Süddeutsche Zeitung, 2020). This was publicly criticized by previous members of the coal commission, who blamed the German government for abrogating the compromise reached by the coal commission (German Nature Conservation Ring, 2020).

7.3 Conclusions and Recommendations

Just transition provides the framework under which the policy and technical recommendations listed throughout this study should be developed and implemented—that is, the approach to transition to a low-carbon future should be based on tripartism and social dialogue.

As countries chart their recovery from the COVID-19 pandemic, just transition conversations will inevitably shift from pre-pandemic realities to confront the new context we are now in. Research from civil society groups shows that there have been increasing concerns since the onset of COVID-19 regarding themes such as the precariousness of work in terms of security and ability to support families and communities, worker health and safety, youth employment opportunities, and the outsized impacts of economic disruption on vulnerable populations (Beedell & Corkal, 2021; Canadian Labour Congress, 2020a). These trends underscore that transitions do not happen in a vacuum and are influenced by multiple factors and forces that governments need to take into consideration.

It is critical that governments apply robust conditions and principles to economic recovery spending in order to ensure COVID-19 recovery fully integrates just transition principles, is worker-focused and contributes to increased equity and the reduction of inequality (Corkal et al., 2020). As governments respond to support energy companies and sectors that have been disproportionately affected by the pandemic's economic disruption, they must consider how support can further just transition objectives. In some cases, transitions may occur earlier than expected. Facilitating a just transition in "real time" (assessing potential impacts and planning for the transition) and following strict adherence to the guidelines of just transition, including tripartism, is no easy task, but to delay the inevitable energy transition and prolong the life of industries that are not viable in the long term (for example, through fossil fuel subsidies) could have significant negative social, economic, and environmental consequences.

Prescriptive recommendations are not offered in this paper on how to conduct just transitions, since transition impacts and necessary responses will be highly localized to the country, region, and communities where they occur. By necessity, a just transition has to be locally developed and implemented. Although regions can learn from one another's successes, there are no blueprints for transition that can be unilaterally imposed based on what has worked elsewhere. While there are best practices that can be shared and learned from, they require local contextualization, and partners must have consensus and understand how to implement them effectively.

That said, **it is essential that just transitions be conducted in full accordance with the ILO guidelines for just transition** (ILO, 2015), including tripartitism, social dialogue, and meaningful stakeholder engagement as fundamental prerequisites and necessities. The term "just transition" (as referenced in ILO guidelines) has a well-established framework, and so we also suggest using this term rather than other ambiguous terms like "fair" or "sustainable" transition where a just transition is the intent, as this signals to partners how a process will be conducted, building trust by all parties. Governments must also take care to understand the risk of the potential for "just transition-washing." As public consciousness grows more aware of the term, there are risks that governments or other organizations redefine, adapt, or co-opt it in a way that is inconsistent with the original guidelines. Where the term "just transition" is used, it is important to be consistent with the guidelines.

Governments should endeavour to pursue a just transition proactively and embed its principles across sectors and policies, rather than acting reactively, which risks exacerbating negative impacts on workers and communities, while missing or delaying positive opportunities. It is also worth considering that focusing on transitions to new industries that are not job creating and are highly automated may not be the best course of action when job creation is badly needed and workers require immediate support. Similarly, repurposing oil or gas production for other outputs (e.g., plastics) may not be economically or environmentally prudent if new activities pose significant new environmental harms or delay adoption of cleaner technologies or economic opportunities that will be more sustainable in the long term. Above all, conversations about diversification within the fossil fuel sector must occur through social dialogue and tripartite processes with strong stakeholder engagement so that employment, social, and environmental priorities are fully considered in industrial policy. **Non-tripartite organizations can also support just transition, and their role should be considered by tripartite partners** (see Box 20).

Box 20. Stakeholder engagement for a just transition

In the context of stakeholder engagement, roles are also emerging for **non-stakeholder and non-tripartite organizations**, including non-profits, academics, and research communities, who are committed to supporting just transition internationally and in their communities. These include:

- Ensuring that the design of policies on energy and low-carbon transitions is rooted in the concept of just transition and universally accessible to those undertaking and impacted by transition.
- Maintaining commitment in research and activities to the guidelines for just transition, social dialogue, and tripartitism, as the definitive approach to achieving an effective transition to a low-carbon economy.
- Educating the public and governments to ensure that partners not only refer to the notion of a just transition but take the guidelines seriously and implement them properly.
- Supporting information exchange and providing platforms for engagement, nationally, regionally, and internationally (particularly in the Global South), that can ideally be trusted equally by different partner and stakeholder groups. In this context, it is also important to provide platforms for local stakeholders and parties to ensure they are adequately heard in an effort to maximize inclusion in just transition.
- Supporting policy development research, as much as possible working with local organizations in the region of focus, to bring together international expertise on energy transitions with knowledge of local dynamics and necessities for transition to be successful. This research can support and serve as an input to the tripartite processes that need to occur.
- Engaging in communications and building public support for just transition policies through effective research, public advocacy and education, and building coalitions.

8.0 Conclusions

Governments are dedicating significant amounts of public money to support the fossil fuel industry as part of their COVID-19 recovery packages. In doing so, they are supporting an energy and economic model that contradicts sustainable development commitments and locks in funding that could instead go to more pressing priorities. Subsidizing the fossil fuel industry also means subsidizing its externalities, including impacts on health and climate change. This situation has to end, and the moment is now for governments to address the climate crisis at the same time as they build out a recovery from COVID-19.

Decisions taken now will be critical in the upcoming years to achieve climate ambitions, deep engagement, and concrete action. Governments should focus recovery support on low-carbon energy activities and sectors that can help achieve the SDGs—and the net-zero or Paris commitments—at the same time as they create jobs and foster economic activity. A fossil-free recovery is possible, and this report presents the key principles to achieving it, demonstrating via concrete examples how other countries have done it.

This report shows how a global but modest tax on gasoline, diesel, and coal, combined with reform of subsidies to these fuels can raise USD 553 billion per year. Implementing price reform requires addressing the misunderstanding that cheap energy is a useful way to help the poor, generate employment, or stimulate economic development. Instead, energy subsidies tend to disproportionately benefit the rich and those that consume more electricity. Reform has significant potential but should also address the needs of those that will suffer from higher prices.

To maximize its sustainable impact, this money can be swapped to areas with high potential to help achieve the SDGs and net-zero commitments while generating economic growth and development: energy access, energy efficiency, decarbonization of transportation, and the power sector. That amount alone would cover needed support for SDG 7 in recovery plans according to the IEA's estimate of USD 150 billion over the next 3 years. This would provide access to clean cooking solutions for 420 million people and access to electricity for 270 million people. The power sector should get special attention, as it is expected to be the backbone of the energy transition: governments should support clean energy generation, as well as grid upgrades and infrastructure to support dynamic demand that includes EVs and energy-efficiency services (sectors that themselves should be supported). Furthermore, as renewable energy becomes more cost competitive, public finance should step in to leverage private finance and help de-risk renewable energy projects. Finally, the transition has to put people and communities at its centre. The last chapter emphasizes why it is important that energy transitions be just and explains how to put in place the conditions for successful just transitions as governments implement recommendations and principles for a fossil-free recovery.

The transition is already underway, and recovery packages offer an opportunity to accelerate it and make sure economies are aligned with the needs to meet climate and development targets. This report offers concrete recommendations on how each of the principles should be implemented and how public money raised from fossil fuel subsidy reform and taxation can be used to increase climate ambition. This can be done while generating economic growth, creating jobs, and achieving the SDGs and net-zero commitments, depending on each country's context.

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Appendix 1. Government Support to Fossil Fuels, Clean and Other Energy Before the COVID-19 Crisis: Best available global proxies

Due to the lack of transparency and comprehensive monitoring, there is no all-encompassing estimate of global support to all types of fossil fuels and clean energy. However, there are several reputable estimates of such support for a subset of countries (OECD members, G20, some regions etc.) and mechanisms (direct budgetary transfers, tax expenditure, induced transfers, public finance, SOE investment, and some other forms of support). A combination of these estimates can be used as the best available global proxy.

Table A1 attempts to summarize the best available global proxy estimates of government support to fossil fuels and clean energy before the COVID-19 crisis.

Table A1. Fossil fuels estimates prior to 2020

	Baseline prior to 2020 (latest estimates available)			
Sectors	**Direct budget transfers, tax expenditure, induced transfers**	**Public finance**	**SOE investment (capex)**	**TOTAL**
Direct fossil fuel* production, consumption and general services	At least USD 468 billion in 2019 in 81 economies** (OECD, n.d.)	At least USD 77 billion per year on average in 2016-2018 in the G20 countries and the major MDBs they control (Tucker et al., 2020)	At least USD 257 billion per year on average in 2017-2019 in the G20 countries (Geddes, Gerasimchuk et al., 2020)	At least USD 802 billion: at least USD 398 billion for production and at least USD 404 billon for consumption ***
Clean energy in the form of renewable power generation	At least USD 166 billion in 2017 (IRENA, 2020a)	At least USD 24 billion per year on average in 2016–2018 in the G20 countries and major MDBs they control (Tucker et al., 2020)	Unknown	At least USD 190 billion
Clean energy in the form of energy efficiency	Unknown		Unknown	

	Baseline prior to 2020 (latest estimates available)			
Sectors	**Direct budget transfers, tax expenditure, induced transfers**	**Public finance**	**SOE investment (capex)**	**TOTAL**
Other energy	At least USD 59 billion in 2017**** (IRENA, 2020a)	At least USD 31 billion per year on average in 2016–2018 in the G20 countries and the major MDBs they control (Tucker et al., 2020)	Unknown	At least USD 90 billion

* Includes fossil fuel-based electricity.

** Includes all of the G20 countries plus around 40 developing and emerging economies.

*** The USD 802 billion estimate of total government support to fossil fuels can be further broken down as:

- **USD 398 billion for the production of fossil fuels and fossil fuel-based power** as a sum of:
    - Direct budgetary transfers and tax expenditure: USD 64 billion for fossil fuel production and for fossil fuel power generation in 81 economies in 2019 (see the section "Global Fossil Fuel Subsidies Estimates" below).
    - Public finance from G20 governments and the major MDBs they control: USD 77 billion per year in 2017-2018 (Tucker et al., 2020).
    - SOE investment (capex) in fossil fuel production and fossil fuel-based power: USD 257 billion per year in 2017-2019 (Geddes, Gerasimchuk et al., 2020).
- **USD 404 billion for the consumption of fossil fuels and fossil fuel-based electricity** in 81 economies in 2019 according to the section "Global Fossil Fuel Subsidies Estimates" below.

**** The USD 59 billion baseline estimate is the result of adding up IRENA's conservative estimates of supply-side subsidies to biofuels (USD 38 billion in 2017) and nuclear power (USD 21 billion in 2017) (IRENA, 2020a). "First-generation" biofuels have proven negative impact on the environment (European Parliament, 2015) and even "advanced" biofuels can have a significant water footprint (Roundtable on Environmental Health Sciences, Research, and Medicine et al., 2014). Nuclear energy has significant environmental risks. Therefore, these types of energy are classified as "Other" in the table.

Global Fossil Fuel Subsidy Estimates

Global fossil fuel subsidy data used in this report is developed from two separate sources, the OECD and IEA. Data includes estimates for direct budgetary transfers, induced transfers (e.g., regulations keeping consumer prices below market level), and tax expenditures for the year 2019. Fuels considered are coal, petroleum products, natural gas, and electricity. These estimates are based on the data and aligned with the methodology from the IISD and OECD Fossil Fuel Subsidy Tracker (n.d.), considering the following adjustments:

- OECD estimates under "general services support estimates" category for all countries have been categorized under "producer support estimates" in the calculations in this report.
- For the disaggregation between consumption and production subsidies for all fuels, a correction factor has been applied to 11 economies for which OECD and IEA provide overlapping subsidy estimates, in order to adjust to the global estimates provided in the Fossil Fuel Subsidy Tracker and by OECD (n.d.).
- IMF data are also included in the Fossil Fuel Subsidy Tracker (n.d.) in addition to OECD's and IEA's in order to provide a fully global picture (the addition of IMF estimates covers a total of 194 economies). However, IMF estimates cover only until 2017. Since this report focuses on 2019 data, IMF estimates have not been considered.

Appendix 2. Calculation of Revenues from Fossil Fuel Subsidy Reform and Taxation

This appendix explains the methodology used to estimate the value of the revenues that can be raised from the taxation of transport fuels (gasoline and diesel) and coal and the savings that can be generated from the reform of subsidies to the consumption of gasoline, diesel, and coal as explained in Chapter 4 and shown in Table A2. Calculations are based on 2019 estimates, and are aligned with the methodology used to estimate fossil fuel subsidies explained in Appendix I.

Table A2. Summary of estimates of revenues from fossil fuel taxation and subsidy reform used in this report

	Consumer subsidy elimination		Tax increase		Total
	Country coverage	**USD billion**	**Coverage**	**USD billion**	**USD billion**
Gasoline & diesel	77	115	Global consumption data	400	**515**
Coal	81	8	Global consumption data	30	**38**
Total		**123**		**430**	**553**

Gasoline and Diesel Subsidies

Consumer gasoline and diesel subsidy data was derived from two sources: the OECD Inventory of Support Measures for Fossil Fuels (44 countries with publicly available disaggregated data for gasoline and diesel support);[49] and the IEA fossil fuel subsidies database for 33 additional countries not covered by the OECD. Where the OECD and IEA data were both provided for a country, the OECD data was used. In all cases, estimates considered are for 2019.

The OECD data was extracted in March 2021 as a customized selection of "consumer support estimates" for "motor gasoline" (excluding biofuel) and "gas/diesel oil" (excluding biofuel) for the year 2019 (OECD, n.d.).

The IEA data was extracted in March 2021 as a customized selection of "transport oil subsidies" for the year 2019 (IEA, 2020f). IEA's definition of "transport oil subsidies" includes fuels other than gasoline and diesel (IEA, 2020m). To be consistent with the OECD estimates, an adjustment factor was therefore applied based on 2018 oil product consumption data (the most recent IEA data publicly available at the time of writing),

[49] The full OECD Inventory of Fossil Fuel Subsidy Support covers 50 countries but disaggregated country data is restricted for six countries: Armenia, Azerbajan, Belarus, Georgia, Moldova and Ukraine.

considering the relative consumption of motor gasoline and gas/diesel versus all other transport fuels (IEA, 2020m).

The calculation of the adjustment factor was done as follows:

Transport oil demand, including gasoline, diesel, jet kerosene and transport LPG (2018)[50]	→	2,693,962 tonnes
Gasoline and diesel demand (2018)	→	2,344,906 tonnes
Therefore gasoline and diesel as % of total transport oil consumption	→	2,344,906 tonnes/2,693,962 tonnes = 0.87 (87%)

Therefore an adjustment factor of 0.87 (87%) was applied to the IEA transport oil subsidy figures to estimate subsidies attributable to gasoline and diesel.

Coal Consumption Subsidies

Coal consumption subsidies have been estimated according to the methodology for fossil fuel subsidy estimates described in Appendix I, i.e., considering IEA and OECD estimates for 81 countries in 2019.

Gasoline and Diesel Tax

The estimate that a global tax on gasoline and diesel could raise over USD 1 billion per day was based on the following assumptions and calculations.

Assumptions:

- Inelastic demand
- 2019 consumption volumes: IEA projects that in 2021 demand for gasoline and diesel will return to 97-99% of their 2019 levels (IEA, 2020g)

Gasoline and diesel consumption:

- IEA's 2019 data on gasoline and diesel consumption was not available at the time of writing. Consumption was therefore estimated based on 2019 oil consumption and 2018 shares of gasoline and diesel in total oil consumption from IEA (n.d.a) (see Table A3)[51]
- Base oil demand in 2019 was 99.7 mb/day (IEA, n.d.a) = 15,851 million litres per day (1 US oil barrel = 158.987295 litres).

[50] The proportion of LPG used in the transport sector was 8% in 2018 (Argus Media, 2019).

[51] Authors of the report acknowledge that these percentage shares can vary from one year to the other and sometimes by source. The assumptions taken here are aligned with other years and sources.

Table A3. Share of gasoline and diesel in final oil consumption

	Share in total oil demand (based on 2018 data)	Estimated share of total oil demand in 2019	
	%	mb/day	million litres/day
Gasoline	27%	26.92	4,280
Diesel	33%	32.90	5,231
Total	**60%**	**59.82**	**9,511**

Estimation of gasoline and diesel tax per day:

Total gasoline and diesel consumption	→	59.82 mb/day = 9,511 million l/day
Gasoline and diesel demand (2018)	→	USD 0.125/l (assumption)
Revenue from tax per day	→	(9,511 million l/day) × (USD 0.125/l) = USD 1,189 million per day
Revenue from tax per year	→	(USD 1,184 million/day) × (365 day/year) = USD 433 billion per year

The annual revenue potential has been rounded down to USD 400 billion per year to reflect the approximate nature of these estimates.

Coal Tax Revenue Estimate

The estimate that a global coal tax of USD 5 per tonne would raise around USD 30 billion per year is based on the following calculations and assumptions.

Assumptions:

- Inelastic demand
- Global coal demand for energy (6,547 million tonnes) was calculated using 2019 IEA (2020) data for global coal (7,627 million tonnes) and excluding/subtracting metallurgical coal demand of (1,080 million tonnes) in order to get the coal demand for energy consumption. Metallurgical coal is an input to steel and other alloys, and this chapter relates to energy consumption.

Annual global revenue potential from USD 5/tonne coal tax	→	(6,547 million tonnes per year) × (5 USD/tonne) = 32,735 USD million per year

The revenue potential has been rounded down to USD 30 billion per year to reflect the approximate nature of these estimates.

Daily global revenue potential from USD 5/tonne coal tax	→	(32,735 USD million/year)/(365 days/year) = 90 USD million/day

CO_2 Tax Equivalents for Coal, Gasoline, and Diesel Taxes

The suggested consumption tax rates for gasoline, diesel and coal can be converted to a carbon tax equivalent considering the CO_2 emissions for each of the fossil fuels. The following calculations provide a broad estimate of the likely carbon tax rate, based on the following assumptions and equations. More detailed calculations would be required to provide precise values: the following are intended to be indicative only.

GASOLINE AND DIESEL

Considerations:

- Gasoline emits 2.8 kg CO_2/l (0.0028 tonnes/1000l) (Schlömer et al., 2014)
- Diesel emits 3.2 kg CO_2/l (0.0032 tonnes of CO_2/1000l) (Schlömer et al., 2014)

Gasoline comprised 45% of gasoline and diesel consumption in 2019 and diesel comprised 55% (IEA, 2021). Therefore the average emissions for the two fuels would be:

Gasoline	→	2.8 kg CO_2/l × 0.45 = 1.26 kg CO_2/l
Diesel	→	3.2 kg CO_2/l × 0.55 = 1.76 kg CO_2/l
Average gasoline + diesel based on consumption volumes	→	1.26 kg CO_2/l + 1.76 kg CO_2/l = 3.02 kg CO_2/l = 0.00302 tonnes CO_2/l

The effective carbon tax is (0.125 USD/l) / (0.00302 tonnes CO_2/l) = USD 41 per tonne CO_2.

COAL

Assumptions and considerations (all from Freund, et al., 2005):

- Coal is assumed to be anthracite (different coal types have different energy and CO_2 contents)
- Anthracite energy content: 26.2 megajoules (MJ)/ kg
- Anthracite carbon content: 96.8 g CO2/MJ (or 0.0968 kg CO_2/MJ)
- Anthracite carbon content per kg: 26.2 MJ/kg x 0.0968 kg CO_2 per MJ = 2.536 kg CO_2/kg = 2.536 tonnes CO_2/tonne

The reporting considers a coal tax of USD 5 per tonne of coal (anthracite). Therefore, the estimate is:

- USD 5 per tonne/ 2.536 tonnes CO_2/tonne anthracite = USD 1.97 per tonne of CO_2
- This has been rounded to USD 2 per tonne CO_2

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