

2021 Report

The Production Gap

Governments' planned fossil fuel production remains dangerously out of sync with Paris Agreement limits



About This Report

The Production Gap Report — first launched in 2019 — tracks the discrepancy between governments' planned fossil fuel production and global production levels consistent with limiting warming to 1.5°C or 2°C. The report represents a collaboration of several research and academic institutions, including input from more than 40 experts. UNEP staff provided guidance and insights from their experience leading other gap reports.

This year's report presents the first comprehensive update of the production gap analysis since our 2019 assessment. The report also tracks how governments worldwide are supporting fossil fuel production through their policies, investments, and other measures, as well as how some are beginning to discuss and enact policies towards a managed and equitable transition away from fossil fuel production. This year's report features individual country profiles for 15 major fossil fuel-producing countries, and a special chapter on the role of transparency in helping to address the production gap.

Assessment of the production gap is based on recent and publicly accessible plans and projections for fossil fuel production published by governments and affiliated institutions. For other elements of the report, such as the magnitude of producer subsidies or the status of policies to limit production, the report draws from a mix of publicly available government, intergovernmental, and research sources as cited and listed in the references.

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Wikipedia image. P. 23: Jharia coal mine. Photo by TripodStories-AB, Wikipedia:
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Errata: Earlier versions of the report contained an error in the "IEA NZE" pathway plotted in Figure 2.4, an error in Figure 2.5 where methane emissions from the energy sector was plotted instead of total methane emissions as intended, and an error on page 44 where "1,149 million tonnes" was incorrectly referenced as "1,149 tonnes".

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Glossary

Countries' plans and projections (CPP)

A global pathway of fossil fuel production estimated in this report, based on our review and assessment of recent national energy plans, strategy documents, and outlooks published by governments and affiliated institutions.

Extraction-based emissions accounting

An accounting framework that attributes greenhouse gas emissions from the burning of fossil fuels to the location of fuel extraction.

Fossil fuel production

A collective term used in this report to represent processes along the fossil fuel supply chain, which includes locating, extracting, processing, and delivering coal, oil, and gas to consumers.

Greenhouse gases (GHGs)

Atmospheric gases that absorb and emit infrared radiation, trap heat, contribute to the greenhouse effect, and cause global warming. The principal GHGs are carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), as well as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆).

Just transition

In the context of climate policy, this refers to a shift to a low-carbon economy that ensures disruptions are minimized for workers, communities, consumers, and other stakeholders who may be disproportionately affected (ITUC 2017; UNFCCC 2016).

Long-term low greenhouse gas emission development strategies (LT-LEDS)

Under the Paris Agreement and its accompanying decision, all countries are invited to communicate LT-LEDS by 2020, taking into account their common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.

Nationally determined contributions (NDCs)

Submissions by Parties to the Paris Agreement that contain their stated ambitions to take climate change action towards achievement of the Agreement's long-term goal of limiting global temperature increase to well below 2°C, while pursuing efforts to limit the increase to 1.5°C. Parties are requested to communicate new or updated NDCs by 2020 and every five years thereafter.

Production gap

The discrepancy between countries' planned fossil fuel production and global production levels consistent with limiting warming to 1.5°C or 2°C.

Stranded assets

Assets that suffer from unanticipated or premature write-offs or downward revaluations, or that are converted to liabilities, as the result of a low-carbon transition or other environment-related risks (Ansar et al. 2013).

Subsidy

A financial benefit accorded to a specific interest (e.g. an individual, organization, company, or sector) by a government or public body including direct transfer of government funds; tax expenditure, other revenue foregone, and underpricing of goods and services; induced transfers (price support); and transfer of risk to government.



Abbreviations

AFOLU	Agriculture, forestry, and other land use	LNG	Liquefied natural gas
Bcf	Billion cubic feet	LT-LEDS	Long-term, low-emission development strategies
BECCS	Bioenergy with carbon capture and storage	Mb/d	Million barrels per day
CCS	Carbon capture and storage	MDB	Multilateral development bank
CDR	Carbon dioxide removal	Mt	Million tonnes (metric tons)
CH ₄	Methane	NDC	Nationally determined contribution
CO ₂	Carbon dioxide	NOC	National oil and gas company
CO ₂ e	Carbon dioxide equivalent	NZE	IEA's Net Zero by 2050 pathway for the energy sector
CPP	Countries' plans and projections	OECD	Organization for Economic Co-operation and Development
°C	Degree Celsius	OPEC	Organization of the Petroleum Exporting Countries
DFI	Development finance institution	PFI	Public finance institution
ECA	Export credit agency	PGR	Production Gap Report
EITI	Extractive Industries Transparency Initiative	SDG	Sustainable Development Goal
EJ	Exajoule	SOE	State-owned enterprise
EU	European Union	TCFD	Taskforce for Climate-Related Financial Disclosures
FPIC	Free, prior, and informed consent	UAE	United Arab Emirates
G7	Group of Seven	UN	United Nations
G20	Group of Twenty	UNEP	United Nations Environment Programme
GDP	Gross domestic product	UNFCCC	UN Framework Convention on Climate Change
GHG	Greenhouse gas	UK	United Kingdom
Gt	Gigatonne (billion tonnes or metric tons)	US	United States
IEA	International Energy Agency	WTO	World Trade Organization
ILO	International Labour Organization		
IMF	International Monetary Fund		
IPCC	Intergovernmental Panel on Climate Change		

Foreword

The latest Intergovernmental Panel on Climate Change Report serves as a crucial reminder that climate change is already affecting our lives today: the damages are widespread, rapid, and intensifying. The report also

serves as a clarion call that while there is still time to limit long-term warming to 1.5°C, that window of opportunity is rapidly closing.

The Production Gap Report – now in its third edition – shines a spotlight on the path that governments must take to align their fossil fuel supply with the goals of the Paris Agreement. Thus far, this action has largely been restricted to promoting carbon capture and storage and minimizing emissions from extraction processes. However, as this year's report shows, these measures alone are insufficient; they cannot substitute for a global, long-term wind down of coal, oil, and gas.

A global transition away from fossil fuels is paramount to avoiding dangerous climate change, saving millions of lives from air pollution, ending harm to local communities in extraction frontiers, and protecting our biodiversity and ecosystems.

At COP26 and beyond, the world's governments must take immediate steps to address the production gap, while ensuring that this transition occurs in a just and equitable manner.



Inger Andersen

Executive Director

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A growing number of countries are announcing targets to achieve net-zero emissions by mid-century.

While this is a positive development, bending the emissions curve downwards requires these pledges to be accompanied by concrete, near- and long-term actions. This includes immediate, steep, and sustained reductions in fossil fuel production and burning.

However, the world's energy supply remains dominated by coal, oil, and gas. And as this report reveals, the global production gap has remained largely unchanged since the first assessment in 2019. Governments are still planning to produce more than twice the amount of fossil fuels in 2030 than would be consistent with limiting global warming to 1.5°C. This discrepancy points to the urgent need for net-zero pledges to be translated into action to wind down fossil fuel production.

Governments have a key role to play here. State-owned companies control more than half of global fossil fuel production, and government policies and spending shape energy markets in significant ways. It is imperative that fossil fuel-producing nations recognize their role and responsibility in closing the production gap and steering us towards a safe climate future.



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Executive Summary

Key Findings

Governments plan to produce more than twice the amount of fossil fuels in 2030 than would be consistent with limiting warming to 1.5°C. The production gap has remained largely unchanged since our first analysis in 2019.

Global fossil fuel production must start declining immediately and steeply to be consistent with limiting long-term warming to 1.5°C.

Most major oil and gas producers are planning on increasing production out to 2030 or beyond, and several major coal producers are planning on continuing or increasing production.

G20 countries have directed more new funding to fossil fuels than clean energy since the beginning of the COVID-19 pandemic.

International public finance for the production of fossil fuels from G20 countries and multi-lateral development banks (MDBs) has significantly decreased in recent years.

Governments have a primary role to play in closing the production gap and in ensuring that the transition away from fossil fuels is just and equitable.

Executive Summary

This report first introduced and quantified the “production gap” in 2019, finding that the world’s governments planned to produce far more fossil fuels than consistent with their Paris Agreement commitment to limit global warming. Two years on, with the climate crisis clearer and more urgent than ever, governments continue to bet on extracting far more coal, oil, and gas than is consistent with agreed climate limits.

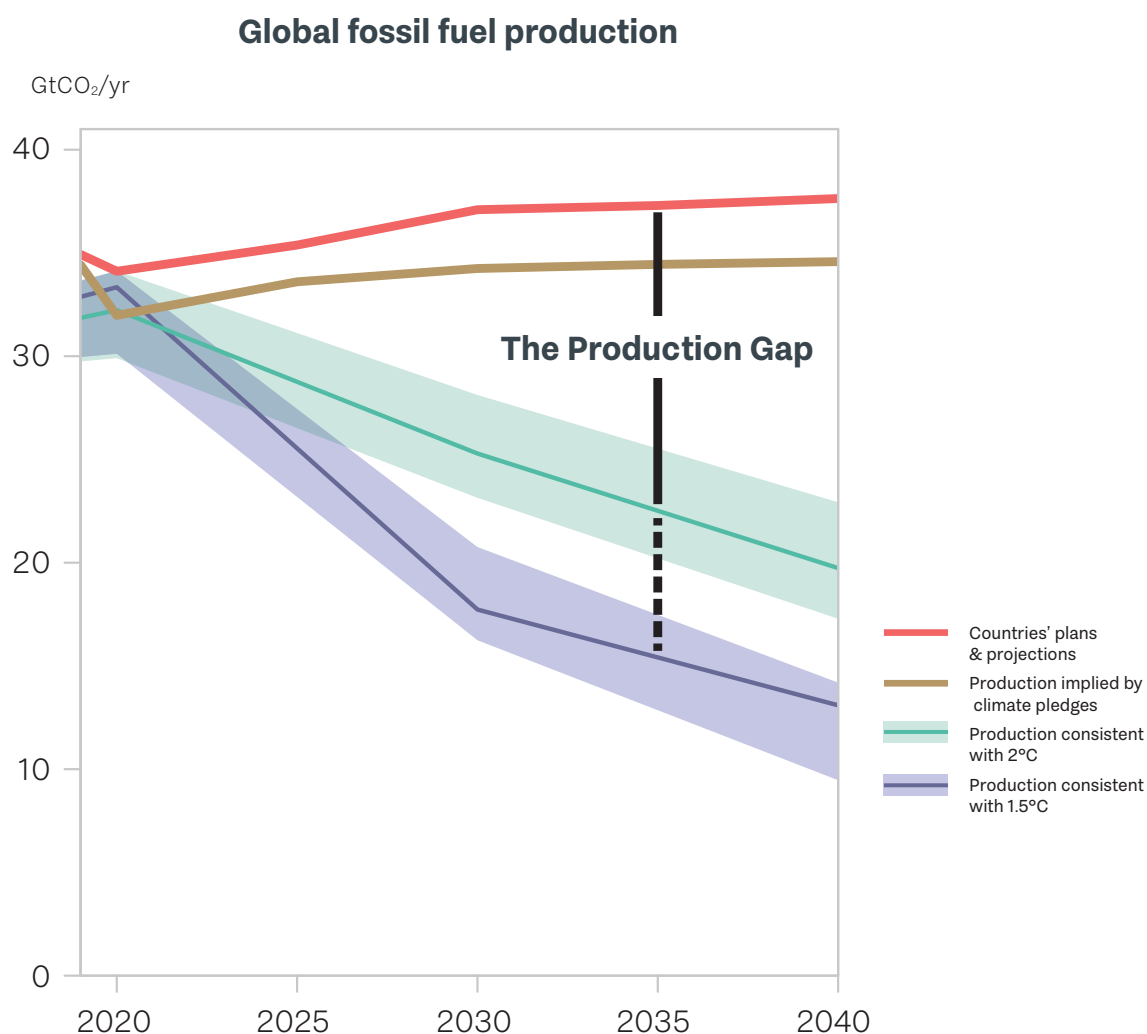
Specifically, this report’s production gap analysis — the first full update since 2019 — finds that the world’s governments still plan to produce more than double the amount of fossil fuels in 2030 than would be consistent with limiting global warming to 1.5°C, and 45% more than consistent with limiting warming to 2°C. Collectively, although many governments have pledged to lower their

emissions and even set net-zero targets, they have not yet made plans to wind down production of the fossil fuels that, once burned, generate most of those emissions.

The latest Intergovernmental Panel on Climate Change report issued an important call to action: we are running out of time to limit long-term global warming to 1.5°C or

Figure ES.1

The fossil fuel production gap — the difference between global fossil fuel production projected by governments’ plans (red line) and those consistent with 1.5°C- and 2°C-warming pathways (blue and green lines), as expressed in carbon dioxide (CO₂) emissions released when the extracted fuels are burned — remains large.



even 2°C. This report shows that doing so requires steep and sustained reductions in fossil fuel production and use. The world's governments must take urgent action to close the production gap.

The report's main findings are as follows:

As countries set net-zero emission targets, and increase their climate ambitions under the Paris Agreement, they have not explicitly recognized or planned for the rapid reduction in fossil fuel production that these targets will require. Rather, the world's governments plan to produce more than twice the amount of fossil fuels in 2030 than would be consistent with limiting warming to 1.5°C. The production gap has remained largely unchanged since our first analysis in 2019.

Since the release of the first Production Gap Report in 2019, many governments have announced new, more ambitious greenhouse gas (GHG) emission reduction targets, including net-zero pledges. While this is a positive development, only a few fossil-fuel-producing countries have begun to grapple with how zeroing out global GHG emissions will affect their future coal, oil, and gas production.

As shown in Figure ES.1, according to our assessment of recent national energy plans and projections, governments are in aggregate planning to produce 110% more fossil

fuels in 2030 than would be consistent with limiting global warming to 1.5°C, and 45% more than would be consistent with limiting warming to 2°C, on a global level. By 2040, this excess grows to 190% and 89%, respectively.

Collectively, governments are planning and projecting production levels higher than those implied by their emission reduction goals, as announced in their nationally determined contributions (NDCs) under the UN climate process and other climate policies as of mid-2020, as also shown in Figure ES.1.

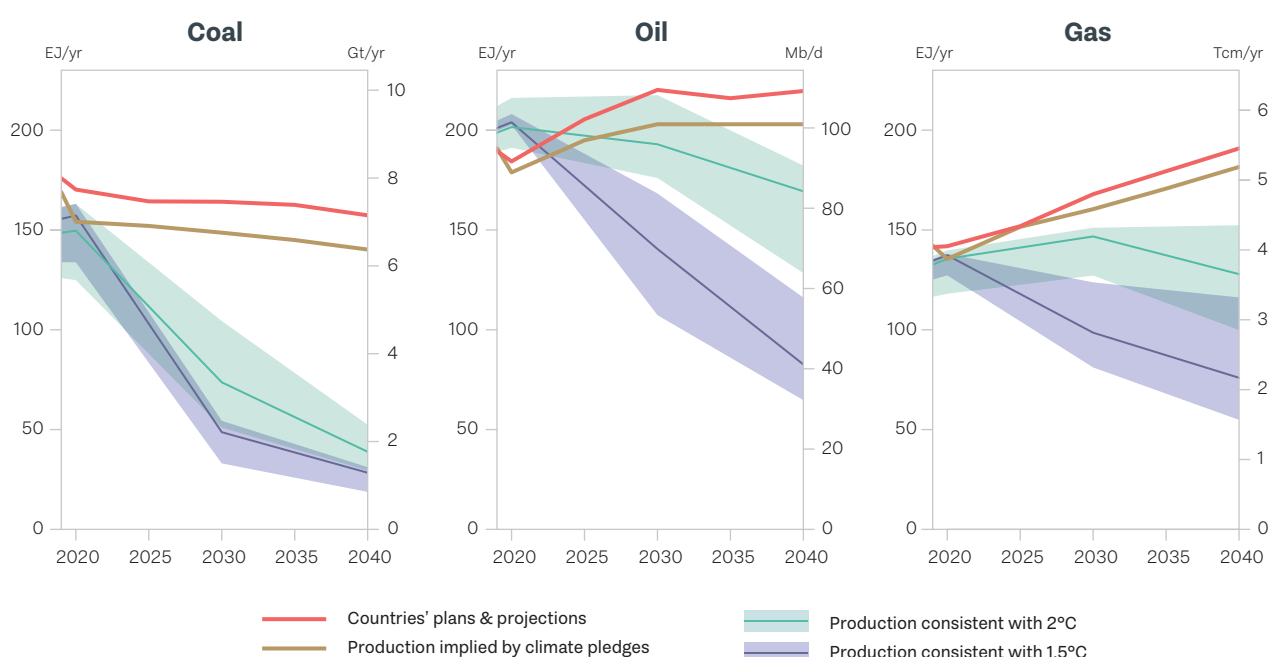
Global fossil fuel production must start declining immediately and steeply to be consistent with limiting long-term warming to 1.5°C.

However, as shown in Figure ES.2, governments are collectively projecting an increase in global oil and gas production, and only a modest decrease in coal production, over the next two decades. This leads to future production levels far above those consistent with limiting warming to 1.5°C or 2°C.

The production gap is widest for coal in 2030: governments' production plans and projections would lead to around 240% more coal, 57% more oil, and 71% more gas than would be consistent with limiting global warming to 1.5°C.

Figure ES.2

Governments are collectively projecting an increase in global oil and gas production, and only a modest decrease in coal production, over the next two decades. This leads to future production levels far above those consistent with limiting warming to 1.5°C or 2°C.



Compared to global production levels under the 2°C-consistent pathways, governments' production plans and projections would lead to 120% more coal, 14% more oil, and 15% more gas in 2030. The production gaps for all fuels grow much wider by 2040 under both temperature limits.

This disconnect could be even worse than our analysis implies. As explored in Chapter 2, our estimate of the size of the production gap depends on model assumptions and conceptions of how the low-carbon transition unfolds, such as how much carbon dioxide can be captured and stored or sequestered, and the tradeoffs among different emission-reduction strategies. If carbon dioxide removal technologies fail to develop at large scale, or if methane emissions are not rapidly reduced, the production gap would be wider than estimated here. Furthermore, Chapter 2 shows that minimizing methane emissions from fossil fuel extraction and distribution alone is not a substitute for a rapid wind-down in fossil fuel production itself.

G20 countries have directed nearly USD 300 billion in new funds towards fossil fuel activities since the beginning of the COVID-19 pandemic — more than they have toward clean energy. In contrast, they have significantly decreased new international public finance for fossil fuel production in recent years; multilateral development banks (MDBs) and G20 development finance institutions (DFIs) holding a total of over USD 2 trillion in assets have adopted policies that exclude fossil fuel production activities from future finance.

The trajectory of fossil fuels will be shaped by the unprecedented levels of investment that many governments are now injecting into their economies, as part of their COVID-19 recovery efforts. Since January 2020, G20 countries have directed USD 297 billion of new public financial commitments towards fossil-fuel-consuming and -producing activities. Though governments have begun to shift more of their COVID-19 recovery spending to clean energy, they still spend more on support for fossil fuels.

While international public finance institutions continue to support fossil fuel extraction, distribution, and processing, there are promising trends: new public finance for the production of fossil fuels from MDBs and G20 countries has significantly decreased since 2017, and, increasingly, MDBs and G20 DFIs have policies that exclude future investment in these activities.

This report details the government strategies, support, and plans for fossil fuel production in 15 major producer countries. Most major oil and gas producers are planning on increasing production out to 2030 or beyond, while several major coal producers are planning on continuing or increasing production.

This report provides country profiles for Australia, Brazil, Canada, China, Germany, India, Indonesia, Mexico, Norway, Russia, Saudi Arabia, South Africa, the United Arab Emirates, the United Kingdom, and the United States. The profiles summarize each country's stated national climate ambitions; available information on government views, projections, and support for fossil fuel production; and emerging policies and discussions towards a managed and equitable wind-down of production.

These countries have announced GHG emission reduction targets through their NDCs and, in some cases, have set net-zero goals. However, few have assessed, at least publicly, whether their projected fossil fuel production is consistent with the goals of the Paris Agreement. This focus on emissions alone ignores their roles and responsibilities in producing the predominant source of these emissions.

Moreover, the country profiles show that most of these governments continue to provide significant policy support for fossil fuel production, through tax breaks, finance, direct infrastructure investments, exemptions from environmental requirements, and other measures. As Figure ES.3 shows, most major oil- and gas-producing countries are planning on expanding production. For coal, some countries plan to reduce production while others still plan to continue or increase it. While some countries are beginning to discuss and enact policies towards a just and equitable transition away from fossil fuel production, these efforts have not yet affected the plans and strategies of major producing countries.

Verifiable and comparable information on fossil fuel production and support — from both governments and companies — is essential to addressing the production gap. Governments should strengthen transparency by disclosing their production plans in their climate commitments under the Paris Agreement.

While existing transparency initiatives have shed some light on fossil fuel production, the available information is incomplete, inconsistent, and scattered. Addressing

Figure ES.3

Most countries profiled in this report are planning on increasing oil and gas production, and several are planning on continued or increasing coal production.

Country	Planned/projected change in national fossil fuel production for 2030 relative to 2019 (EJ)		
	Coal	Oil	Gas
Australia	■	▲ 0.2 EJ	▲ 0.6 EJ
Brazil	●	▲ 5.3 EJ	▲ 1.3 EJ
Canada	▼ 0.5 EJ	▲ 1.4 EJ	▲ 0.3 EJ
China	▼ 9.2 EJ	▲ 0.6 EJ	▲ 3.8 EJ
Germany	▼ 0.6 EJ	●	●
India ⁺	▲ 6.1 EJ	▲ 0.5 EJ	▲ 0.8 EJ
Indonesia	■	▼ 0.7 EJ	▼ 0.2 EJ
Mexico	●	▲ 2.4 EJ	▲ 0.5 EJ
Norway	●	▲ 0.3 EJ	▼ 0.6 EJ
Russia	▲ 3.6 EJ	■	▲ 4.3 EJ
Saudi Arabia	●	▲ 7.1 EJ	▲ 4.7 EJ
South Africa	No available projections	●	●
United Arab Emirates	●	▲ 1.9 EJ	No available projections
United Kingdom	●	▼ 1.2 EJ	▼ 0.7 EJ
United States	▼ 4.3 EJ	▲ 5.2 EJ	▲ 3.8 EJ

⁺ For India, changes shown are for 2024 relative to 2019.

▲ Denotes an increase of greater than 5% by 2030, relative to 2019 production in energy terms.

▼ Denotes a decrease of greater than 5% by 2030, relative to 2019 production in energy terms.

■ Denotes change in production by 2030 stays within 5% of 2019 production in energy terms.

● Annual production in 2019 is less than 0.5 EJ.

the production gap requires governments to be far more transparent in their plans and projections for oil, gas, and coal production.

Governments have already committed to reporting climate-related information as part of the Paris Agreement. This reporting currently focuses on emissions goals, but governments could also include production plans and projections — and how these plans align with climate goals — in their NDCs, their long-term, low-emissions development strategies (LT-LEDs), and their progress reports on implementing and achieving their NDCs.

Governments can also mandate that investor- and state-owned fossil fuel companies disclose their spending, project plans, emissions, and climate-related financial risks in a way that is consistent across countries.

Governments have a primary role to play in closing the production gap.

In addition to strengthening measures to reduce the demand for fossil fuels, governments should also take actions to ensure a managed and equitable decline in production, such as the following:

- Acknowledge in their energy and climate plans that there is a need to wind down global fossil fuel production in line with the Paris Agreement's temperature limits. This creates impetus and accountability for policy action.
- Chart the course towards a rapid, just, and equitable wind-down of fossil fuel production as part of overall decarbonization plans. Comprehensive efforts to wean countries off the use of coal, oil, and gas should be coupled with strategies to ramp down production to ensure a less disruptive transition.
- Place restrictions on fossil fuel exploration and extraction to avoid locking in levels of fossil fuel supply that are inconsistent with climate goals.
- Phase out government support for fossil fuel production. Governments can end subsidies and other support for production, exclude fossil fuels from public finance, and direct greater support towards low-carbon development.
- Leverage international cooperation to ensure a more effective and equitable global wind-down of production. A just, equitable, and effective transition will require greater international support for countries highly dependent on fossil fuel production and with limited financial and institutional capacity. Countries with greater capacity can lead the way.



1

Introduction

1. Introduction

For many people, the extraction, processing, and burning of coal, oil, and gas is invisible; it happens out of sight and out of mind. We turn on lights, heat water, light a stove, buy goods — and rarely see the physical fuel itself, let alone the emissions caused by burning it. Further from view is where the fuel came from: the well or mine.

Governments, however, very much have fossil fuels in their sights. The production and export of fossil fuels can support or hinder local economies, aid or impede alliances between countries, and make or break the political careers of government policymakers.

This report, now in its third edition, highlights the tension between the importance that governments have traditionally attached to fossil fuels and a harmful effect of fossil fuel production and trade: global warming. We find that government plans for fossil fuel production are still far more in line with worsening climate disasters than they are with internationally agreed temperature limits.

This disconnect is the “production gap” — the difference between government plans for fossil fuel production and the levels consistent with globally agreed climate limits. And while the breadth of the gap is sobering, governments have the power to address it.

Fossil fuels are something governments have substantial control over. More than half of the world’s fossil fuel production is directly owned by governments, including by state-owned companies. Even when governments do not directly own fossil fuels, their policies and permits still control, to a large degree, how much fossil fuel gets extracted.

This ability to steer fossil fuel supply can be an important component of meeting global temperature and emissions goals, including “net-zero” emissions targets. When fewer fossil fuels are produced, fewer are burned, and fewer greenhouse gas emissions are released. Therefore, by working together to constrain fossil fuel production, countries can help bend the emissions curve downwards on a path towards net zero.

Working together on emissions from fossil fuels is something nations already do, through major critical venues like the United Nations Framework Convention on Climate Change (UNFCCC), which yielded the Paris Agreement in 2015. Though nations have also cooperated on steering fossil fuel production — such as through the Organization of the Petroleum Exporting Countries (OPEC) — they have not yet done so with the intent of limiting climate change.



A few countries, however, are starting to announce their intentions to ban or move away from producing fossil fuels. This collection of nations is — so far — composed of countries with relatively limited fossil fuel resources (such as Costa Rica and Denmark), but it could expand, while other groups and coalitions of fossil-fuel-producing nations could form or adapt their missions to focus on climate.

After all, major fossil-fuel-producing countries have reason to limit the supply of fossil fuels: tighter supply leads to higher prices and revenues for existing fossil fuel resource holders, which can boost local economies. Higher prices also can help reduce emissions.

Governments may be wary of being perceived as getting too directly involved in fossil fuel markets in a way that might increase prices for energy consumers. That is understandable, and fossil fuel prices that are too high can negatively affect the economy. However, the bigger, longer-term risk is instead prices that are too low. By enacting measures to limit greenhouse gas emissions in line with the Paris Agreement, and hence cutting fossil fuel demand, countries will already be pushing producer prices lower.

As an example of the problem of low fossil fuel prices, the International Energy Agency (IEA) recently found in its *Net Zero by 2050* report that oil prices could head steadily downward toward USD 37 per barrel by the end of this decade, as nations move to low-carbon forms of



transport such as electric vehicles. To ward off volatility and keep prices from sinking even lower, the IEA foresees that even fossil-fuel-rich states may need to purposefully limit supply, so as not to threaten the financial value of their existing deposits.

In other words, working together to limit supply, in tandem with demand, could bring more certainty to the markets, adding extra force to the low-carbon transition.

Furthermore, constraining supply can help ensure that, as fossil fuel demand declines, prices do not get so low as to spur new consumption, undermining the path to net-zero emissions. Put simply, limits on supply can ensure that when increasingly stringent climate policy prevents a barrel of oil or ton of coal from being burned in one location, it is not instead burned somewhere else.

The way forward for aligning fossil fuel production with climate limits is not easy. Government efforts to limit fossil fuel production will need strong support to succeed politically. That is a challenge, in part due to the long history of

fossil fuel extraction — and associated social and political institutions that maintain fossil fuel dominance — in many coal-, oil-, and gas-producing communities.

One source of support may be local residents. They feel the health effects of extracting fossil fuels, whether through water pollution, coal dust, or other dangerous chemicals in the air. Local residents also value biodiversity, recreation, and tourism; fossil fuel development conflicts with these priorities. And, in many areas of the world, engaged citizens are the ones who have most clearly pointed out the disconnect between fossil fuel development and climate change mitigation.

Another source of support may be the courts. National courts in some countries have issued rulings that underscore the conflict between expanding fossil fuel production and climate limits. For example, the District Court of The Hague in the Netherlands ruled that Royal Dutch Shell's production levels contribute to global warming, and that, by reducing production of fossil fuels, Shell would help reduce global carbon emissions.

Still, few national policymakers are on board with limiting fossil fuel supply in the name of climate protection. The most recent cooperative climate effort from major fossil-fuel-producing national governments — the Net-Zero Producers Forum — has thus far focused on extracting fossil fuels in less-polluting ways, not on winding down production levels in line with climate goals.

Those efforts are important, as reducing methane and other emissions at fossil fuel extraction sites is a critical step in meeting the goals of the Paris Agreement. But as we show in this report, making fossil fuel extraction less polluting is also highly insufficient. The overall levels of fossil fuel production urgently need to decrease.

Governments, with fossil fuels under their policy control, are key to closing the production gap. They can establish the norms and rules that will ensure that companies extract less fossil fuels, and only they have the broad,

economy-wide interests, power, and responsibilities to protect social and economic stability during the transition. While private-sector actors — including energy companies and financial institutions — should also move away from extracting and investing in fossil fuels, their action is no substitute for the economy-wide, public-interest role and responsibility of government.

This report thus focuses on governments, and their role in widening, or closing, the production gap. It quantifies the size of the production gap (Chapter 2), summarizes how governments support fossil fuel production (Chapter 3), details how governments in 15 key countries deal with fossil fuel production (Chapter 4), and highlights opportunities for strengthening the transparency necessary to help close the production gap (Chapter 5). Finally, a concluding chapter (Chapter 6) discusses how governments can manage the decline of fossil fuel production in line with climate goals in a just and equitable way.



2

The Production Gap

Key Messages

The world's governments are planning to produce 110% more fossil fuels in 2030 than would be consistent with limiting global warming to 1.5°C, and 45% more than would be consistent with limiting warming to 2°C. The production gap grows much wider by 2040.

The size of the production gap has remained largely unchanged compared to our prior assessments.

The production gap is widest for coal: governments' production plans and projections would lead to around 240% more coal, 57% more oil, and 71% more gas in 2030 than global levels consistent with limiting warming to 1.5°C.

Governments are in aggregate planning on increasing gas production out to at least 2040. This continued, long-term expansion in gas production is inconsistent with the Paris Agreement's temperature limits.

Global coal, oil, and gas production must start declining immediately and steeply to be consistent with limiting long-term warming to 1.5°C.

If carbon dioxide removal technologies fail to develop at large scale, fossil fuel production would need to decline even more rapidly.

2. The Production Gap

Since the release of the first Production Gap Report in 2019, many governments have updated their nationally determined contributions (NDCs) under the Paris Agreement and announced new, more ambitious greenhouse gas (GHG) emission reduction targets, including net-zero pledges. While this is a positive development, only a few fossil-fuel-producing countries have begun to grapple with how zeroing out global GHG emissions will affect their future coal, oil, and gas production.

This chapter quantifies the global fossil fuel production gap: the discrepancy between the global levels of fossil fuel production implied by governments' plans and projections and the levels consistent with the Paris Agreement's goals (namely, limiting warming to well below 2°C and "pursuing efforts to limit the temperature increase to 1.5°C"). It provides the first comprehensive update to the production gap estimate since the inaugural edition of this report in 2019.¹ We first quantify the production gap in Section 2.1, before discussing the major trends and drivers of the gap — and its changes compared to our 2019 assessment — in Section 2.2. We then explore the uncertainties of the production gap, due to assumptions underlying different mitigation pathways, in Section 2.3.

2.1 The fossil fuel production gap

The calculation of the production gap relies on two major elements. The first is the pathway of global future fossil fuel production implied by the plans and projections of national governments. The second is the pathway of global fossil fuel production that would be consistent with limiting warming to 1.5°C or to 2°C.

The first element relies on our compilation of government projections for fossil fuel production, as outlined in recent and publicly available national energy outlooks and targets as of August 2021.² This year, that includes outlooks from the eight major countries included in our 2019 report, as well as outlooks from seven additional countries. Altogether, these 15 countries accounted for around 75% of global fossil fuel extraction, on an energy basis, in 2020. Their combined production levels are then scaled up to a global estimate, based on these countries' projected future shares of global production (see details in Section 2.2 and [online Appendix B](#)). The result is our global "countries' plans and projections" pathway. Our updated assessment of the gap therefore reflects — to the extent



possible based on data availability — how governments expect their fossil fuel production will be influenced by more ambitious climate mitigation targets and policies, the COVID-19 pandemic, and other factors.

The second element to the production gap is the pathway of global fossil fuel production that would be consistent with limiting warming to 1.5°C or to 2°C, based on the mitigation scenarios compiled by the Intergovernmental Panel on Climate Change (IPCC) for their *Special Report on Global Warming of 1.5°C*, which the IPCC refers to as "SR1.5" (IPCC, 2018b; Rogelj et al., 2018). These scenarios show how much "primary energy" is supplied by coal, oil, and gas under emissions pathways with varying global warming outcomes, from which we calculate the median values and interquartile ranges. We calculated the "2°C-consistent" pathway as the median of scenarios that have at least a 66% probability of limiting warming to below 2°C over the *entire* 21st century (meaning, no temperature overshoot), relative to the pre-industrial global average atmospheric temperature. We calculated the "1.5°C-consistent" pathway as the median of scenarios with at least a 50% likelihood of limiting warming to below 1.5°C by *end-of-century* (meaning, with a low amount of

¹ Last year's Special Report 2020 put the production gap in the context of the COVID-19 pandemic, but did not fully re-assess the production gap.

² Throughout the report, we collectively refer to the sources from which future fossil fuel production is estimated as "plans and projections", given that there are varying levels of details, certainty, and intent associated with each document published by governments and affiliated institutions. Governments take a variety of factors into consideration in assembling these plans and projections, including the state of each country's fossil fuel reserves, the evolution of technologies and costs of extraction, the presence of subsidies and regulations, and foreseeable dynamics of domestic and international demand. Some of these factors are described further in Chapters 3 and 4.

temporary overshoot allowed before 2100).³ We further constrained these two sets of scenarios by how much carbon they sequester from bioenergy with carbon capture and storage (BECCS) and by afforestation; specifically, we only included scenarios in which BECCS sequesters an average of less than 5 billion tonnes of carbon dioxide per year (GtCO₂/yr) and in which afforestation sequesters an average of less than 3.6 GtCO₂/yr, both as assessed between 2040 and 2060. This approach follows the Climate Action Tracker's interpretation of sustainable limits for these carbon dioxide removal (CDR) practices, given their "multiple feasibility and sustainability constraints," as noted by the IPCC (IPCC, 2018a, p. 19; New Climate Institute et al., 2018). Further details are provided in [online Appendix B](#).

These low-carbon pathways are identical to those we used in prior assessments of the production gap, since new scenario sets from the IPCC were not yet available when we conducted this year's gap analysis. The release of the IPCC's *Mitigation of Climate Change: Working Group III Contribution to the Sixth Assessment Report* in 2022 will enable us to update these low-carbon pathways in the future.⁴

The global levels of fossil fuel production under each of these pathways are shown in Figure 2.1. The production gap is the difference between the production level under the low-carbon pathways (2°C or 1.5°C) and the level under the countries' plans and projections pathway in any given year. In this figure, the production gap is denominated in units of billion tonnes of carbon dioxide (GtCO₂), representing the amount of CO₂ emissions expected to be released from the combustion of extracted coal, oil, and gas.⁵

As shown, countries are planning on producing around 110% more fossil fuels (or more than double the amount) in 2030 than would be consistent with the median 1.5°C-warming pathway, and 45% more fossil fuels in 2030 than would be consistent with the median 2°C-warming pathway. This amounts to 19 GtCO₂ more than the median 1.5°C pathway (with an interquartile range of 16–21 GtCO₂ relative to all 1.5°C pathways

analysed), and 12 GtCO₂ more than the median 2°C pathway (with a range of 9–14 GtCO₂), in 2030.

The gap then grows wider beyond 2030, as countries' plans and projections continue upward, further departing from the low-carbon pathways. By 2040, countries' plans and projections show 190% more fossil fuels than would be consistent with the median 1.5°C pathway, and 89% more than the median 2°C pathway.

Figure 2.1 also shows a fourth pathway (gold line): global fossil fuel production levels implied by countries' climate pledges, as modelled by the International Energy Agency (IEA) in their Stated Policies Scenario (STEPS) in the World Energy Outlook 2020 (IEA, 2020). This pathway reflects the estimated levels of fossil fuel production that would result from countries' nationally determined contributions (NDCs under the UN climate process), as well as other announced policy intentions as of mid-2020 (IEA, 2020, p. 415). We find that governments' fossil fuel production plans and projections in aggregate (red line) exceed, by close to 10%, the levels of global fossil fuel production implied by their own stated climate pledges (gold line).⁶

The production gap can also be quantified in terms of its component fuels. Figure 2.2 shows the individual production gaps for coal, oil, and gas. Here, the amounts of fossil fuel production under the four different pathways are calculated and shown in energy-based units (exajoules). This enables a direct comparison between the levels of production under the countries' plans and projections pathway, and those under the 1.5°C- and 2°C-consistent pathways (which are in their original energy-based units, as reported by the integrated assessment model scenarios compiled by the IPCC SR1.5) (IPCC, 2018b).

Under both the median 1.5°C- and 2°C-warming pathways, global coal and oil production peak in 2020 and decline thereafter. The same is true for gas under the 1.5°C-warming pathway; under the 2°C-warming pathway, it rises modestly until 2030 before declining thereafter.

³ The Paris Agreement does not provide a precise definition for what is meant by its reference to "well below" 2°C. The "2°C-consistent" pathways in this report include those that limit peak warming to below 2°C throughout the entire 21st century with a 66% likelihood or greater (these scenarios are categorized as "lower-2°C" in the IPCC SR1.5 database), as well as pathways that limit median warming to below 1.5°C in 2100 with a 67% probability of temporarily overshooting that level earlier (these scenarios are categorized as "1.5°C-high overshoot"). This report's "1.5°C-consistent" pathways include those with a lower probability of overshoot (i.e., 50%-67%, which are categorized as "1.5°C-low overshoot" in the SR1.5 database).

⁴ *The Contribution of Working Group I to the Sixth Assessment Report* — published in August 2021 — focuses on the physical science of climate change (IPCC, 2021). The Working Group III report will assess new mitigation scenarios in detail and will be accompanied by the scenario database that will allow us to update our analysis of coal, oil, and gas production under low-carbon pathways.

⁵ This accounting method does not consider other GHGs besides CO₂, such as methane emissions from production processes. The 1.5°C- and 2°C-consistent levels of fossil fuel production are derived from the outputs of "primary energy" supply of coal, oil, and gas in the mitigation scenarios compiled for the IPCC SR1.5. Primary energy supply by fossil fuels represents the amount of energy that can be harvested directly from the fuels prior to any conversion. The primary energy variables generally include non-energy uses of coal, oil, and gas (such as for chemical or plastics feedstocks), though this reporting may vary between models. The IPCC database does not report what fraction of coal, oil, or gas primary energy is for non-energy uses in past or future years. In this analysis, we assume that the percentage of each fuel that is non-energy remains constant at recent levels for the purpose of tallying extraction-based CO₂ emissions from fossil fuel production under all four pathways (Davis et al., 2011). For more details, see [online Appendix B](#).

⁶ The IEA estimates that GHG emissions under their Stated Policies Scenario (STEPS) would lead to a long-term temperature rise of around 2.7°C by 2100 (with a 50% probability) (IEA, 2020). The levels of fossil fuel production in our countries' plans and projections pathway are higher than those in the STEPS and therefore would likely imply greater warming (unquantified here).

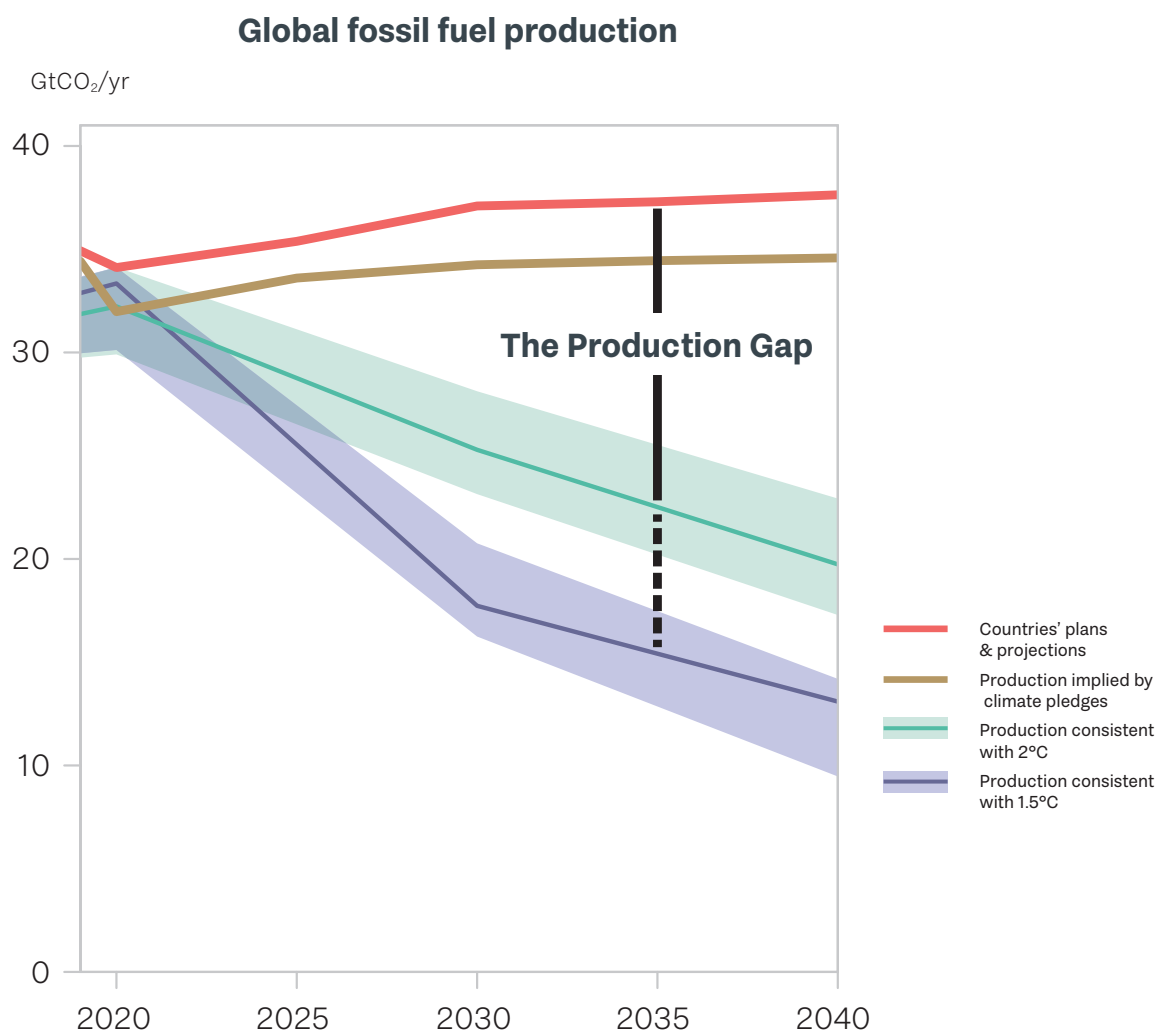
To be consistent with limiting warming to 1.5°C, global coal, oil, and gas production would have to *decrease* by around 11%, 4%, and 3%, respectively, each year between 2020 and 2030.⁷ However, governments are collectively projecting an *increase* in global oil and gas production, and only a modest decrease in coal production, from 2020 onwards (as shown by the “countries’ plans and projections” pathways in Figure 2.2). By 2030, this would lead to 240% more coal, 57% more oil, and 71% more gas than consistent with the median 1.5°C-warming pathway, and to 120% more coal, 14% more oil, and 15% more gas than consistent with the median 2°C-warming pathway. The production gaps grow much wider by 2040 under both temperature limits.

In other words, the production gap is proportionally largest for coal, with countries planning on producing coal at levels vastly incommensurate with the goals of the Paris Agreement. In aggregate, countries are planning on producing 5.3 billion tonnes more coal in 2030 than would be consistent with the median 1.5°C-warming pathway (with an interquartile range of 5.0 billion–6.0 billion tonnes relative to all 1.5°C pathways analysed). To put this excess amount into context, it is roughly equivalent to 75% of current levels of global coal production.

The production gap for oil is also substantial, especially compared to the 1.5°C-warming pathway. Nations are, in aggregate, planning on producing around 40 million

Figure 2.1

Global fossil fuel production under four pathways from 2019 to 2040, denominated in extraction-based CO₂ emissions in units of billion tonnes of CO₂ per year (GtCO₂/yr). This reflects the amount of CO₂ emissions expected to be released from the combustion of extracted coal, oil, and gas. For the 1.5°C- and 2°C-consistent pathways, the median and 25th–75th percentile range (shaded) of all analysed scenarios are shown.



⁷ As explained in our previous production gap reports, a global wind-down of fossil fuel production that would be consistent with limiting warming to 1.5°C or 2°C could be achieved by a different mix of decline rates for coal, oil, and gas. The median trajectories shown in Figure 2.2 are dependent on the underlying assumptions of the integrated assessment models.

barrels per day (Mb/d) more oil than would be consistent with the median 1.5°C pathway in 2030 (with a range of 26–56 Mb/d). This excess is roughly equivalent to half of current global oil production.

Similarly, for gas, countries are in aggregate planning on producing around 2 trillion cubic meters (Tcm) more in 2030 than would be consistent with the median 1.5°C-warming pathway (with a range of 1.3–2.5 Tcm). This excess is roughly equivalent to half of current global gas production.

Our analysis shows that continued, long-term expansion in gas production is inconsistent with the goals of the Paris Agreement. Moreover, the models that generate the 1.5°C- and 2°C-consistent pathways include assumptions that may not pan out, meaning gas production would need to decline even more quickly than shown in Figure 2.2. Namely, these models assume that methane emissions associated with producing, transporting, and distributing gas can be minimized, and also rely on substantial levels of carbon capture and storage (CCS) for gas-based energy from 2040 onwards (installed, for example, at gas power plants or hydrogen facilities) (Rogelj et al., 2018). Should these outcomes not be plausible because of technical and public perception issues (Bruckner et al., 2014),

the role of gas in low-carbon pathways would be even more limited than that shown in Figure 2.2.

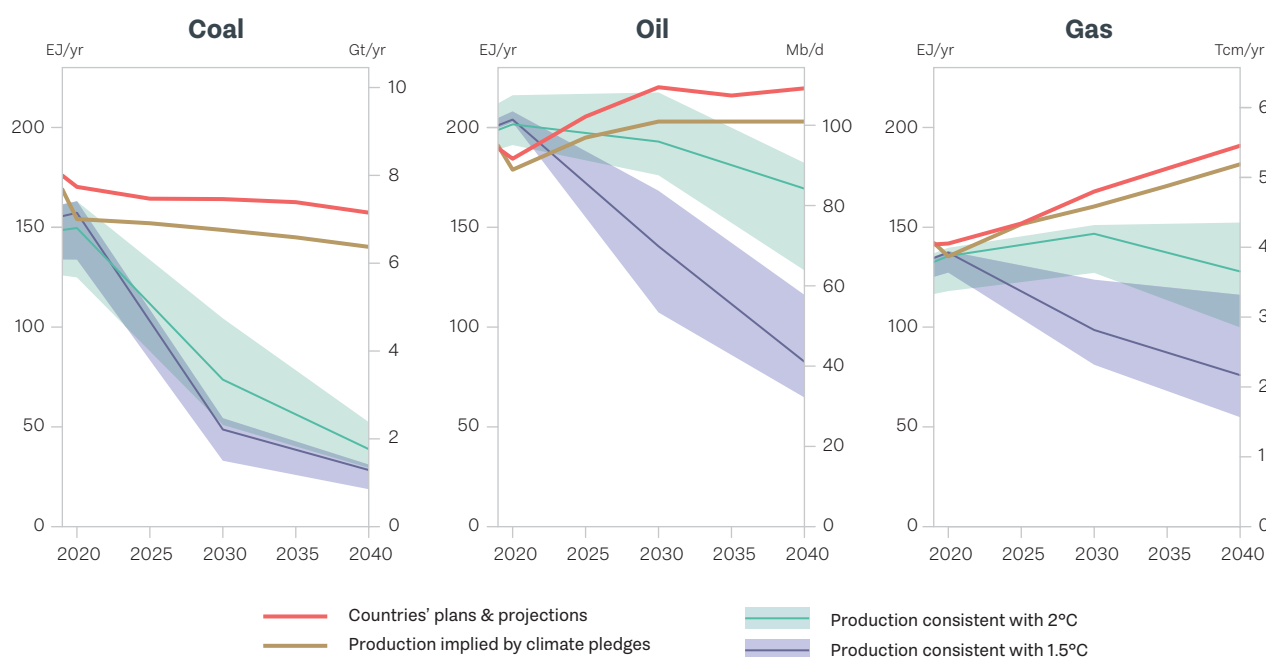
2.2 A breakdown of the “countries’ plans and projections” pathway

In this section, we explore trends in major producer countries that underlie the global coal, oil, and gas “countries’ plans and projections” (CPP) pathway, and then describe how these pathways have changed compared to our 2019 assessment.

This year’s analysis of the CPP pathway comprises an evaluation of the most recent government plans and projections from the eight major fossil-fuel-producing countries we assessed in our 2019 report, as well as from seven additional countries. This year’s analysis thus relies on the plans and projections of 15 major producer countries (countries added this year are denoted with an asterisk*): Australia, Brazil*, Canada, China, Germany*, India, Indonesia, Kazakhstan*, Mexico*, Norway, Russia, Saudi Arabia*, the United Arab Emirates (UAE)*, the United Kingdom (UK)*, and the United States (US). On an energy basis, these producer countries accounted for 75% of global fossil fuel production in 2020 (IEA, 2020). Within these 15 countries, 8 had government plans and

Figure 2.2

Global coal, oil, and gas production (denominated in exajoule or EJ per year) under four pathways from 2019 to 2040. Physical units are displayed as secondary axes: billion tonnes per year (Gt/yr) for coal, million barrels per day (Mb/d) for oil, and trillion cubic meters per year (Tcm/yr) for gas. For the 1.5°C- and 2°C-consistent pathways, the median and 25th–75th percentile range (shaded) of all analysed scenarios are shown.



projections for coal (accounting for around 90% of global production), 14 had projections for oil (70%), and 13 had projections for gas (65%).

Figure 2.3 shows the individual contributions of these 15 countries to the global coal, oil, and gas CPP pathways, denominated in units of energy and extraction-based CO₂ emissions. The global values (shown by the red lines, which are equivalent to the pathways shown in Figure 2.2) are estimated by scaling the aggregated production levels of the 15 countries shown, based on their future shares of global coal, oil, and gas production as modelled in the IEA STEPS (IEA, 2020) (see [online Appendix B](#) for further details on this approach).

As previously described, the CPP pathways show global oil and gas production continuously rising out to 2040, after a small dip in 2020, while coal declines slightly throughout this period. Specifically, under the CPP pathways, annual coal production is projected to be 12 EJ lower (-7%) in 2030 than in 2019, while oil production is 31 EJ higher (+16%), and gas production is 28 EJ higher (+19%).

The decline in coal is led by today's largest two coal producers, China and the US, which foresee drops of 13 EJ and 4 EJ, respectively, over this period. However, this decline is partially counteracted by projected increases in India, Russia, and Australia.⁸

The projected increase for oil is led by Saudi Arabia, Brazil, and the US, each of which project oil production to be 5–7 EJ higher in 2030 relative to 2019. Of the other 11 countries assessed, 8 also foresee smaller increases (while the UK, Russia, and Indonesia see small decreases).

For gas, the planned increase is led by Saudi Arabia, Russia, China, and the US, each of which project gas production to be more than 5 EJ higher in 2030 than in 2019. Australia, Brazil, Canada, India, and Mexico also foresee smaller increases (while the UK, Norway, Indonesia, and Kazakhstan foresee small decreases).

As shown in Figure 2.3, according to the outlooks from governments and affiliated institutions, today's largest producers will dominate the global total cumulative production between 2019 and 2040. Between one and four

countries will account for around half of the projected global total of each fuel: China for coal; the US, Saudi Arabia, Russia and Canada for oil; and the US, Russia, China, and Saudi Arabia for gas.

Compared to our 2019 analysis, this year's assessment of the global CPP pathways is more comprehensive, since it includes government plans and projections from seven additional countries. This expanded scope makes it difficult to directly compare the CPP pathways in our 2021 assessment to those in our 2019 assessment; the lack of regular, standardized reporting across countries on planned domestic fossil fuel production, and a general lack of transparency, also complicates the comparison.⁹

Nevertheless, in aggregate, we find that the size of the production gap has remained largely unchanged compared to our 2019 assessment (see Figures B.1 and B.2 and further details [online Appendix B](#)).¹⁰

This broadly stagnant gap includes slight changes for oil production. The COVID-19 pandemic has played some role in lowering the CPP pathway for oil in the near term. The sharp decrease in travel associated with the response to the pandemic pushed down oil demand forecasts (and, in turn, investment levels in new oil supply). However, these economic effects are projected to be short-lived (IMF, 2021). By 2030, plans for oil production grow to the same levels foreseen in our 2019 analysis, before flattening out by 2040 to levels about 9% below our previous analysis. Still, we find that global planned oil production will exceed levels consistent with limiting warming to 1.5°C by 57% in 2030 and by 170% in 2040.

For coal, projections under the CPP pathway in 2030–2040 have decreased slightly compared to our 2019 analysis. Still, governments' planned coal production will vastly exceed global levels consistent with limiting warming to 1.5°C — by 240% in 2030 and by 450% in 2040.

For gas, the global level of production estimated under the CPP pathway in 2030–2040 has remained largely unchanged since our 2019 analysis. Governments' planned gas production will exceed the levels consistent with limiting warming to 1.5°C by 71% in 2030 and by 150% in 2040.

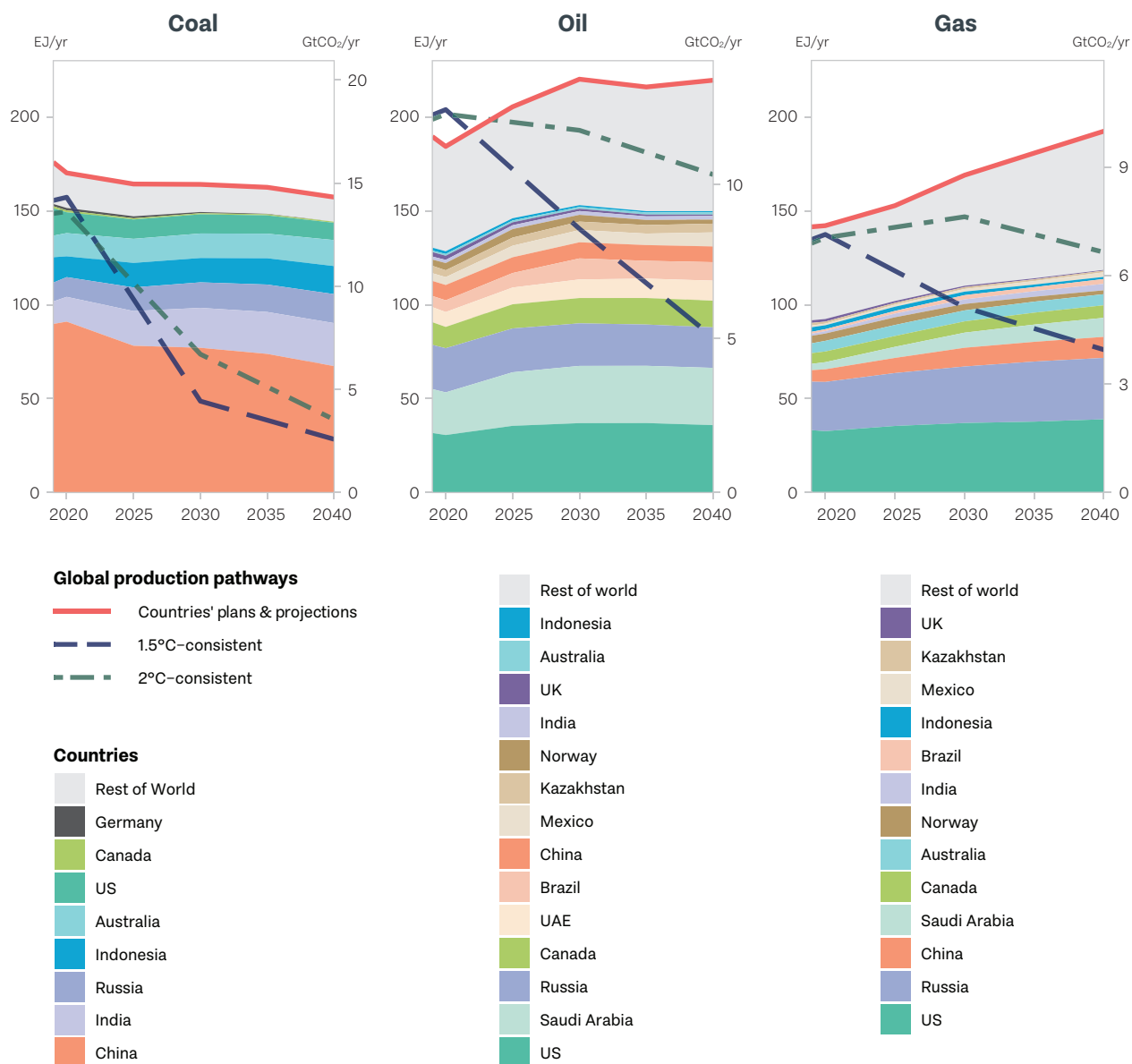
⁸ For India, government projections end in 2024. To extrapolate to 2040, we use the percent change in India's coal production as modelled under the IEA's *Stated Policies Scenario* (STEPS) in the *World Energy Outlook 2020* (IEA, 2020). STEPS is a scenario that reflects existing and announced climate policies as of 2020; thus, this is likely a conservative extrapolation approach, given that global production estimated under our CPP pathway is higher than those under the STEPS (as shown in Figures 2.1–2.2). See [online Appendix B](#) for further details.

⁹ For example, some governments issue long-term national energy outlooks annually, which enables a direct, year-to-year comparison of their projections. However, many countries do not. In some cases, countries provide projections in different government documents, which makes comparison over time more difficult (see [online Appendix B](#) for details).

¹⁰ Our 2019 report found that governments are planning to produce around 52% more fossil fuels in 2030 than would be consistent with a 2°C pathway and 120% more than would be consistent with a 1.5°C pathway. Upon re-analyzing the source data for that calculation, it appears that we misinterpreted the units of India's coal projections given in "coal-equivalents" in the government source document analysed (NITI Aayog, 2017, p. 27). When we account for our new interpretation of India's projections, our 2019 coal CPP pathway would have been slightly lower. Consequently, the size of the production gap in 2030 would have been around 110% relative to the 1.5°C pathway and 46% relative to the 2°C pathway (see details in [online Appendix B](#)). All reported results are rounded to 2 significant figures.

Figure 2.3

Individual countries' contributions to global production estimated under the "countries' plans and projections" pathways. For each fuel, countries are plotted in order of decreasing cumulative 2019–2040 production, from bottom to top. Global production under the median 1.5°C- and 2°C-warming pathways are overlaid. Annual coal, oil, and gas production are shown in energy units (exajoules, or EJ) on the primary axes, and in units of extraction-based CO₂ emissions on the secondary axes. (To allow for these two units to be shown on the same plot, globally averaged, extraction-based emission factors for each fuel are applied to all countries here. See [online Appendix B](#) for details on each country's plans and projections.)



Altogether, the largely unchanged outlooks for global coal, oil, and gas production under the CPP pathways in 2030 means that our estimate of the overall production gap has remained almost the same for that year. In 2040, small reductions in the levels of oil and coal under the CPP pathways translate to a very small narrowing of the overall gap (by 3%).¹¹

2.3 Implications of mitigation pathways on the production gap

As discussed in Section 2.1, one of two major elements we use to estimate the size of the production gap is the future pathways of global fossil fuel production that would be consistent with limiting warming to 1.5°C or 2°C. Our analysis relies on the set of mitigation pathways assembled by the IPCC SR1.5 (IPCC, 2018b). Each model scenario has its own estimates for how quickly coal, oil, and gas have to be phased down in order to meet the 1.5°C- and 2°C-warming limits of the Paris Agreement.¹² We use the median values across scenarios to calculate the production gap, but this is not the only way this estimate could be made (Huppmann et al., 2018). For example, it is possible that certain groups of scenarios — or even individual scenarios on their own — are more plausible than the median values. There are also very different conceptions of how the low-carbon transition might unfold.

Accordingly, in this section, we explore how the size of the production gap might differ under the four “illustrative pathways” of the IPCC SR1.5 (IPCC, 2018b; Rogelj et al., 2018), as well as under IEA’s recently released *Net Zero by 2050* pathway (NZE) for the energy sector (IEA, 2021). Since these pathways are all designed to limit long-term warming to 1.5°C, we focus on this temperature limit in this section. Figure 2.4 shows how global fossil fuel production differs among different 1.5°C-consistent pathways, and how these six pathways compare to the “countries’ plans and projections” pathway. We include the median pathway used to calculate the production gap, as well as the four IPCC SR1.5 illustrative pathways (termed P1, P2, P3, and P4) and the IEA NZE pathway.

IPCC chose the four illustrative pathways to demonstrate “the spectrum of CO₂ emissions reduction patterns consistent with 1.5°C”, which range from very rapid decreases, facilitated by efficiency and demand-side measures, to relatively slower reductions that lead to a temperature overshoot and necessitate large carbon dioxide removal (CDR) deployment later in the century (Rogelj et al., 2018, p. 99).¹³ CDR refers to various approaches to removing carbon dioxide from the air, including afforestation, reforestation, BECCS, direct air capture (DAC), enhanced weathering of minerals, and ocean fertilization (Minx et al., 2018). The two CDR methods most often included in the IPCC SR1.5 scenarios are BECCS and afforestation (Rogelj et al., 2018).

Figure 2.5 shows how four key model variables that could substantially affect the size of the production gap differ among the P1–P4 and NZE scenarios. These are: (a) CO₂ emissions from fossil fuel burning that can be captured and stored (fossil CCS); (b) CO₂ emissions that can be captured and stored from bioenergy use from biomass (BECCS); (c) CO₂ emissions from agriculture, forestry, and other land use (AFOLU); and (d) methane emissions.¹⁴

The P1 pathway warrants special mention. This pathway was designed to reflect a mitigation approach that relies much more on reducing energy demand and electrifying end uses than on deploying CDR technologies (Grubler et al., 2018). As shown in Figure 2.4, the P1 scenario relies on lower levels of fossil fuels as a source of primary energy than either the *Production Gap Report* (PGR) median or any of the other pathways. Relatedly, as shown in the Figure 2.5 panels (a) and (b), the P1 scenario uses no CCS, either with fossil fuels or biomass, while relying on similar amounts of forest carbon sequestration as our PGR median pathway (panel c).

Accordingly, this P1 pathway illustrates a key finding of this sensitivity exercise: the less CDR and CCS that can be deployed at scale in future years, the faster that fossil fuel supply and demand must decline, and the wider the production gap. Specifically, under the P1 pathway,

¹¹ We quantify the overall production gap (Figure 2.1) in terms of the amount of CO₂ emissions expected to be released from the combustion of extracted coal, oil, and gas. Because coal is the most carbon-intensive, changes in its individual production gap will have a larger influence on the overall production gap than those in oil or gas.

¹² The mitigation pathways are generated by integrated assessment models that are typically run to achieve a specific temperature outcome while minimizing costs — but not necessarily minimizing other objectives, such as air pollution reduction or the attainment of other sustainable development goals (Rogelj et al., 2018, p. 98).

¹³ Briefly, P1 is a sustainability-oriented scenario with “lower energy demand up to 2050 while living standards rise, especially in the global South”, and with afforestation as the only CDR option. P2 has “a broad focus on sustainability.” P3 is a “middle-of-the-road scenario in which societal as well as technological development follows historical patterns, and there is more of a focus on changing energy production than on reducing demand.” P4 is “a resource- and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas-intensive lifestyles”, and where most emission reductions are achieved through technology, including CDR (IPCC, 2018a). For more details, see page 16 of IPCC (2018a).

¹⁴ We focus on the variables shown here because, of all those in the IPCC SR1.5 database, these ones vary (on a CO₂-equivalent basis) by 20% or more as compared to the PGR median 1.5°C-consistent values in 2030 or 2040. In other words, besides coal, oil, and gas consumption, these are the most important variables to consider when evaluating how the production gap could be different under different conceptions of the low-carbon transition. The terminology for these four variables in the IPCC SR1.5 database (Huppmann et al., 2018) are Carbon Sequestration|CCS|Fossil (which includes CCS in the industrial sector), Carbon Sequestration|CCS|Biomass, Emissions|CO₂|AFOLU, and Emissions|CH₄. Methane emissions are converted to CO₂-equivalent units using its 100-year time horizon Global Warming Potential value of 28, following the IPCC Fifth Assessment Report (Myhre et al., 2013, p. 731).

the production gap in 2030 would be 23 instead of 19 GtCO₂ — or 21% larger than when using the median 1.5°C-warming scenario, as shown in Figure 2.4.

The opposite is also true: with more CDR and/or CCS assumed to take place, more fossil fuels could be produced and burned in 2030, as the P3, P4, and NZE pathways illustrate. As shown in Figure 2.5a-b, the P3 pathway assumes that much more emissions from fossil fuel burning can be captured and stored (as does the NZE, but to a lesser extent), while the P4 pathway assumes much more BECCS. This higher reliance on CCS and/or BECCS leads to a smaller production gap than that relative to our median pathway. This observation deserves a major caveat, however: the P4 scenario's use of land for both afforestation and biomass (and, by extension, biomass used in CCS) is higher than levels considered to be plausibly sustainable by the IPCC itself (Rogelj et al., 2018). Using this

much land (and associated nutrient and chemical inputs) for afforestation and biomass could lead to unsustainable levels of water use and pollution and pose additional sustainability risks for agriculture and food systems and biodiversity (Calvin et al., 2021; Fuss et al., 2014, 2018; Minx et al., 2018; Nemet et al., 2018; Robledo-Abad et al., 2017; Séférien et al., 2018; Smith et al., 2016, 2019). Consequently, we consider the production gap implied by the P4 scenario to also be implausible, at least on the basis of land requirements. In fact, we did not use the P4 scenario in our calculation of the median 1.5°C-warming pathways, as it exceeded the BECCS and AFOLU constraints we imposed to select our scenario set (see Table B.4 in the [online Appendix](#) for a list of all scenarios included).

The P2 pathway offers some more nuanced insights about how different forms of emissions abatement can substitute for each other. It shows how, even if CDR technol-

Figure 2.4

Comparison of global 2020–2040 fossil fuel production under the “countries’ plans and projections” pathway and six different 1.5°C-warming pathways. As in Figure 2.1, fossil fuel production modelled in energy terms are denominated here in extraction-based CO₂ emissions. The 1.5°C-warming pathways shown include the median and 25th–75th percentile range (shaded) used in this report (i.e. Figure 2.1), plus four “illustrative pathways” from the IPCC SR1.5 (P1–P4) and the IEA’s Net Zero by 2050 pathway (NZE). The P4 and NZE pathways are not included in the scenario set used to calculate the median 1.5°C-consistent pathway in this report.

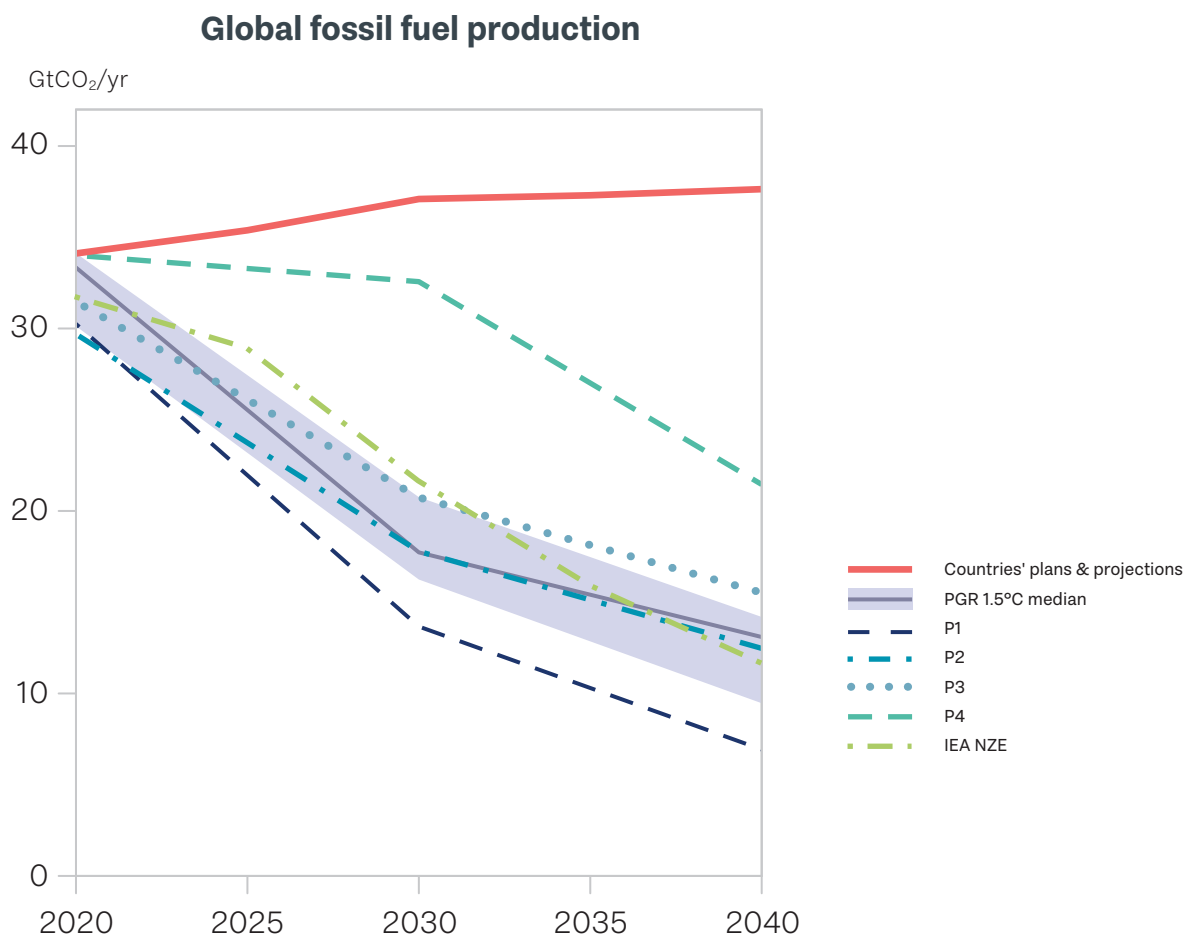
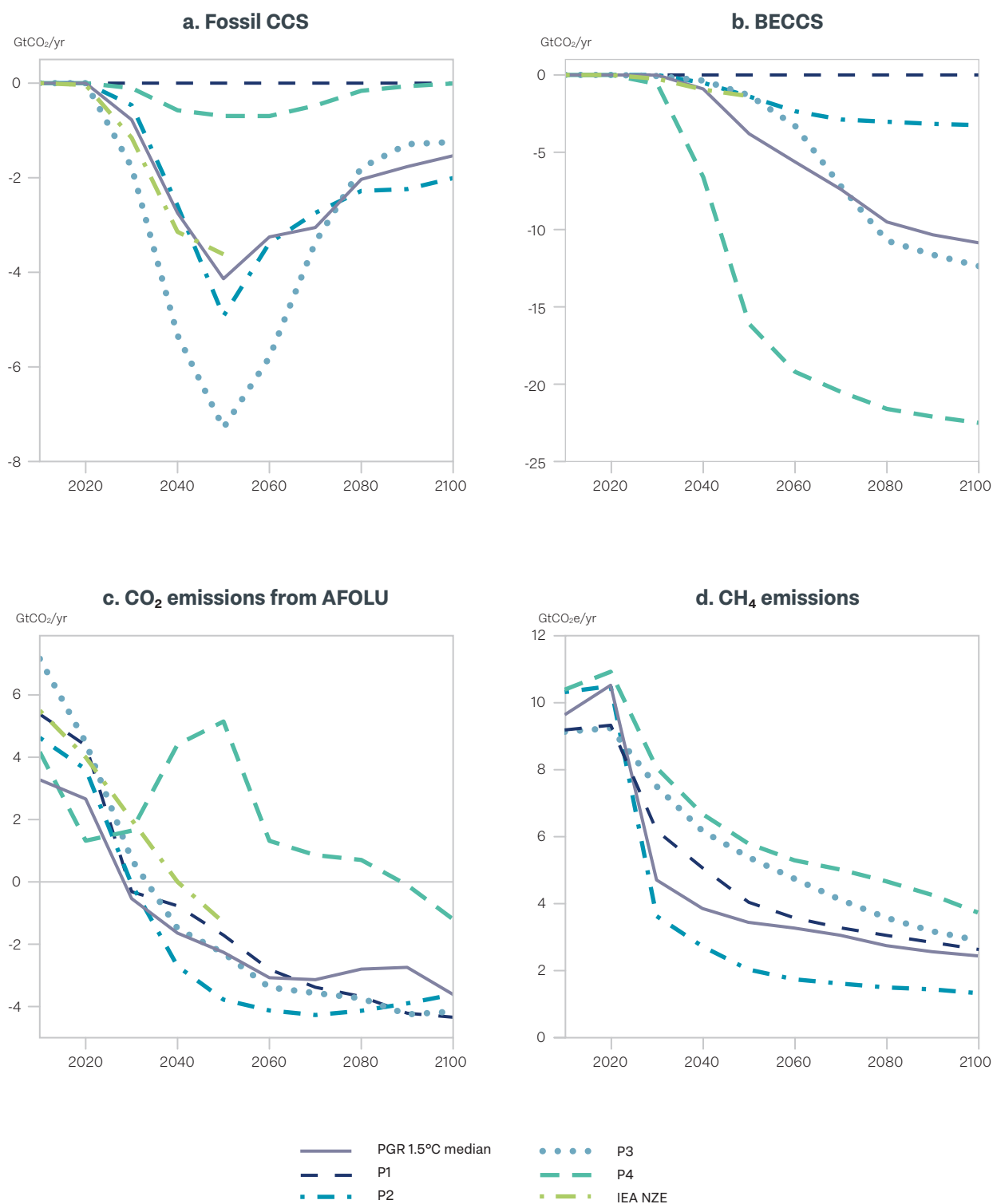


Figure 2.5

Key model variables underlying different 1.5°C-warming pathways, 2010-2100: a) the amount of CO₂ emissions from fossil fuel burning that can be captured and stored, fossil CCS (GtCO₂/yr); b) the amount of CO₂ emissions that can be captured and stored through bioenergy from biomass, BECCS (GtCO₂/yr); c) CO₂ emissions from agriculture, forestry, and other land use, AFOLU (GtCO₂/yr); and d) methane emissions from all sources (GtCO₂-equivalent/yr). Negative emission values represent carbon storage or sequestration. The six pathways are as shown in Figure 2.4. (For the NZE pathway, data for the model variables are only available to 2050; total methane emissions are not provided, so NZE is omitted from panel d).



ologies develop more slowly than in the median scenario, other forms of mitigation could achieve a similar level of emissions reduction. Specifically, while the P2 pathway relies on less BECCS than the PGR median pathway (Figure 2.5b), it relies on greater methane emissions reduction (Figure 2.5d) and carbon sequestration in land (Figure 2.5c). Consequently, the size of the production gap in 2030 relative to the P2 pathway is nearly the same as that relative to the median 1.5°C pathway (Figure 2.4).

These trade-offs between different means of reducing or removing emissions should not be surprising, since climate change is driven largely by cumulative total carbon dioxide emissions (IPCC, 2018b). Thus, different options for reducing or removing emissions can, in some cases, substitute for each other, depending on assumptions about — among other factors — non-CO₂ warming effects, the interpretation of the required timing of the Paris Agreement temperature goals (Schleussner et al., 2019), and the effectiveness and social acceptability of CDR and its associated risks for land, food, water, and biodiversity, as discussed above.

These observations have important implications for the production gap. First, even under implausibly high levels of BECCS in the P4 pathway, there would still be a sizeable production gap, and fossil fuel production would still need to start declining between now and 2030 (Figure 2.4).

Second, CDR technologies may fail to develop at large scale due to technical and economic viability and/or social constraints (Anderson & Peters, 2016; Fuss et al., 2018; Grant et al., 2021; Smith et al., 2016). Thus, a precautionary approach would demand that fossil fuel production and use decline even more rapidly than in our median 1.5°C-warming pathway (Figure 2.4, P1 scenario). From this perspective, our calculation of the production gap is conservative, since it assumes more than 5 billion tonnes of CDR annually in the latter half of the century, a level at which the “multiple feasibility and sustainability concerns” noted by the IPCC (IPCC, 2018a, p. 19) — such as intense land competition, and water pollution and biodiversity risks — may present themselves (Fuss et al., 2018; Rogelj et al., 2018).

Lastly, relying on other emission-reduction strategies, such as reduction of methane, to compensate for the delayed availability of CDR strategies also poses some

risks. As shown in Figure 2.5d, the IPCC 1.5°C-consistent scenarios (P1, P2, P3 and P4) all show steep declines in methane emissions over the next 20 years, including by aggressive measures to minimize methane emissions at fossil fuel production sites (UNEP & CCAC, 2021). However, global methane emissions from human activities have been increasing and are expected to continue to increase under current policies; methane emissions from gas and oil production alone is expected to increase by around 280 million tonnes of carbon dioxide equivalent each year (MtCO₂e/yr) (Saunio et al., 2020; UNEP & CCAC, 2021).¹⁵ Ongoing efforts to reduce methane emissions from the extraction and distribution of fossil fuels are essential for slowing the rate of near-term warming (Ocko et al., 2021), and represent one of the most cost-effective, emission-reduction strategies (UNEP & CCAC, 2021). Nevertheless, a focus on reducing methane and other “upstream” emissions, as advocated by some fossil fuel producers and industry partnerships, is not a substitute for the need to wind down fossil fuel production itself in line with the Paris Agreement’s goals.

There are also other decarbonization roadmaps for limiting warming to 1.5°C beyond the model scenarios analysed and discussed here. For example, other researchers have explored pathways that do not assume continued growth in gross domestic production and do not rely on CDR technologies (Keyßer & Lenzen, 2021). Others have also pointed out that low-carbon pathways with limited CDR deployment and a faster phase out of fossil fuels will bring additional air pollution reduction and public health co-benefits (Shindell et al., 2018). Among all these models, the peak dates and decline rates in coal, oil, and gas production and use vary, depending on their assumptions. However, they all share one common outcome for meeting the temperature limits of the Paris Agreement: a global, long-term wind down of coal, oil, and gas production and use.

¹⁵ Here we convert an increase of 10 MtCH₄/yr in UNEP & CCAC (2021) to MtCO₂e/yr using its 100-year time horizon Global Warming Potential value of 28, following the IPCC Fifth Assessment Report (Myhre et al., 2013, p. 731).

2.4 Conclusions

Our assessment of the most recent government plans and projections for fossil fuel production reveals that the world's governments plan on producing around 110% more fossil fuels in 2030 than would be consistent with the median 1.5°C-warming pathway, and 45% more fossil fuels than would be consistent with the median 2°C-warming pathway. The production gap has remained largely unchanged since our 2019 analysis. The gap remains proportionally largest for coal, even as governments plan small production decreases in aggregate. Meanwhile, governments plan to increase oil and gas production until at least 2040, leading to large production gaps for these fuels as well.

As shown in this chapter's analysis of modelled scenarios assembled by the IPCC, global coal, oil, and gas production (and consumption) have to start declining immediately to be consistent with limiting warming to 1.5°C. Global coal and oil also have to decline immediately to be consistent with a 2°C limit, while gas production must decline no later than 2030. However, current government

plans and outlooks for fossil fuel production would take the world in the opposite direction, creating an ever-widening production gap that is vastly inconsistent with the Paris Agreement's goals.

This disconnect could be even worse than our analysis implies. As explored in this chapter, our estimate of the size of the production gap partly depends on model assumptions and conceptions of how the energy sector can be decarbonized, such as how much carbon dioxide emissions can be captured and stored or sequestered, or how much methane emissions can be reduced in the near term. If CDR technologies fail to develop at large scale, a precautionary approach would demand that fossil fuel production and use decline even more rapidly than in our median 1.5°C- and 2°C-consistent pathways. Similarly, relying on other near-term, emission-reduction strategies to compensate for the delayed availability of CDR technologies, such as minimizing methane emissions from fossil fuel extraction and distribution, is not a substitute for a sustained wind-down in fossil fuel production and use.



3

Government support and policies for fossil fuel production

Key Messages

Governments continue to commit more funds to fossil fuels than to clean energy through their COVID-19 recovery plans.

Since the adoption of the Paris Agreement, public finance institutions have spent at least USD 294 billion supporting fossil fuels overseas.

Major multilateral development banks (MDBs) and G20 countries have significantly decreased new international public finance for production since 2017. MDBs and G20 development finance institutions (DFIs) holding a total of over USD 2 trillion in assets have adopted policies that exclude fossil fuel production activities from future finance.

Governments have an opportunity to reduce production through their leverage in state-owned companies, which control 50% of global oil and gas production and 55% of global coal production. However, current trends instead show an increase in government support for fossil fuel production and infrastructure.

Seven of the 15 major fossil-fuel producing countries analysed in this report have made net-zero emissions pledges. At the same time, most still plan on increasing their oil and gas production until at least 2030, in contradiction with the global production declines needed to limit warming to 1.5°C or 2°C.

3. Government support and policies for fossil fuel production

Governments have injected trillions of US dollars into the economy to respond to the consequences of the COVID-19 pandemic. Many governments have committed to using some of these funds to “build back better,” including through public investment in low-carbon development, high-quality clean energy jobs, and a just transition for all. However, the policies, investments, and measures adopted so far have yet to match up with this “build back better” commitment.

Since the start of the pandemic, many governments have added to their long-standing support for domestic and overseas fossil fuel production through tax breaks, direct government spending, public finance, and support for state-owned enterprises (SOEs) (Geddes et al., 2020; Sanchez et al., 2021). This increase in support stands in contrast with the declines in production necessary to meet the Paris Agreement’s goals as shown in Chapter 2, as well as with the International Energy Agency’s recent report that found that “there is no need for investment in new fossil fuel supply” in a scenario that limits warming to 1.5°C (IEA, 2021b, p. 21).

This chapter reviews both the way in which the COVID-19 pandemic has influenced new public support for fossil fuels and the mixed trends in government institutions’ efforts to shift public support away from fossil fuel production.

3.1 Plans, targets, and projections

Governments are key entities in driving future fossil fuel production. Not only do SOEs control more than half of global fossil fuel production (Beaton & Roberts, 2019; Nelson et al., 2014; NRG, 2021), but governments also influence the decision-making of private fossil fuel companies and investors, including through their plans, targets, and projections for fossil fuel production. The future trajectory of fossil fuels is also being shaped by the unprecedented levels of COVID-19-related investment that many governments are injecting to boost their economies. The IEA and International Monetary Fund (IMF) now both project strong rebounds in oil demand and supply in coming years (IMF, 2021; IEA, 2021a).

At the same time, a growing number of countries have announced targets to achieve net-zero emissions by mid-century. As of July 2021, 53 countries and the European Union, representing more than two thirds of global GHG emissions and 93% of global GDP, have pledged



net-zero emissions targets (Climate Watch, 2021; Energy & Climate Intelligence Unit, 2021).¹⁶ Seven of the 15 major fossil fuel producers profiled in Chapter 4 have adopted such commitments. Meeting these targets will require declines in fossil fuel production alongside reductions in consumption. Yet, as illustrated in Figure 3.1, and described in more detail in Chapter 4, most producer countries with net-zero targets still plan on increasing their oil and gas production, as do most who lack such targets. Indonesia, Norway, and the UK do project declines in the long term. But such trends are primarily a reflection of natural resource depletion (as producing fields become exhausted), rather than the result of intentionally aligning production with a decarbonized future. All major coal-producing countries with net-zero targets also project some declines in coal production; however, among those without them, some — notably India and Russia — are still projecting significant production increases this decade.

Many countries continue to view expanding fossil fuel production as a key lever for their national development, energy security, and sovereignty (Harrison & Bang, 2021;

¹⁶ Government net-zero targets differ in terms of standards, scope and methodology and are thus not directly comparable among themselves or to other low-emission targets (Hale et al., 2021).

Figure 3.1

Net-zero commitments and planned/projected fossil fuel production in 15 selected fossil fuel producers.

Country	Status of national net-zero commitment; net-zero target year	Planned/projected ^a change in national fossil fuel production for 2030 ^b relative to 2019 (EJ)		
		Coal	Oil	Gas
Australia	No commitment	■	▲ 0.2 EJ	▲ 0.6 EJ
Brazil	Political pledge 2050	●	▲ 5.3 EJ	▲ 1.3 EJ
Canada	In law 2050	▼ 0.5 EJ	▲ 1.4 EJ	▲ 0.3 EJ
China	Political pledge 2060	▼ 9.2 EJ	▲ 0.6 EJ	▲ 3.8 EJ
Germany	In law 2045	▼ 0.6 EJ	●	●
India	No commitment	▲ 6.1 EJ	▲ 0.5 EJ	▲ 0.8 EJ
Indonesia	No commitment	■	▼ 0.7 EJ	▼ 0.2 EJ
Mexico	No commitment	●	▲ 2.4 EJ	▲ 0.5 EJ
Norway	No commitment ^c	●	▲ 0.3 EJ	▼ 0.6 EJ
Russia	No commitment	▲ 3.6 EJ	■	▲ 4.3 EJ
Saudi Arabia	No commitment	●	▲ 7.1 EJ	▲ 4.7 EJ
South Africa	In policy document 2050	No available projections	●	●
United Arab Emirates	No commitment	●	▲ 1.9 EJ	No available projections
United Kingdom	In law 2050	●	▼ 1.2 EJ	▼ 0.7 EJ
United States	In policy document 2050	▼ 4.3 EJ	▲ 5.2 EJ	▲ 3.8 EJ

^a See Chapter 4 for details and sources of countries' fossil fuel production plans and projections, and [online Appendix B](#) for unit standardization.

^b For India, changes shown are for 2024 relative to 2019 as projections are only available until then.

^c Norway has committed to a "low-emission society" by 2050 in its 2018 Climate Change Act, with 90-95% emission reduction targets.

Sources: Own analysis; Net Zero Tracker, 2021; WRI Climate Watch Data, nd

▲ Denotes an increase of greater than 5% by 2030, relative to 2019 production in energy terms.

▼ Denotes a decrease of greater than 5% by 2030, relative to 2019 production in energy terms.

■ Denotes change in production by 2030 stays within 5% of 2019 production in energy terms.

● Annual production in 2019 is less than 0.5 EJ.

Strambo & González Espinosa, 2020), even though the risks of relying on production have become increasingly clear — either of stranded assets if decarbonization goals are achieved or of climate damages undermining development if they are not (IPCC, 2021; IEA, 2021b; IPCC, 2014). These views, along with projections and plans to increase fossil fuel production, provide rationales for continued national and international support for fossil fuels — support which is at odds with countries' commitments to achieve the Paris Agreement's goals.

3.2 National support mechanisms

At the national level, governments support fossil fuel production through a variety of financial, regulatory, and administrative mechanisms. In this section, we pay specific attention to financial mechanisms, including fossil fuel subsidies,¹⁷ aid to state-owned coal and oil and gas companies, and public funding commitments approved during the COVID-19 pandemic.

COVID-19 response and economic recovery

The scale and type of COVID-19 economic responses have varied widely across countries. Many wealthier countries have been able to rapidly fund large stimulus efforts, while many low- and middle-income countries are struggling to mobilize support at scale, burdened by high levels of debt and unfavourable conditions in international markets (Kose et al., 2021; O'Callaghan & Murdock, 2021).

Several research efforts are tracking the potential climate, social, and environmental implications of economic measures approved during the COVID-19 pandemic. While they differ in scope, sectoral coverage, and methods, their findings are broadly aligned. The Global Recovery Observatory found that as of August 2021, only 23% (USD 530 billion) of announced economic recovery spending (USD 2.35 trillion) was “green spending” (Global Recovery Observatory, 2021). Another assessment found that, as of July 2021, stimulus measures in 20 of 30 countries analysed are likely to have a net negative environmental impact (Vivid Economics & Finance for Biodiversity Initiative, 2021). Focusing on energy-intensive sectors, the Energy Policy Tracker found that since January 2020, G20 countries have directed 45% (USD 297 billion) of new public money commitments towards fossil-fuel-consuming and -producing activities¹⁸ (Energy Policy Tracker, 2021).



In late 2020, countries' proportion of expenditure toward “green” policies increased, though governments continue to commit more COVID-19 funds to fossil fuels than to clean energy (Dufour et al., 2021; Green Recovery Tracker, 2021; SEI et al., 2020; Vivid Economics & Finance for Biodiversity Initiative, 2021). This is shown in Figure 3.2.

As part of their COVID-19 responses, governments have provided support to the production of fossil fuels through new tax incentives, guarantees, regulatory changes, and other financial support, largely without accompanying social, economic, or environmental requirements (Energy Policy Tracker, 2021). Between January 2020 and June 2021, 31 countries added over USD 55 billion in support to production of fossil fuels (Energy Policy Tracker, 2021). This may be an underestimate, given the lack of data and transparency in many countries.

These types of commitments may have long-lasting impacts by locking in fossil-fuel-intensive energy systems with equipment lifetimes of 10–50 years (Erickson et al., 2015). Such commitments have included, for example, a special COVID-19 tax in Argentina, used to raise an estimated USD 479 million for new gas production (Government of Argentina, 2021; Boletín Oficial, 2020), and Canada's creation of the Oil and Gas Industry Recovery Assistance Fund, which has allocated USD 241 million (CAD 320 million) to activities such as facility maintenance and

¹⁷ According to the World Trade Organization's definition (Agreement on Subsidies and Countervailing Measures (ASCM) Article 1.1), fossil fuel subsidies include direct transfer of government funds; tax expenditure, other revenue foregone, and underpricing of goods and services; induced transfers (price support); and transfer of risk to government. Such measures typically confer benefits to a specific industry or group of industries (ASCM Article 2) (Marrakesh Agreement 1994). Governments also provide types of support to the fossil fuel industry that go beyond fossil fuel subsidies.

¹⁸ Data as of August 2021. G20 countries directed far less public money to clean energy (35%, or USD 229 billion) and other types of energy (20%, or USD 134 billion). Policies supporting “other types of energy” include policies not labelled as clean energy or fossil fuels, and policies that support multiple energy types, such as intertwined fossil fuels and clean energy. The Energy Policy Tracker figures do not include COVID-related wage support that was accessed by fossil fuel companies, but not targeted specifically to the industry. See www.energypolicytracker.org for further details.

upgrades for the Newfoundland and Labrador offshore energy sector (Department of Finance Canada, 2020). This latter measure was part of a larger federal stimulus package, which also included USD 1.3 billion (CAD 1.7 billion) to fund the closure and reclamation of orphan and inactive wells in Western Canada, as well as USD 559 million (CAD 750 million) to reduce emissions in Canada's oil and gas sector, with a focus on methane.

Fossil fuel subsidies

A large number of fossil fuel production and consumption subsidies predate the COVID-19 pandemic. In 2019, fossil fuel subsidies totalled approximately USD 468 billion (OECD, 2021). While lower fossil fuel prices have driven a recent decline in fossil fuel consumer subsidies,¹⁹ fossil fuel producer subsidies have been on the rise (OECD, 2021).

In 2019, subsidies supporting the production of fossil fuels increased by 30% compared to 2018 levels, reaching a total of USD 53 billion, according to the data collected on 50 OECD members, non-OECD G20 members, and economies in the European Union's Eastern Partnership (OECD, 2021).²⁰ The surge in production subsidies among OECD

countries was driven by attempts to alleviate corporate debt and promote investment in fossil fuel infrastructure — trends that the COVID-19 pandemic exacerbated in 2020 (OECD, 2021). The increase was particularly prominent in North America, due in part to Mexican government efforts to shore up its heavily indebted state-owned oil company, Pemex, and to automatic increases in long-standing US subsidies as oil prices declined and production increased (OECD, 2021).

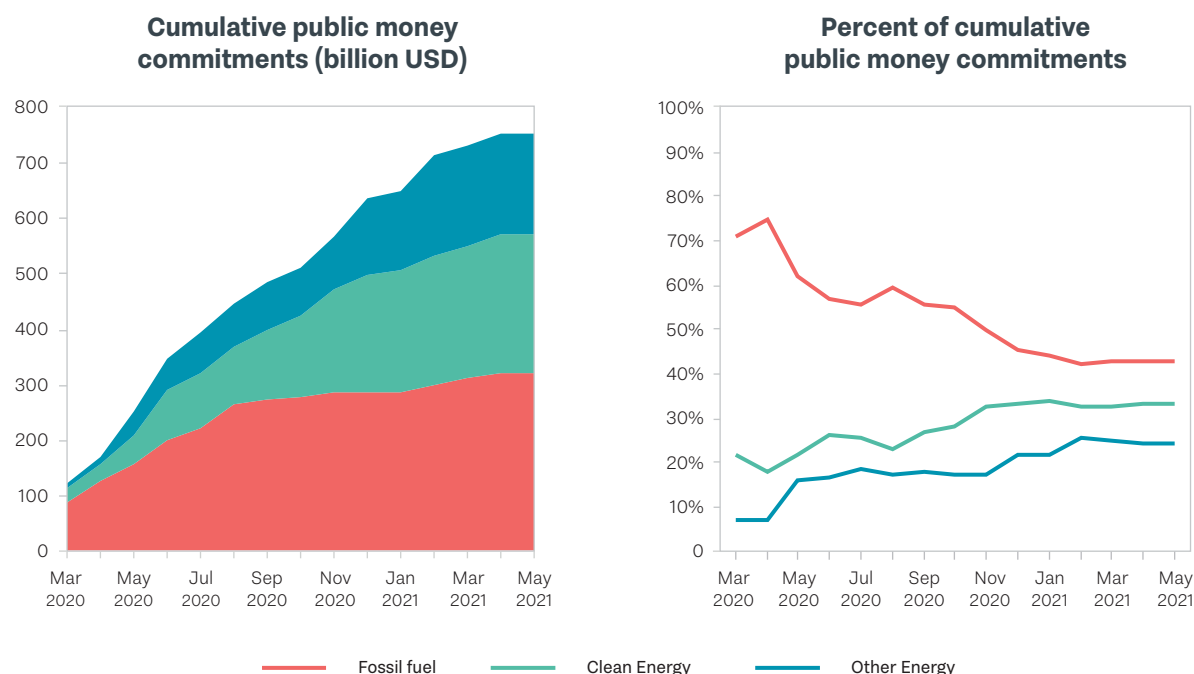
This trend is at odds with the commitment made by G20 countries in 2009 to “rationalise and phase out over the medium term inefficient fossil fuel subsidies that encourage wasteful consumption, while providing targeted support for the poor” (G20, 2009), and the reaffirmed G7 commitment to “eliminating inefficient fossil fuel subsidies by 2025” (G7, 2021). The lack of progress in reforming fossil fuel subsidies is a lost opportunity, as such reforms could free up scarce public resources to build back better from the pandemic (IISD, 2021).

State-owned coal and oil and gas companies

Support channelled into fossil fuel production and infra-

Figure 3.2

Cumulative public money for energy producing and consuming activities approved in 31 major economies during the COVID-19 pandemic (2020–2021). Source: Energy Policy Tracker www.energypolicytracker.org



¹⁹ Most consumption subsidies cover the gap between domestically regulated prices and the international price benchmark: the smaller the gap, the lower the subsidy. Therefore, as oil prices declined in 2020, the value of consumption subsidies shrank accordingly.

²⁰ If we consider only the 44 OECD advanced and emerging economies, the increase in production subsidies between 2018 and 2019 would be equal to 38% (instead of 30%) and the overall increase in consumption and production subsidies would be 10% (instead of 5%) (OECD, 2020a). A larger share of the increase was driven by OECD members and emerging economies.

structure through state-owned enterprises (SOEs) — specifically, national oil, gas, and coal companies — also plays a prominent role in the evolution of the production gap. National oil and gas companies (NOCs)²¹ are responsible for more than 50% of global oil and gas production, and national coal companies control around 55% of global coal production.²² NOCs account for 40% of total investment in oil and gas worldwide, making them one of the largest vehicles steering public revenues toward fossil fuel production (Manley & Heller, 2021).

Governments have traditionally justified investments by NOCs and national coal companies by pointing to the central role fossil fuel extraction has played in government revenue, jobs, and energy security (Mahdavi, 2020; Victor et al., 2011). However, the risks of investing in fossil fuel extraction are rising amid the global energy transition. An increasing number of public finance institutions, investors, and insurance companies are reluctant to finance upstream fossil fuels (see Section 3.3). Meanwhile, NOCs are expected to invest almost USD 2 trillion over the next decade,²³ predominantly on projects that may break even only if global oil and gas consumption exceeds the carbon budget compatible with limiting global temperature rise to 1.5°C or well below 2°C (Manley & Heller, 2021).

Moreover, NOCs tend to react to price changes more slowly than private companies when it comes to oil and gas investments, because their public ownership serves as a buffer from the effects of markets. When their revenues fall, NOCs cut governments' dividends and taxes faster than the capital they invest back into the oil sector.²⁴ This not only results in governments having fewer funds for public services — including diversification — it also allows NOCs to sustain spending longer on new exploration and production. As oil prices fell between 2014 and 2016, for example, NOCs' share of global upstream oil and gas investment increased from 36% to 44% (IEA, 2018), indicating that NOCs' spending cuts were less than those of international oil companies. This suggests that NOCs may sustain production even if private companies turn away from some of their new fossil fuel investments (Adams-Heard et al., 2021; Cahill, 2021; Eschenbacher & Jessop, 2020). This tendency does not bode well for the resilience of NOC-dependent countries under a global

energy transition, where long-term global oil demand and prices fall. In addition to making demand-side policy less effective by dampening market signals, it risks both greater stranding of assets and fewer resources to prepare workers and economies for the transition.

Presently, NOCs show the least comprehensive plans to shift to a low-carbon economy compared to other types of companies (World Benchmarking Alliance, 2021). This trend suggests that the barriers outweigh the opportunities for state-owned oil and coal companies to transition away from fossil fuels production (Box 3.1), slowing down changes in a sector whose investments and support contribute significantly to the production gap.

3.3 Multilateral and bilateral finance

International finance plays a significant role in supporting fossil fuel production. We focus here on international public support provided by governments through bilateral export credit agencies (ECAs), development finance institutions (DFIs), and multilateral development banks (MDBs). This finance — in the form of loans, grants, equity, insurance, and guarantees — is often provided at prefer-



²¹ NOCs and national coal companies are defined as companies fully or majority-owned by a national government.

²² Authors' calculation using data from Rystad Energy UCube. See Manley and Heller (2021). SOEs dominate oil and gas production in almost all major Gulf producers, as well as in China and Latin American countries, including Brazil and Mexico (NRGI, 2021). SOEs account for almost all of the coal production in China, 90% in India, and smaller shares in Indonesia and Poland (IEA, 2019, p. 242). These countries respectively account for 47%, 9%, 5% and 1% of global coal production (BP, 2020).

²³ This is according to Rystad Energy's baseline scenario, cited in Manley and Heller (2021).

²⁴ The Natural Resource Governance Institute's National Oil Company Database, which uses published financial reports by NOCs, shows that between 2011 and 2019, on average, a 10% year-on-year change in company revenue (e.g. due to a change in oil prices) was associated with a 3.3% change in capital expenditure, and a 6.5% change in transfers to government (NRGI, 2021). For a description of the methodology for calculation, see Heller and Mihalyi (2019, pp. 40–51, 66–67).

Box 3.1 Opportunities and barriers for transitioning state-owned enterprises away from fossil fuel production

Opportunities: SOEs generally have lower financing costs than privately owned companies, and access to grants and other forms of government support, all of which can help in a transition (Prag et al., 2018). Some NOCs — such as those based in China and Colombia — have explicit social missions that could provide the framework to ensure social policies are integrated into any business plans as part of a just transition (Bridle et al., 2017). Governments also can direct SOEs to reduce production. This occurred in 2020, when OPEC+ countries required NOCs to meet agreed production cuts (OPEC, 2020). In that case, the national interest was economic, not climate mitigation, with OPEC+ aiming to increase prices and reduce oversupply; however, a government that committed to wind down production to achieve climate goals could use its NOC as a lever to do so.

Barriers: The entrenched interests of NOCs and national coal companies, especially in countries that are highly dependent on revenues from fossil fuels, can prevent many of these companies from reducing production (Alsharif et al., 2017; Muttitt & Kartha, 2020; Stevens et al., 2015). They are less subject to short-term competition and market pressures than private companies, meaning they also tend to be less commercially efficient and organizationally nimble (Eller et al., 2011; Phi et al., 2019; Wolf & Pollitt, 2008); this can make it harder to pivot to new lines of business. Most NOCs have an explicit legal mandate to extract fossil fuels and manage the large revenues they generate as their main or sole objective — an additional obstacle that stands in opposition to the goals of a low-carbon transition.

ential below-market rates and has a significant impact on what projects get implemented by leveraging substantial additional commercial investment; international private finance has provided trillions of US dollars to fossil fuels since the adoption of the Paris Agreement (Rainforest Action Network et al., 2021). Public finance institutions (PFIs) also shape the energy landscape by signalling government priorities, providing political cover and pre-investment support (OECD, 2017; Tucker et al., 2020).

Scale of finance

Governments have committed to making finance flows “consistent with a pathway towards low GHG emissions and climate-resilient development” (Paris Agreement, 2015 Art. 2.1(c)). Since the adoption of the Paris Agreement, however, international PFIs have continued to support fossil fuels significantly, totalling USD 294 billion since 2016. From 2017 to 2019, international public finance for fossil fuels from major MDBs²⁵ and G20 countries averaged USD 62 billion a year, including USD 28 billion for fossil fuel extraction, distribution, and processing (OCI, 2021).

As shown in Figure 3.3, international public finance for fossil fuel extraction from major MDBs and G20 countries has decreased significantly since 2017, which may reflect the increasing number of commitments to exclude, or limit, future investments in fossil fuels, referred to here as “exclusion policies” and discussed below. However, since some historically significant funders of fossil fuel extraction have not excluded upstream finance, this trend could ultimately be reversed.

For coal, international public finance from the G20 countries and major MDBs²⁶ totalled USD 14 billion each year from 2014 through 2017; this dropped to an average of USD 8 billion per year in 2018 and 2019. International coal finance should continue to fall, following the G7 commitment to end “new direct government support for unabated international thermal coal power generation by the end of 2021” and China’s commitment to not build new coal-fired power plants abroad (G7, 2021; Xi, 2021).²⁷ Oil finance, however, stayed relatively stable over the 2014–2019 period, and gas finance has continued to grow.

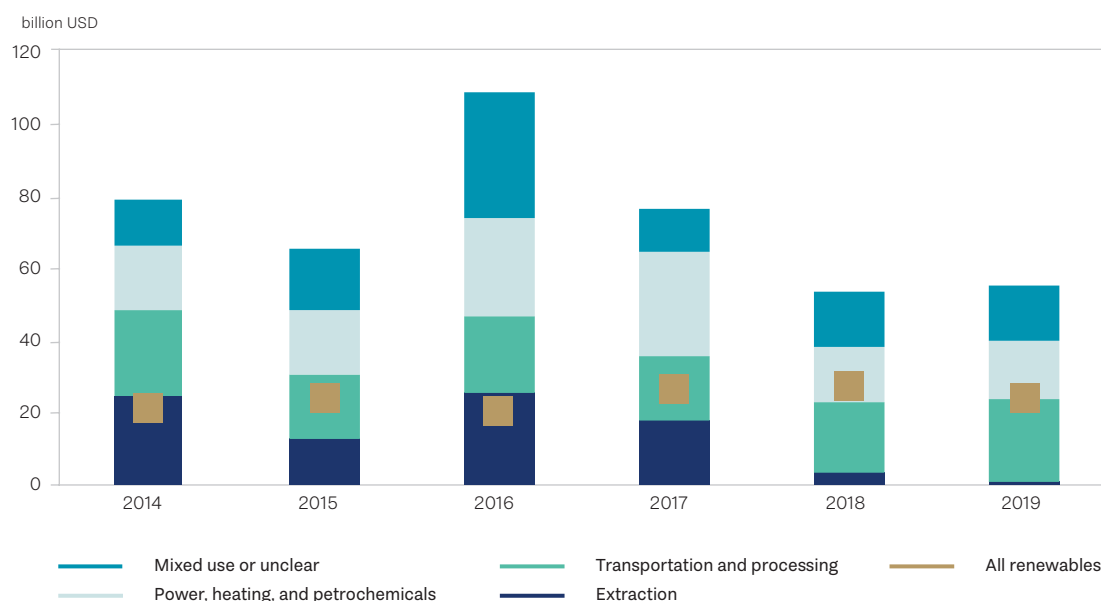
²⁵ Including the African Development Bank (AfDB), the Asian Development Bank (ADB), the Asian Infrastructure Investment Bank (AIIB), the EU Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Inter-American Development Bank (IDB), the Islamic Development Bank (IsDB), the New Development Bank (NDB) and the World Bank Group (WBG).

²⁶ See Footnote 25.

²⁷ At the Climate and Energy Ministerial meeting in July 2021, the G20 Presidency also stated that “the large majority of [G20] members acknowledged that unabated coal power plants and their international public funding are incompatible with the transition to net-zero emissions” (G20 Presidency, 2021).

Figure 3.3

International public finance for fossil fuels and renewable energy reported by major MDBs and G20 trade and development finance institutions, 2014-2019. Source: Oil Change International (2021). Shift the Subsidies Database. <http://priceofoil.org/shift-the-subsidies/>



Note: Public finance to "renewables" includes investments in energy efficiency and renewable energy coming from naturally replenished resources such as sunlight, wind, small hydropower, rain, tides, green hydrogen, and geothermal heat.

Gas received more international public finance than any other source of energy from 2017 to 2019, averaging USD 16 billion each year (Muttitt et al., 2021). Levels of international public finance may be underestimated, given the lack of transparency in reporting and the increasing levels of public finance flowing through financial intermediaries (Fuchs et al., 2021; Larsen et al., 2018).

Preliminary data for 2020 suggest an overall drop in multilateral and bilateral finance for energy across all categories, following the outbreak of the COVID-19 pandemic and an outsized drop in finance for oil and gas in particular (OCI, 2021). It remains unclear whether this is representative of future trends, given the growing perception of climate risks by PFIs, or a temporary effect due to the drop in demand during the pandemic (McMonigle et al., 2020).

Fossil fuel exclusion policies

Meanwhile, a growing number of PFIs have made commitments to limit or exclude fossil fuels from their future investments and align with the Paris Agreement goals (Bhattacharya et al., 2019; Larsen et al., 2018; Finance in Common Summit, 2020; IDFC & MDBs, 2017). At the time of writing, the European Investment Bank is the only MDB to formally exclude *all* "unabated" energy fossil fuel projects

(EIB, 2019, p. 4). Most other institutions with exclusion policies have limited them to fossil fuel production.

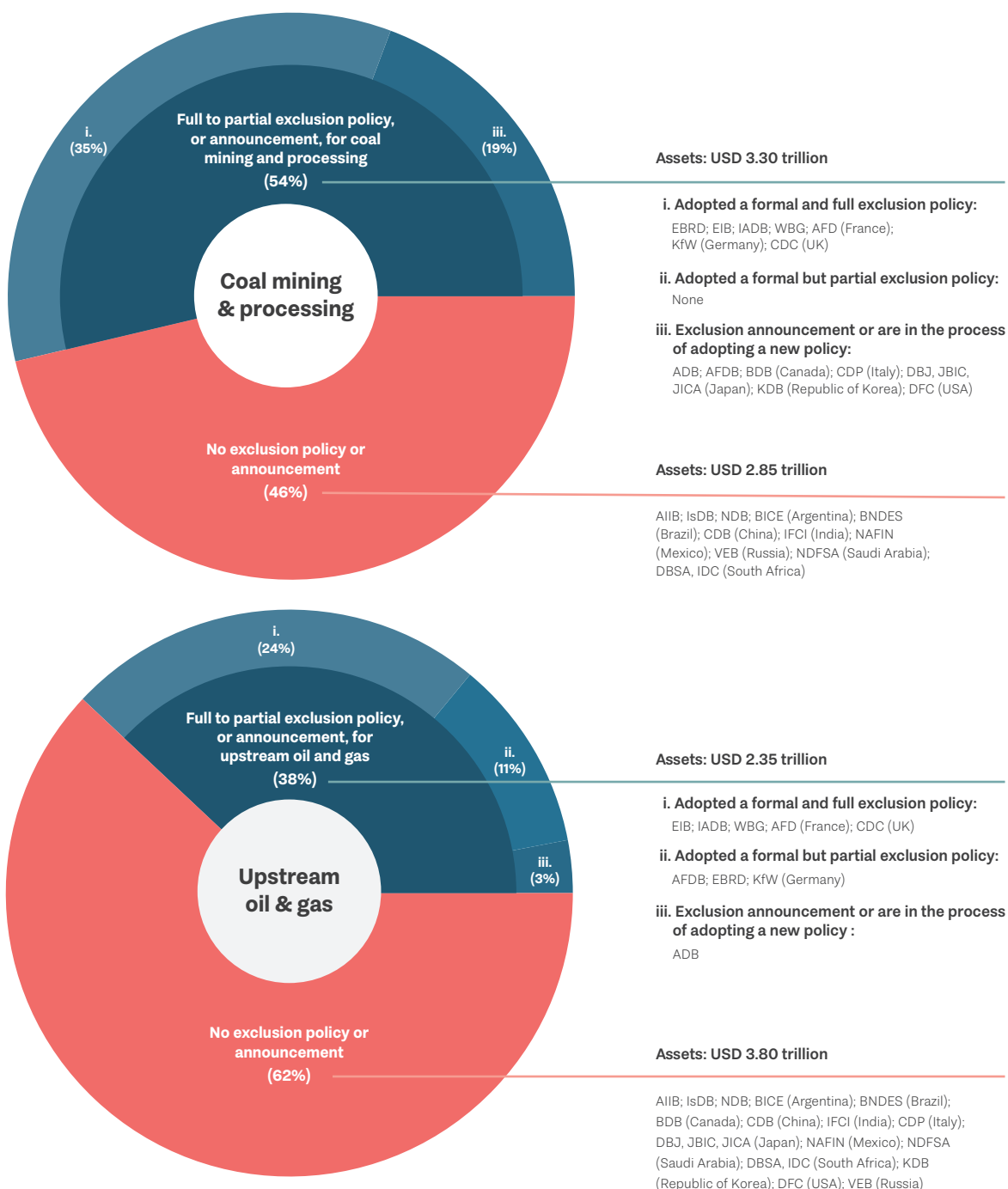
Major MDBs and DFIs from G20 countries control more than USD 6.1 trillion in public assets, and thus have a major influence on public and private investment decisions in the countries they support. MDBs and DFIs representing thirty four percent of these assets have adopted official policies limiting or excluding future financing for coal, oil, and gas production. If we also consider publicly announced policies, this proportion increases to 38% for oil and gas, and 54% for coal (see Figure 3.4). However, for some G20 DFIs and MDBs, debates on these policies are still in the early stages, or non-existent (Erzini et al., 2020; Khinmaung-Moore et al., 2020; Muttitt et al., 2021).

The majority of the world's ECAs have yet to formally exclude or limit future fossil fuel production investments (Shishlov et al., 2021; Tucker et al., 2020). A full exclusion policy on coal, oil, and gas has only been reported for the UK, which in 2021 excluded all fossil fuel production from its export credit support (UK BEIS, 2021). Other countries, like France and Sweden, are tightening their restrictions on upstream oil and gas (EKN, 2020; French Ministry for the Economy and Finance, 2020), and in 2021,

Figure 3.4

Exclusion policies for coal mining & processing and upstream oil and gas in major MDBs and G20 development finance institutions (DFIs), by asset size.

Total assets of major MDBs and G20 DFIs: USD 6.15 trillion



Notes: Upstream activities include all the steps involved from the preliminary exploration through the extraction of the resource. They do not cover power generation and transportation. Exclusion policies usually apply only to future investments, current assets are displayed as indicative information.

Sources: Authors own calculations using (Xu et al., 2020, Korean Development Bank, 2019, Tucker and DeAngelis, 2020, Erzini et al., 2020, E3G, nd), as well as official public finance institutions and governments announcements and updates.

China, the Republic of Korea and the G7 announced they will end financing of overseas coal-fired plants (G7, 2021; Government of Korea, 2021; Xi, 2021). Some legal experts argue that continued financing of fossil fuel production is a breach of international obligations for ECAs (Cook & Viñuales, 2021).

There can also be a perceived disconnect between the stated policies and recent actions of international finance institutions (Ramos et al., 2021). For example, in its most recent annual report, the IMF underscores the need for diversification in economies that depend on fossil fuel exports (IMF, 2020). Yet in some of its country monitoring reports — known as Article IV consultations — the IMF appears to promote expanded fossil fuel production, including for Mongolia, South Sudan, and Bolivia (IMF, 2017a, pp. 8, 54, 2017b, 2019). In another example, UK Export Finance — along with the African Development Bank and ECAs from Italy, Japan, South Africa, Thailand, and the United States — approved support for a multibillion-dollar gas project in Mozambique, just months before the UK exclusion policy was formally approved (TotalEnergies, 2020).

3.4 Conclusions

As Chapter 2 shows, global coal, oil, and gas production need to decline steeply if we are to limit global warming to 1.5°C or 2°C. In contrast, many countries continue to offer significant support to new and increased fossil fuel production — and are even increasing this support when it comes to subsidies and pandemic recovery packages. A significant course correction, including profound changes in technology deployment, policy adoption, and financing, is needed if the world is to get on track with an equitable, low-carbon recovery that is consistent with the Paris Agreement goals. In their efforts to “build back better,” governments should shift their support away from fossil fuel production and towards preparing for a managed transition that equitably addresses the needs of people and communities. Some governments and international financial institutions have begun to take encouraging steps in this direction. These efforts need to deepen and more must follow.



4

Fossil fuel production and policies in key countries

Key Messages

This chapter provides an overview of the climate ambitions and fossil fuel production plans, views and policies for 15 key producer countries: Australia, Brazil, Canada, China, Germany, India, Indonesia, Mexico, Norway, Russia, Saudi Arabia, South Africa, the UAE, the UK, and the US.

These countries have announced various emission reduction targets through their nationally determined contributions (NDC) and, in several cases, have set net-zero goals. Few have assessed, at least publicly, whether their projected fossil fuel production is compatible with limiting global warming to 1.5°C or well below 2°C.

Most major oil and gas producers are planning on increasing production out to 2030 or beyond, while several major coal producers are planning on continuing or increasing production.

A few countries are beginning to discuss and enact policies towards a just and equitable transition away from fossil fuel production. However, these efforts have not yet affected the plans and strategies of major producer countries.

4. Fossil fuel production and policies in key countries

This chapter surveys government strategies, support, and plans and projections for fossil fuel production across 15 key countries. As shown in Figure 4.1, the first eight countries — China, the United States, Russia, Saudi Arabia, Indonesia, Australia, India, and Canada — are the largest global producers of fossil fuels in terms of extraction-based CO₂ emissions.²⁸ The remaining seven countries represent other major producers with readily available data (United Arab Emirates, South Africa, Brazil, and Mexico), as well as those with strongly stated climate ambitions (Norway, the United Kingdom, and Germany). Altogether, these 15 countries accounted for 77% of global, extraction-based CO₂ emissions in 2019.

Each of the 15 profiles in this chapter includes a summary of the country's stated national climate ambitions; available information on government views, projections, and support for fossil fuel production; and emerging policies and discussions towards a managed and equitable wind-down of production. The profiles draw on national energy plans and outlooks published by government and affiliated institutions; on studies by government, research, and intergovernmental institutions; and on other publicly available information.

These countries' plans and projections for domestic fossil fuel production underpin the global gap analysis detailed in Chapter 2. We do not provide an assessment on whether each individual country's projected level of fossil fuel production would be consistent with limiting global warming to 1.5°C or 2°C. This would require making assumptions and establishing principles for how to equitably distribute the remaining global fossil fuel extraction consistent with these temperature limits, taking into account factors including, but not limited to, countries' relative capacity to transition away from fossil fuel production, relative economic dependence on production, relative costs of production, and historical responsibility in terms of past extraction and benefits accrued (Caney, 2016; McGlade & Ekins, 2015; Muttitt & Kartha, 2020; Pye et al., 2020; SEI et al., 2020).

As one starting point for considering how to effectively and equitably align their domestic production with the Paris Agreement's goals, countries could look to *global* decline rates that would be consistent with these goals. As shown in Chapter 2, annual average decline rates of around 11% for coal, 4% for oil, and 3% for gas between



2020 and 2030 would be consistent with limiting warming to 1.5°C, based on the mitigation scenarios compiled by the Intergovernmental Panel on Climate Change (IPCC). In order to ensure a just and equitable wind-down, countries with greater capacity and lower dependency on fossil fuels will likely need to wind down their production faster than the global average. Meanwhile, countries with limited capacity will need financial, technological, and capacity-building support from the international community, as discussed in Chapter 4 of the 2020 Production Gap Report (SEI et al., 2020). Table 4.1 provides some metrics that reflect countries' dependence on, and capacity to transition away from, fossil fuel production.²⁹

The countries profiled here have announced various emission reduction targets through their nationally determined contributions (NDCs) and, in several cases, have set net-zero goals (See Figure 3.1). However, this focus on emissions alone ignores their roles and responsibilities

²⁸ This accounting method allocates CO₂ emissions from fossil fuel combustion to the location of extraction. See [online Appendix B](#) for details.

²⁹ The metrics shown are intended to provide a quick overview and should not be viewed as exhaustive. For a summary of approaches to evaluating the dependence of countries on the extractives industry (including oil and gas), see Hailu and Kipgen (2017). These metrics are also discussed in Chapter 4 of the 2020 Production Gap Report (SEI et al., 2020).

in producing the predominant source of these emissions, fossil fuels. Achieving net-zero emissions globally will require countries to wind down their production of coal, oil, and gas. To date, few producer countries have assessed, at least publicly, whether their projected fossil fuel production is compatible with limiting global warming to 1.5°C or well below 2°C.

In April 2021, the governments of Canada, Norway, Saudi Arabia, and the US – along with Qatar – announced a “Net-Zero Producers Forum” with goals to “form a cooperative forum that will develop pragmatic net-zero emission strategies, including methane abatement, advancing the circular carbon economy approach, development and deployment of clean-energy and carbon capture and storage technologies, diversification from reliance on hydrocarbon revenues, and other measures in line with each country’s national circumstances” (U.S. Department of Energy,

2021). Further details have not emerged since this initial announcement, and the Forum has not acknowledged or addressed the need to reduce production itself.

As this chapter illustrates, several major coal producers are planning on continuing or increasing domestic production, while most major oil and gas producers are promoting, investing in, and planning on expanding production. For the few oil and gas producers projecting long-term decreases, this largely reflects natural resource depletion rather than a managed wind-down. A few countries are now beginning to discuss — and in some cases to enact policies towards — a just and equitable transition away from fossil fuel production, but thus far, these efforts have largely been limited to coal (see e.g., Germany) and have yet to affect the plans and strategies of major producer countries.

Figure 4.1

Top 25 countries in terms of extraction-based CO₂ emissions (million tonnes CO₂, or MtCO₂) in 2019. The top eight producers account for 70%, and the top 25 producers account for 90%, of the global total. Countries profiled in this chapter are indicated in bold and denoted with an asterisk (Germany ranks 34th and is not shown). Coal, oil, and gas production data are from the IEA (2021); the methodology for estimating extraction-based emissions is provided in [online Appendix B](#).

Extraction-based CO₂ emissions (MtCO₂), 2019

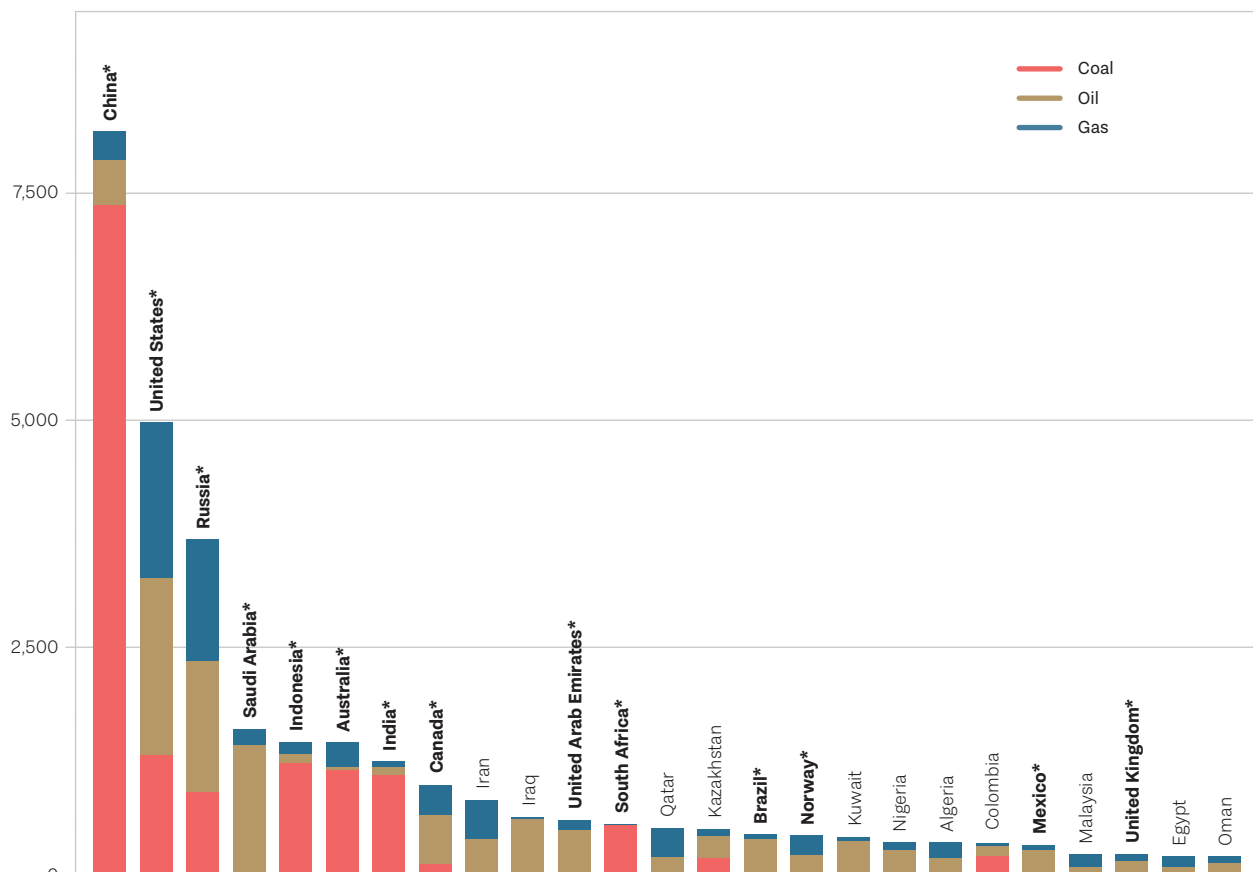


Table 4.1

Fossil fuel producer rankings, transition capacity, and dependence on fossil fuel production for the 15 countries profiled in this chapter (see footnote 29). Countries are listed in order of decreasing 2019 extraction-based CO₂ emissions. Data are shown as reported or estimated from the sources listed; there is no standardized methodological approach and thus estimates may not be fully comparable between countries. A dash (-) indicates that a country's 2019 production of that fuel is zero or below 0.5 exajoules per year (EJ/yr).

Country	Rank and share of global production in 2019 on an energy (EJ) basis (IEA, 2021)			Economic capacity for transition	Dependence on fossil fuel production		
	Coal	Oil	Gas	Income level, 2021 (World Bank, 2021b)	Coal miners per 1,000 workers*	Share of government revenue from oil and gas production	Sources
China	1st (49%)	6th (4%)	6th (4%)	Upper-middle	3.6 ^a	<3% ^b	^a 2020 estimate (CEIC, 2021b, 2021a) ^b 2017 estimate; includes coal, oil, and gas production (Gerasimchuk et al., 2019)
United States	2nd (9%)	1st (17%)	1st (23%)	High	0.3 ^c	0.5% ^d	^c 2020 estimate (U.S. Bureau of Labor Statistics, 2021) ^d 2020 estimate (US DOI, 2021b; U.S. Treasury Data Lab, 2021)
Russia	6th (6%)	2nd (13%)	2nd (18%)	Upper-middle	2.0 ^e	39% ^f	^e 2018 estimate (Grachev, 2018) ^f 2019 estimate (Government of the Russian Federation, 2021a)
Saudi Arabia	–	3rd (12%)	9th (2%)	High	–	64% ^g	^g 2019 estimate (Saudi Central Bank, 2021)
Indonesia	3rd (8%)	22nd (1%)	13th (2%)	Upper-middle	1.0 ^h	3% ⁱ	^h 2014 estimate (Directorate General of Mineral and Coal, 2015; World Bank, 2021a) ⁱ 2020 estimate; oil and gas extraction accounts for 3% of total and 18% of non-tax government revenue (Reuters, 2020)
Australia	4th (8%)	31st (0.4%)	7th (4%)	High	3.3 ^j	0.6% ^k	^j 2015–2019 average (Australian Bureau of Statistics, 2020) ^k 2020 estimate (APPEA, 2020; Parliament of Australia, 2020)
India	5th (7%)	24th (1%)	23rd (1%)	Lower-middle	1.0 ^l	1% ^m	^l 2020 estimate (Aggarwal, 2020) ^m 2019 estimate (Ministry of Finance, 2021)
Canada	11th (1%)	5th (5%)	4th (4%)	High	0.4 ⁿ	1% ^o	ⁿ 2020 estimate (Statistics Canada, 2021b) ^o 2014–2018 average (Government of Canada, 2020; Statistics Canada, 2021a)
United Arab Emirates	–	7th (4%)	15th (1%)	High	–	41% ^p	^p 2019 estimate (Arab Monetary Fund, 2020)
South Africa	7th (4%)	–	–	Upper-middle	3.6 ^q	–	^q 2017 estimate (Montmasson-Clair et al., 2019)
Brazil	–	8th (3%)	27th (1%)	Upper-middle	–	7% ^r	^r 2017 estimate (Deloitte, 2021)
Norway	–	14th (2%)	8th (3%)	High	–	14% ^s	^s 2021 estimate (Norwegian Petroleum Directorate & Norwegian Ministry of Petroleum and Energy, 2021)
Mexico	–	13th (2%)	26th (1%)	Upper-middle	–	16% ^t	^t 2020 estimate; likely includes revenues from both production and consumption (Mora-Tellez, 2021)
United Kingdom	–	19th (1%)	19th (1%)	High	–	0.1% ^u	^u 2019 estimate (HM Revenue & Customs, 2020; Keep, 2020)
Germany	12th (1%)	–	–	High	0.3 ^v	–	^v 2019 estimate (Federal Statistical Office of Germany, 2021)

* This estimate does not include informal or indirect jobs related to the coal mining industry.

China

Announced climate ambitions

In 2020, President Xi Jinping announced China's updated 2030 NDC targets that "aim to peak CO₂ emissions before 2030 and achieve carbon neutrality before 2060" (Xi, 2020a, 2020b). As of August 2021, the government had not yet submitted its updated NDC to the UNFCCC.

Government views on fossil fuel production

President Xi recently stated that China will wind down coal consumption during the 15th Five-Year Plan period, and "control the total use of fossil fuels and take action to shift to alternative energy sources," but did not explicitly address production at these meetings (Xi, 2021a; XinhuaNet, 2021). China's heavy reliance on gas imports is driving the country's recent efforts to develop unconventional gas production (OECD, 2021g), and China's first NDC listed expanding gas production and use as one of its strategies for "building [a] low-carbon energy system" (Government of China, 2016).

Plans and projections for domestic fossil fuel production

As of August 2021, the Chinese government had not yet released sector-specific plans of its 14th Five-Year Plan. China's fossil fuel production is dominated by several large state-owned companies (G20 Peer-review Team, 2016). As shown in Figure 4.2, the China National Petroleum Corporation (CNPC)'s 2050 World and China Energy Outlook projects oil and gas production to increase by 5% and 58%, respectively, and coal production to decrease by 8%, between 2020 and 2030 (CNPC Economics & Technology Research Institute, 2020). However, a 2025 production target from the China National Coal Association (CNCA) suggests an increase in coal production through 2025 (CNCA, 2021).

Government support for fossil fuel production

■ Provincial governments provided budgetary transfers for coal exploration and extraction totalling CNY 2.6 billion (USD 380 million) in 2019, according to the Organisation for Economic Co-operation and Development (OECD, 2021i).

■ The central government provided CNY 8.8 billion (USD 1.3 billion) in budgetary transfers and tax expenditures for oil and gas production in 2019, including per-unit payments to coal-bed methane and shale gas producers (OECD, 2021i).

■ In 2020, the central government issued a five-year special fund to support "the clean development and utilization of renewable energy, clean fossil energy, and the clean utilization of fossil energy," targeted at unconventional gas and hydropower development (China Ministry of Finance, 2020; quotations translated from Mandarin Chinese). The starting budget for 2020 is CNY 420 million (USD 61 million); to incentivize unconventional gas production, the level of "reward" will increase from year to year if production increases (China Ministry of Finance, 2020a).

■ China does not release official data on its overseas development finance. According to independent estimates, in 2000-2019, the Chinese Development Bank (CDB) and Chinese Export-Import Bank (EXIM) provided a total of at least USD 169 billion in finance to international fossil fuel projects, including USD 70 billion for oil and gas exploration and extraction (Gallagher, 2021). In 2021, China committed to not build new coal-fired power plants abroad (Xi, 2021b).

Policies and discourses towards a managed wind-down of fossil fuel production

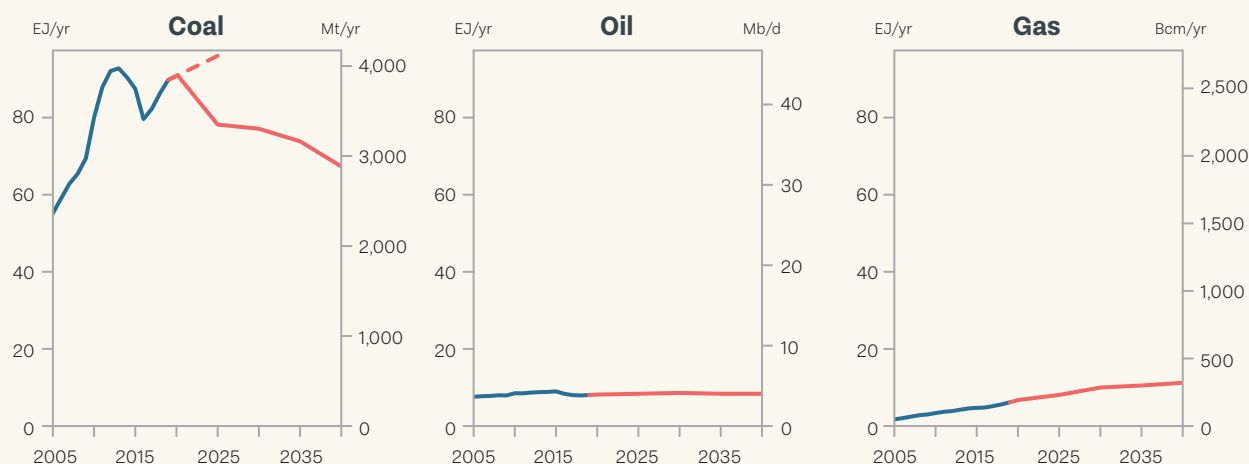
No specific discourses were identified beyond President Xi's announcement that China will reduce its coal consumption between 2026 and 2030; this has implications for production since over 90% of coal use is domestically produced (National Bureau of Statistics of China, 2019).

Policies and discourses supporting a just and equitable transition away from fossil fuel production:

In his speech at the 2021 Leaders Summit on Climate, President Xi mentioned delivering "social equity and justice in the course of green transition" (Xi, 2021a). No other government policies or discourses were identified.

Figure 4.2

Historical and projected coal, oil, and gas production for China. Sources: Projections for all fuels are from the reference scenario from the CNPC's 2050 World and China Energy Outlook (2020 Edition) (CNPC Economics & Technology Research Institute, 2020). For coal, production projections are estimated from consumption projections, assuming imports will account for around 7% of total consumption, the 2016–2020 average. A 2025 coal production target from the CNCA is also shown by the dotted red line (CNCA, 2021). Historical data are from China's National Bureau of Statistics (2019, 2021).



United States

Announced climate ambitions

In 2021, President Biden announced a goal to achieve net-zero emissions by 2050, and a new NDC target to reduce GHG emissions by 50%–52% by 2030, compared to 2005 levels (The White House, 2021b, 2021c).

Government views on fossil fuel production

The US government has long incentivized the expansion of US oil and gas production, including through support for the research and development of fracking technologies and the withdrawal of a four-decade ban on most crude oil exports (National Research Council, 2001; Rusco, 2020; Vietor, 1984; Wang & Krupnick, 2015; Warner & Shapiro, 2013). The government also has largely taken a permissive approach to fossil fuel development and supporting infrastructure, such as pipelines (Brady & Crannell, 2012; Clark, 1987; Vietor, 1984). A notable exception is the Keystone XL pipeline, which it cancelled because the pipeline “would undermine U.S. climate leadership” (The White House, 2021a). The country is now the world’s largest producer of oil and gas, and second (in energy terms) in coal (IEA, 2021). In April 2021, the US joined four other countries in establishing the Net-Zero Producers Forum (see chapter introduction).

Plans and projections for domestic fossil fuel production

Projections from the U.S. Energy Information Administration (EIA) show oil and gas production increasing to 17% and 12% above 2019 levels by 2030, respectively, increases that would largely go to exports (US EIA, 2021). EIA projects that coal production will continue its decline, to 30% below 2019 levels in 2030 (US EIA, 2021).

Government support for fossil fuel production

■ The federal government provides over a dozen subsidies to coal, oil, and gas production (US Government, 2015), such as the immediate depreciation of many capital expenses, worth USD 4 billion in 2019 (OECD, 2021f).

■ Individual US states provide additional subsidies, including through tax exemptions (OECD, 2021f), and by levying charges for well plugging and abandonment that are much too low to

cover actual clean-up costs (Achakulwisut et al., 2021; Raimi et al., 2021).

■ The US leases public lands and waters for fossil fuel extraction, often at below-market rates (Rusco, 2019). About 40% of all coal (and less than 20% of all oil and gas) has been extracted from federal lands and waters in recent years (Merrill et al., 2018; US EIA, 2015).

■ Over time, the US Congress has exempted fossil fuel extraction from numerous federal environmental regulations, such as hazardous waste requirements (Achakulwisut et al., 2021; Brady & Crannell, 2012; Congressional Research Service, 2020; Goldman et al., 2013; Simms, 2017).

■ The US government also indirectly supports fossil fuel production through long-standing support to fossil fuel consumption, such as by constructing and expanding the extensive highway system (Dilger, 2015). Support for highways was expanded in the infrastructure legislation that passed Congress in August 2021 along with other indirect measures of support for both fossil and non-fossil energy (Infrastructure Investment and Jobs Act, 2021).

Policies and discourses towards a managed wind-down of fossil fuel production

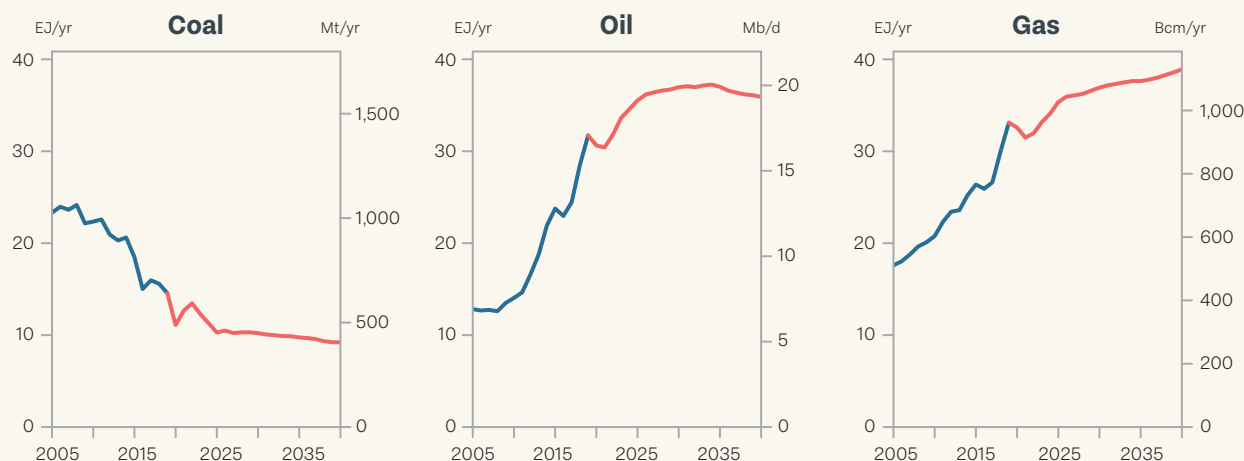
The current administration is considering aligning the leasing of federal lands for fossil fuel extraction with climate goals (US DOI, 2021a, 2021c). The State of California, historically one of the top oil-producing states, is evaluating how to phase out oil extraction across the state by 2045 as part of its climate strategy (Erickson et al., 2018; Office of the Governor, 2021).

Policies and discourses supporting a just and equitable transition away from fossil fuel production

The current administration has created a working group to “revitalize the economies of coal, oil and gas, and power plant communities” as part of decarbonizing the economy (The White House, 2021b). The group’s initial recommendations have been on funding infrastructure, mine clean-up, and economic development in coal-mining communities (NETL, 2021).

Figure 4.3

Historical and projected coal, oil, and gas production for the US. Source: Reference scenario from the EIA Annual Energy Outlook 2021 (US EIA, 2021).



Russia

Announced climate ambitions

Russia's 2020 updated NDC reiterated its 2015 NDC goal of reducing net greenhouse gas emissions to 30% below 1990 levels by 2030 (Ministry of Economic Development of the Russian Federation, 2020).

Government views on fossil fuel production

In June 2020, Russia approved its new Energy Strategy to 2035 (Ministry of Energy of the Russian Federation, 2020a). While recognizing shifts in global energy markets, the strategy relies heavily on the production and export of fossil fuels as "stimulating infrastructure" for development and diversification of the Russian economy, particularly for gas and coal.

Plans and projections for domestic fossil fuel production

Under the Russian Energy Strategy's "Optimistic" scenario, gas and coal production increase by 38% and 52%, respectively, from 2018 to 2035, and by 18% and 10%, respectively, under its "Pessimistic" scenario, as shown in Figure 4.4 (Ministry of Energy of the Russian Federation, 2020a). In contrast, the strategy projects relatively flat (Optimistic) or declining (Pessimistic) production for oil.

Government support for fossil fuel production

■ Russia is investing heavily in liquefied natural gas (LNG) infrastructure (RUB 11.5 trillion, or USD 158 billion, by 2030), with LNG exports expected to account for most of the growth in gas production over the coming decade (Ministry of Energy of the Russian Federation, 2020a; RBC, 2021). Similarly, Russia is expanding its seaport terminals and other coal export infrastructure, with an eye to increasing coal exports across the Asia-Pacific Region (Ministry of Energy of the Russian Federation, 2020a).

■ Tax breaks and budget expenditures for fossil fuel production totalled RUB 713 billion in 2019 (USD 9.8 billion), nearly three times the amount in 2015, with the vast majority associated with exemptions or reductions of extraction taxes for oil and gas development (OECD, 2021d). By one prior estimate, not adjusted for

new and removed exemptions, the government could forego RUB 2.3 trillion (USD 32 billion) in revenue by 2033, by under-taxing oil extraction (RBC, 2019).

■ In response to the major drop in oil and gas revenues in 2020, the Russian government removed certain tax breaks for the industry, including repealing prior exemptions of some petroleum fields from mineral extraction tax and export duties (Official Portal of Legal Information, 2020b, 2020a). The government also adopted measures to support fossil fuel producers and other "systemically important enterprises", providing for potential state guarantees, deferral and instalment plans for the payment of taxes, and preferential loans (Ministry of Energy of the Russian Federation, 2020b). It granted new exemptions from the mineral extraction tax to promote new oil and gas development in the Arctic regions, as well as LNG production and exports. It also launched a program to subsidize the use of Russian oil and gas equipment, allowing advance payments to be reduced by up to 30% (Government of the Russian Federation, 2020).

Policies and discourses towards a managed wind-down of fossil fuel production

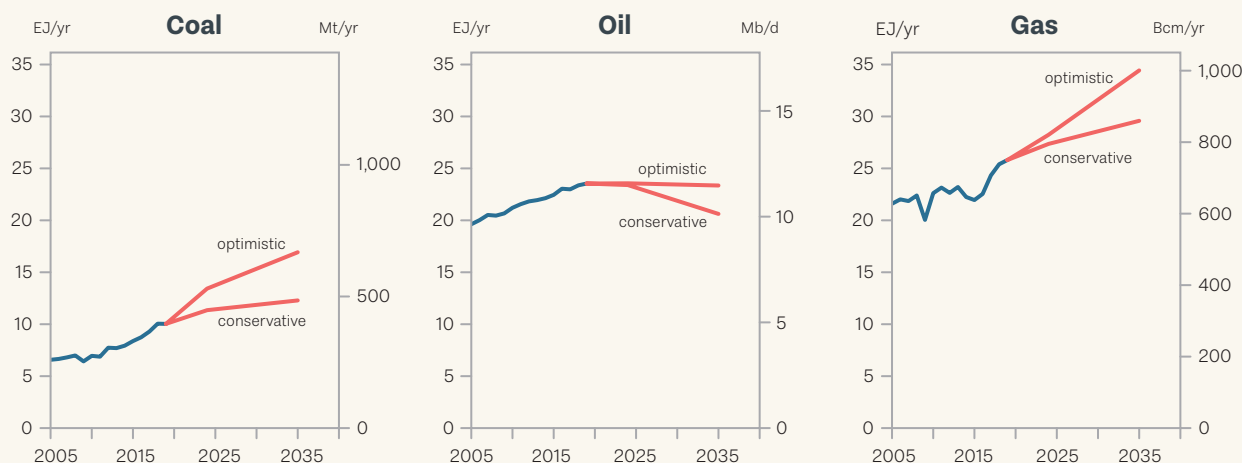
Over the past year, the Russian president has issued a federal decree to reduce GHG emissions (President of the Russian Federation, 2020), the government has drafted a law to limit emissions (Government of the Russian Federation, 2021b), and the Bank of Russia has launched a consultation process to consider climate risks and disclosure (Bank of Russia, 2021). However, there are no publicly available indications that Russian authorities and state-owned energy companies have discussed the need to prepare for a managed wind-down in fossil fuels (Grushevenko et al., 2021; Korppoo et al., 2021).

Policies and discourses supporting a just and equitable transition away from fossil fuel production

No such government policies or discourses were identified.

Figure 4.4

Historical and projected coal, oil, and gas production for Russia. Sources: The 2024 and 2035 projections under two scenarios, "optimistic" and "conservative", are from Russia's Energy Strategy to 2035 (Ministry of Energy of the Russian Federation, 2020a). Historical data are from the IEA (IEA, 2021).



Saudi Arabia

Announced climate ambitions

Saudi Arabia's first NDC, issued in 2015, seeks to reduce emissions by 130 million tonnes of carbon dioxide equivalent (MtCO₂e) by 2030 (no baseline indicated), contingent on "an increasingly diversified economy and a robust contribution from oil export revenues" (Kingdom of Saudi Arabia, 2015, p. 1).

Government views on fossil fuel production

Saudi Aramco, the state-owned enterprise responsible for oil and gas exploration and extraction, holds 17% of the world's proven petroleum reserves. It has indicated its intention to remain the "last man standing" among major producers, even under a global transition to low-carbon energy, given that its oil is among the world's cheapest and least GHG-intensive to extract (Blas, 2021; Krane, 2021; McQue, 2021). In April 2021, Saudi Arabia joined four other countries in establishing the Net-Zero Producers Forum (see chapter introduction).

Plans and projections for domestic fossil fuel production

There are few publicly available government documents that reveal planning assumptions or government intentions for future domestic oil and gas production. A notable exception is Saudi Aramco's bond prospectus, first issued in 2019. As illustrated in Figure 4.5, it forecasts that Saudi oil production will increase by 37% from 2020 to 2040 under a scenario where global oil demand levels off by 2035, and by 31% over the same period under a more rapid transition scenario where demand declines by the late 2020s (Saudi Aramco, 2020d). In March 2020, the Saudi Ministry of Energy directed Saudi Aramco to raise maxi-

mum production capacity from 12 to 13 million barrels per day, which is expected by 2024 (Kawar, 2021; Saudi Aramco, 2020b). Saudi Aramco also plans to double its natural gas production and export gas for the first time by 2030, with an aim to be one of the world's top three natural gas producers (Saudi Aramco, 2020c). Saudi Arabia has recently approved the world's largest gas development project; the offshore Jafurah shale gas field costs USD 110 billion and will also be used to produce blue hydrogen (with carbon capture and storage) for export (Kimani, 2021; Saudi Aramco, 2020a).

Government support for fossil fuel production

No information is publicly available on tax expenditures or other measures that support fossil fuel production in Saudi Arabia.

Policies and discourses towards a managed wind-down of fossil fuel production

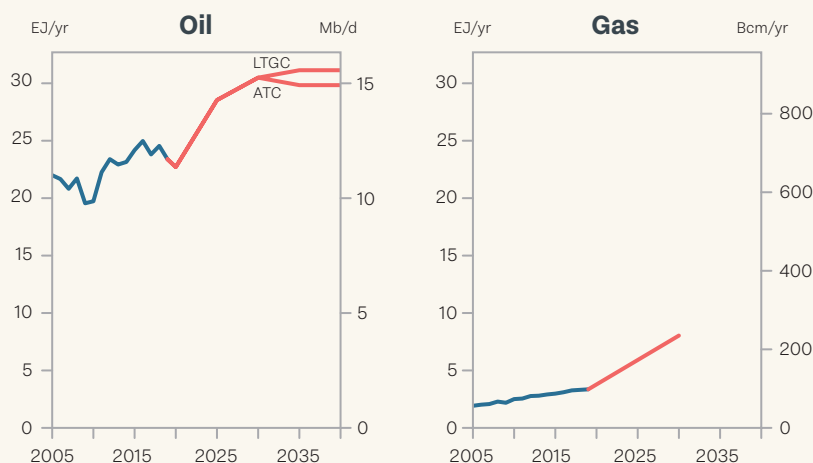
No such government policies or discourses were identified.

Policies and discourses supporting a just and equitable transition away from fossil fuel production

While economic diversification lies at the core of Saudi Arabia's Vision 2030 planning framework (Kingdom of Saudi Arabia, 2021), no government policies or discourses to prepare and support workers and communities for a just transition away from fossil fuels were identified.

Figure 4.5

Historical and projected oil and gas production for Saudi Arabia. Saudi Arabia does not produce coal. Sources: For oil projections, two scenarios — "long term growth case" (LTGC) and "accelerated transition case" (ATC) — are taken from Saudi Aramco's Global Medium Term Note Programme, Base Prospectus (Saudi Aramco, 2020d, p. 87). Gas projections are from Saudi Aramco's 2019 Prospectus (Saudi Aramco, 2020c). Historical data are from the IEA (IEA, 2021).



Indonesia

Announced climate ambitions

Indonesia's NDC, first issued in 2016 and updated in 2021, sets an unconditional emission reduction target of 29% by 2030, against a business-as-usual scenario, and a reduction target of up to 41% conditional on international support (Republic of Indonesia, 2016, 2021). The state-owned electric monopoly utility, Perusahaan Listrik Negara (PLN), has pledged carbon neutrality by 2050 (Rahman, 2021).

Government views on fossil fuel production

The central government has undergone a paradigm shift from viewing oil and gas as export commodities to seeing them as strategic domestic resources (Braithwaite & Gerasimchuk, 2019).

Plans and projections for domestic fossil fuel production

As shown in Figure 4.6, the most recent government outlook provides short-term projections under various scenarios to account for the effects of the pandemic on Indonesia's energy sector (PPIPE & BPPT, 2020). Longer-term projections from the government's 2019 outlook foresee coal production growing at 1% per year, on average, through 2050, with around three-quarters destined for export (PPIPE & BPPT, 2019). In contrast, the long-term strategy (LTS) that Indonesia recently submitted to the UNFCCC projects coal production to peak around 2025 and decline about 1% annually thereafter in its current policy scenario, and 3% per year in its low-carbon scenario (Indonesian Ministry of Environment and Forestry, 2021). These latter projections, however, have not yet been integrated into national energy outlooks and thus are not depicted in Figure 4.6. According to the government's 2019 outlook, crude oil and gas production are projected to decrease by around 5% and 3% per year, respectively, between 2019 and 2040 (PPIPE & BPPT, 2019).

Government support for fossil fuel production

■ Indonesia provided subsidies for oil and gas production valued at IDR 4.4 trillion (USD 320 million) in 2019, according to the OECD (OECD, 2021c). These subsidies include special treatment for import duties and taxes, value-added tax, income tax, capital goods and equipment taxes, and land and building taxes (MEMR & MoF, 2019), as well as other fiscal benefits such as investment credit, domestic market obligation (DMO) holidays, and accelerated depreciation (PPIPE & BPPT, 2019).

■ The 2020 Job Creation Act provided a royalty exemption to coal producers who expand their businesses into coal derivatives, such as coal gasification as an alternative fuel to liquefied petroleum gas (LPG) (Kementerian Sekretariat Negara, 2020). One study estimates the resulting forgone revenue to be USD 1.1 billion in royalties and USD 1.2 billion in taxes (Peh, 2020).

■ In 2020, the government created automatic contract extensions for coal mining areas and relaxed environmental regulations related to spatial planning (Harsono, 2020). For example, the Job Creation Act reduced public engagement during the environmental impact assessment process and eliminated the requirement of an environmental license (Kementerian Sekretariat Negara, 2020).

Policies and discourses towards a managed wind-down of fossil fuel production

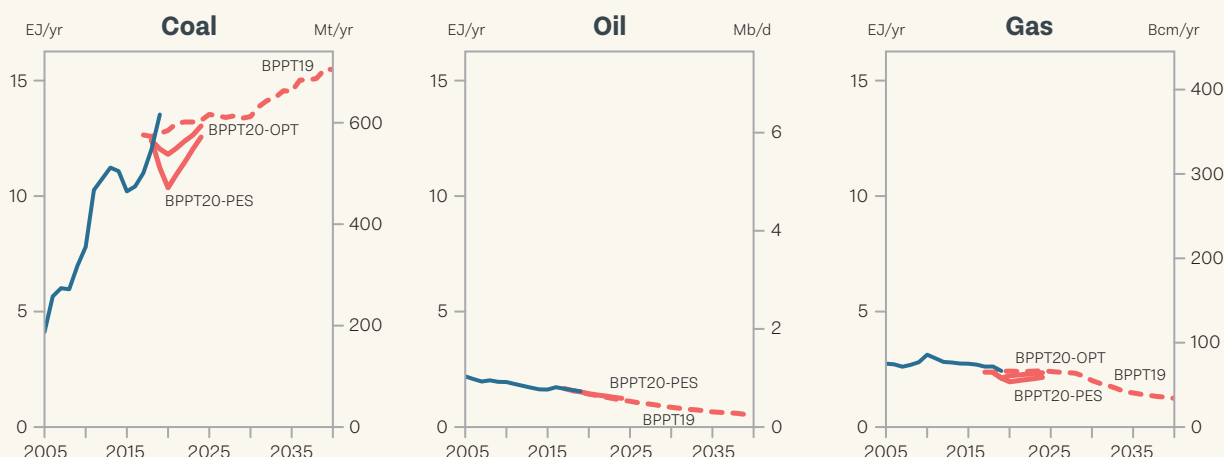
No such government policies or discourses were identified.

Policies and discourses supporting a just and equitable transition away from fossil fuel production

Indonesia's LTS identifies future policies and interventions that are needed to ensure a just transition of the work force, gender equality, intergenerational equity, and the protection of vulnerable people (Indonesian Ministry of Environment and Forestry, 2021).

Figure 4.6

Historical and projected coal, oil, and gas production for Indonesia. Sources: Three projected scenarios are shown from the Agency for the Assessment and Application of Technology (BPPT): BPPT19 shows 2017–2040 projections from BPPT's Indonesia Energy Outlook 2019 (PPIPE & BPPT, 2019); BPPT20-OPT and BPPT20-PES show 2018–2024 projections under the optimistic and pessimistic scenarios, respectively, from BPPT's Indonesia Energy Outlook 2020 (PPIPE & BPPT, 2020). Historical data are from the IEA (IEA, 2021).



Australia

Announced climate ambitions

Australia's first and updated NDCs both set the same emission reduction target of 26%–28% below 2005 levels by 2030 (Government of Australia, 2016, 2020).

Government views on fossil fuel production

The federal government promotes its fossil fuel industry, emphasizing the economic importance of its coal and gas sectors (Minister for Energy and Emissions Reduction, 2020; Prime Minister of Australia, 2021). As shown in Fig 4.7, coal and gas production have grown rapidly since 2010, driven by the major expansion of coal exports and a newly established liquefied natural gas (LNG) export industry. Australia is now the world's largest coal exporter and the second largest LNG exporter (Australian Department of Industry, Science, Energy and Resources, 2021a; IEA, 2021).

The federal government has promoted a “gas-fired recovery” from the COVID-19-related economic slowdown, including by providing substantial new public funding to unlock new gas basins, supporting the expansion of the gas transport network, and using various measures to boost gas supply and domestic gas use (Australian Department of Industry, Science, Energy and Resources, 2020b, 2021b; Prime Minister of Australia, 2020).

Plans and projections for domestic fossil fuel production

As illustrated in Figure 4.7, the Australian government projects increases in coal, oil, and gas production of 4%, 32%, and 12%, respectively, from fiscal year 2019 to 2030 (Australian Department of Industry, Science, Energy and Resources, 2020a).

Government support for fossil fuel production

■ Australia's fiscal regime for oil and gas production allows some operators of major projects to pay little or nothing in royalties or resource rent taxes (Bruce, 2019; Butler, 2021; Campbell, 2020).

■ Australia exempts fuel used in mining from fuel taxes through the fuel tax credit system, which is also available to other sectors of the economy (Australian Taxation Office, 2017).

■ The Queensland State government has expedited approval for proposed large coal mine developments in the Galilee basin (Bavas, 2019; Wahlquist, 2019), as well as agreed to defer royalty payments on a concessional basis (Swann, 2018; Thornhill, 2020; Zillman & Horn, 2020). However, market conditions, limited access to financing, and recent Chinese import restrictions have delayed, limited, or stalled these developments (Australian Department of Industry, Science, Energy and Resources, 2021a).

■ Export Finance Australia provided between AUD 1.6 and 1.7 billion (USD 1.1 to 1.2 billion) in finance to fossil fuel projects from mid-2009 to mid-2020, including AUD 0.3 billion (USD 0.2 billion) to a LNG facility and coal export terminal (Rui & Strachan, 2021).

Policies and discourses towards a managed wind-down of fossil fuel production

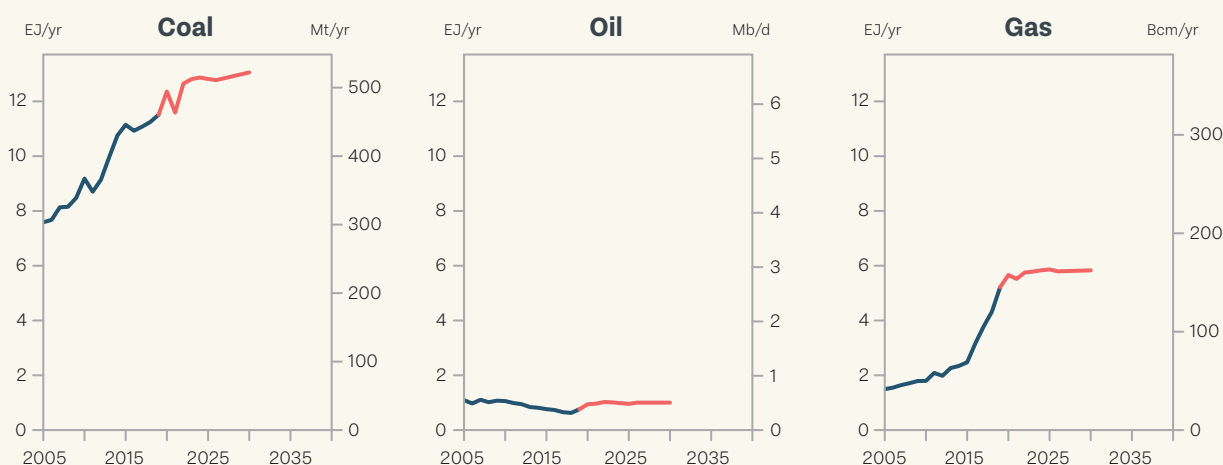
No such government policies or discourses were identified.

Policies and discourses supporting a just and equitable transition away from fossil fuel production

Policies and discourses have been limited to transition assistance at the local level, related to coal plant closure in the Latrobe Valley, as well as some early considerations for how to handle future coal plant closures in the Hunter Valley (Green, 2019; Wiseman et al., 2020).

Figure 4.7

Historical and projected coal, oil, and gas production for Australia. Sources: Historical data and 2020–2026 projections are from the Resources and Energy Quarterly, March 2021 (Australian Department of Industry, Science, Energy and Resources, 2021a); 2030 projections are from Australia's emissions projections 2020 (Australian Department of Industry, Science, Energy and Resources, 2020a).



India

Announced climate ambitions

India's first NDC, issued in 2016, pledged a 33%–35% reduction in the “emissions intensity” of its economy by 2030, compared to 2005 levels (Government of India, 2016).

Government views on fossil fuel production

Under the Aatma Nirbhar Bharat (Self-Reliant India) campaign, the government seeks to “unleash the power of coal” and become self-reliant by 2023–24 (Press Information Bureau of the Government of India, 2020c), and commits to “augment production through government companies” (Indian Ministry of Coal, 2021a). The government articulated this as “a paradigm shift in the approach from being oriented to maximum revenue from coal to making maximum coal available in the market at the earliest” (Press Information Bureau of the Government of India, 2020b).

Plans and projections for domestic fossil fuel production

In 2020, several ministries jointly produced a vision and action plan for developing India's resources. The plan outlines measures to expand coal production by nearly 60% from 2019 to 2024 (from 730 to 1,149 million tonnes), including through the removal of barriers to land acquisition and building capacity for exploration (Indian Ministry of Coal, 2021b). India also aims to increase total oil and gas production by over 40% in the same period through measures such as accelerated exploration licensing, faster monetization of discoveries, and gas marketing reforms (Indian Ministry of Coal, 2021b; Ministry of Petroleum and Natural Gas, 2020).

Government support for fossil fuel production

■ India provided tax breaks and budget expenditures for fossil fuel production worth INR 11.8 billion (USD 168 million) in 2019, according to the OECD (OECD, 2021b). Another report, considering a wider range of government support measures, estimates that subsidies for coal production totalled INR 17.5 billion (USD 249 million) and those for oil and gas production totalled INR

29.3 billion (USD 417 million) in 2020 (Garg et al., 2021). Fiscal support for coal production is small in comparison with the fiscal revenue collected from coal.

■ In response to the COVID-19 crisis, the government provided a 50% rebate on revenue payable to the government for coal extraction projects (Bhaskar, 2021).

■ As part of structural reforms announced in 2020 amid the Self-Reliant India campaign, the government committed INR 500 billion (USD 7.1 billion) for coal extraction infrastructure (Press Information Bureau of the Government of India, 2020a).

■ In 2020, India opened up its coal mining sector to private and foreign investment, offering financial incentives and organizing large auctions of coal mining blocks. A 2020 auction included mines that would add an estimated 225 million tonnes at peak production, representing around 15% of India's projected coal output for 2025 (Press Information Bureau of the Government of India, 2020d, p. 41). It was opposed by the states of Jharkhand, Chhattisgarh and Maharashtra, with concerns about potential social and environmental impacts (Indian Ministry of Coal, n.d.; Jamwal, 2020). A second auction took place in 2021.

■ Over the past decade, the Ministry of Environment, Forest and Climate Change has narrowed the public consultation process for coal mine projects (Ministry of Environment, Forest and Climate Change, 2019; Aggarwal, 2021).

Policies and discourses towards a managed wind-down of fossil fuel production

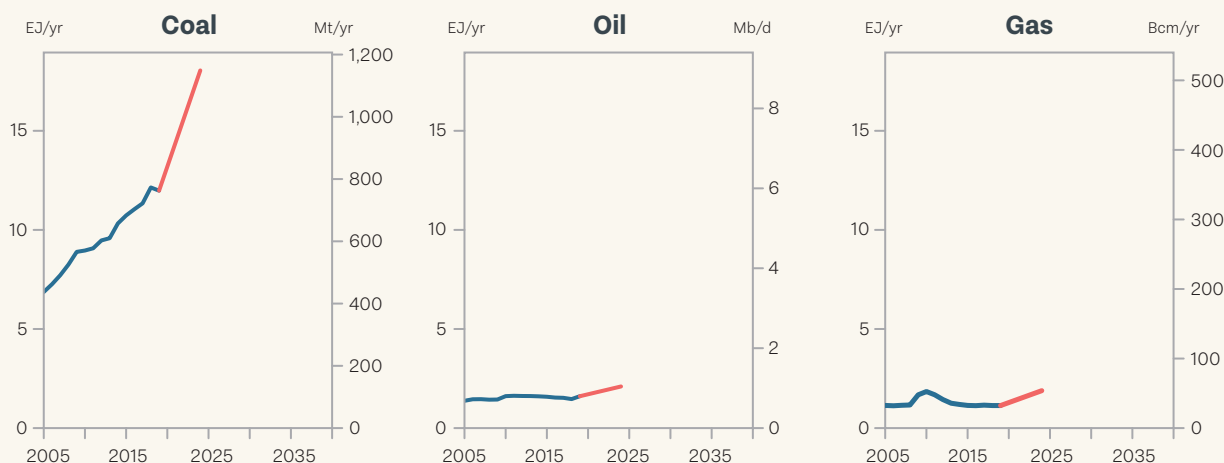
No such government policies or discourses were identified at the federal level.

Policies and discourses supporting a just and equitable transition away from fossil fuel production

No such government policies or discourses were identified at the federal level.

Figure 4.8

Historical and projected coal, oil, and gas production for India. The 2024 oil and gas production projections are estimated from the total reported in the source document, assuming the oil-to-gas ratio remains constant at 2019 values. Sources: 2024 projections from the Five Year Vision Document 2019–2024 (Indian Ministry of Coal, 2021b). Historical data are from India's Bureau of Mines (2021).



Canada

Announced climate ambitions

Canada released its updated NDC in mid-2021, pledging to reduce emissions 40%–45% from 2005 levels by 2030 and confirming its 2019 commitment to reach net-zero domestic emissions by 2050 (Government of Canada, 2021; Prime Minister of Canada, 2021). In 2021, Canada also passed climate accountability legislation that enshrines the net-zero target in law (Parliament of Canada, 2021).

Government views on fossil fuel production

The federal government views fossil fuel exports as critical for Canada's economic growth and prosperity and to funding the transition to a low-carbon economy (McSheffrey, 2017; O'Regan, 2021). In particular, it has emphasized the need to expand export infrastructure, such as pipelines and LNG (Jang, 2019; Rabson, 2020). In April 2021, Canada joined four other countries in establishing the Net-Zero Producers Forum (see chapter introduction).

Plans and projections for domestic fossil fuel production

In the 2020 Canada's Energy Future report, the government changed its primary scenario from the "reference" scenario to a new "evolving" scenario, with assumptions of greater global climate action and lower future oil prices (Canada Energy Regulator, 2020a). It projects lower oil and gas production than the report's updated "reference" scenario. As shown in Figure 4.9, under the evolving scenario, oil and gas production increase by 18% and 17% respectively from 2019 to 2040, as compared with increases of 43% and 38% respectively under the reference scenario (Canada Energy Regulator, 2020a).

Government support for fossil fuel production

■ National and subnational subsidies for fossil fuel production amounted to CAD 1.4 billion (USD 1 billion) in 2019, according to the OECD (OECD, 2021a). Other estimates, which include direct transfers made by governments, suggest national and subnational

subsidies are much higher, totalling over CAD 4.8 billion (USD 3.6 billion) per year pre-pandemic, mostly for production (Corkal & Gass, 2019, 2019; Environmental Defence & IISD, 2019; Equiterre & IISD, 2018; OECD, 2021a; Touchette et al., 2017).

■ In 2020, as part of its COVID-19 economic response efforts, the Government of Canada allocated CAD 320 million (USD 240 million) for an Oil and Gas Industry Recovery Assistance Fund to support the Newfoundland and Labrador's offshore oil industry. It also allocated CAD 1.7 billion (USD 1.3 billion) for provincial governments to clean up orphan and inactive oil and gas wells that the private sector has not remediated on their own, and CAD 750 million (USD 560 million) for an Emissions Reduction Fund for oil and gas companies (Department of Finance Canada, 2020; Department of Natural Resources Canada, 2021; Prime Minister of Canada, 2020).

■ During the 2018–2020 period, the Governments of Canada and Alberta provided at least CAD 23 billion (USD 17 billion) in public finance to three fossil fuel pipelines (Corkal, 2021).

■ Since 2016, Export Development Canada (EDC) has provided a yearly average of over CAD 13 billion (USD 10 billion) in public finance for fossil fuels (EDC, 2021a, 2021b).

Policies and discourses towards a managed wind-down of fossil fuel production

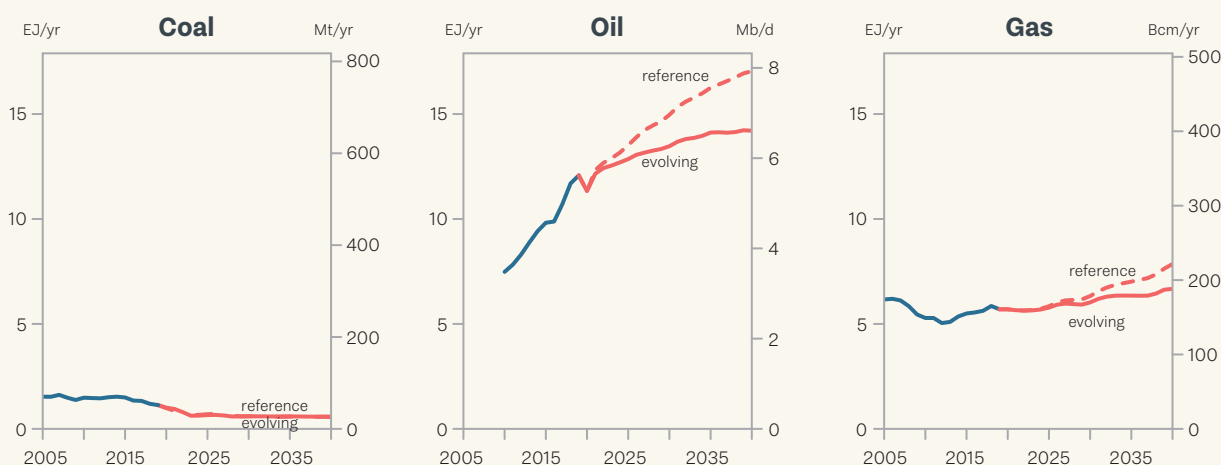
No such government policies or discourses were identified.

Policies and discourses supporting a just and equitable transition away from fossil fuel production

In 2018, the Canadian government created a Task Force on Just Transition for Canadian Coal Power Workers and Communities. Its 2018 and 2019 budgets allocated CAD 35 million (USD 26 million) for worker transition centres and CAD 150 million (USD 110 million) for economic diversification in affected communities, over five years (Department of Finance Canada, 2019).

Figure 4.9

Historical and projected coal, oil, and gas production for Canada. The 2020 edition of Canada's Energy Future introduced a new "evolving" scenario as its main scenario. Sources: Canada's Energy Future 2020 (Canada Energy Regulator, 2020b).



United Arab Emirates

Announced climate ambitions

The UAE announced its second NDC in December 2020, committing to reduce GHG emissions by 23.5% below business-as-usual in 2030 (Government of the United Arab Emirates, 2020). The NDC also notes that in 2020, the state-owned Abu Dhabi National Oil Company (ADNOC) announced a target to reduce the GHG emissions intensity of oil and gas production by 25% by 2030.

Government views on fossil fuel production

The UAE government views oil and gas, the mainstay of its economy, as key to the country's future socio-economic growth (Government of the United Arab Emirates, 2020), with the stated objective to maximize export revenues from its hydrocarbon sector for the longest time possible (United Arab Emirates Ministry of Energy & Industry, 2019). In parallel, the country has stepped up efforts over the past decade to position itself within the Middle East as a "green hub", promoting clean energy and freeing up domestic fossil fuel production for export.

Plans and projections for domestic fossil fuel production

The UAE has ambitious plans to ramp up oil and gas production in the near term, reflecting increasing pressure to reconcile long-term profit maximization with global climate action and the risk that oil and gas assets could become stranded in the future (Ca-hill, 2021; Faucon et al., 2021; Meyer, 2021). ADNOC, which produces nearly all of the country's hydrocarbons, plans to increase the UAE's crude oil production capacity from 4 million barrels per day (Mb/d) in 2020 to 5 Mb/d by 2030, relying on enhanced oil

recovery (EOR) in existing oil fields, as well as output from around 22 billion barrels of unconventional reserves newly confirmed in 2020 (Kerr, 2020). To support this aim, the UAE government has pledged USD 122 billion in capital expenditure for its national oil company between 2020 and 2025 (Kerr, 2020). With the intent of ensuring self-sufficiency and becoming a net exporter once again, the country has also announced plans to invest aggressively in gas production, including significant unconventional gas resources (ADNOC, 2018a, 2018b). ADNOC plans to add 3 billion cubic feet (Bcf) per day of new gas production this decade, an increase of 50% over current production levels (6 Bcf/day).

Government support for fossil fuel production

No information is publicly available on tax expenditures or other measures to support fossil fuel production in the UAE.

Policies and discourses towards a managed wind-down of fossil fuel production

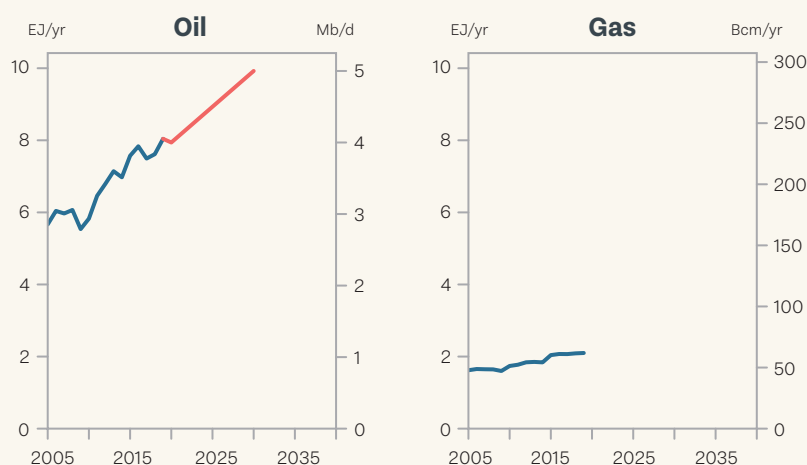
No such government policies or discourses were identified.

Policies and discourses supporting a just and equitable transition away from fossil fuel production

No such government policies or discourses were identified, though UAE has invested in workforce training for energy efficiency, renewable energy, and other low-carbon technologies.

Figure 4.10

Historical oil and gas and projected oil production for the UAE. The UAE does not produce coal; gas projections are not available. Sources: Oil projections are based on ADNOC's plans as reported by Kerr (2020). Historical data are from the IEA (IEA, 2021).



South Africa

Announced climate ambitions

South Africa released a draft of its enhanced NDC in March 2021, proposing to limit the country's annual emissions to 398–440 MtCO₂e by 2030 (Government of South Africa, 2021a); the country's 2017 emissions were around 513 MtCO₂e/yr (Government of South Africa, 2021b). In its long-term, low-emissions development strategy (LT-LEDS), South Africa mentioned that it will "ultimately mov[e] towards a goal of net zero carbon emissions by 2050" (Government of South Africa, 2020).

Government views on fossil fuel production

Coal mining has been central to the industrialization of South Africa (Burton et al., 2018). Coal currently accounts for around 77% of South Africa's primary energy mix and is historically viewed as key to the country's economy (Department of Mineral Resources and Energy, 2021), though this view is increasingly contested (The Presidency of the Republic of South Africa, 2021). Coal production has historically had relatively secure demand from users such as Eskom, South Africa's state-owned electricity utility, and from the country's large coal-to-liquids industry (Burton et al., 2018). Eskom recently "committed in principle to net zero emission[s] by 2050" (Ramaphosa, 2021).

Plans and projections for domestic fossil fuel production

To date, the government has not published national projections or targets for coal production. South Africa's 2019 Integrated Resource Plan sets a target for reducing coal's contribution to installed power sector capacity — from 72% in 2018 to 45% in 2030 — but does not address production (Department of Mineral Resources and Energy, 2019).

Government support for fossil fuel production

■ The coal sector has historically received significant direct and indirect support via regulatory measures, state-owned enterprises, and subsidies to large users such as Eskom and Sasol (a minority state-owned, coal-to-chemicals producer) (Bridle et al.,

2020; Burton et al., 2018). While indirect support remains substantial, direct subsidies for coal mining are now smaller than in the past (Bridle et al., 2020; Burton et al., 2018; OECD, 2021l). In 2019, the government still provided direct budgetary transfers worth an estimated ZAR 760 million (USD 53 million) to projects that supply water to power stations and to coal mines (OECD, 2021l).

■ South Africa's state-owned development finance institutions, the Development Bank of Southern Africa (DBSA) and the Industrial Development Corporation of South Africa (IDC), support coal production through their investment holdings (Halim & Omar, 2020). For example, the IDC holds shares in the New Largo proposed coal mine project, which is intended to supply Eskom's under-construction plant, Kusile (Seriti, 2019).

Policies and discourses towards a managed wind-down of fossil fuel production

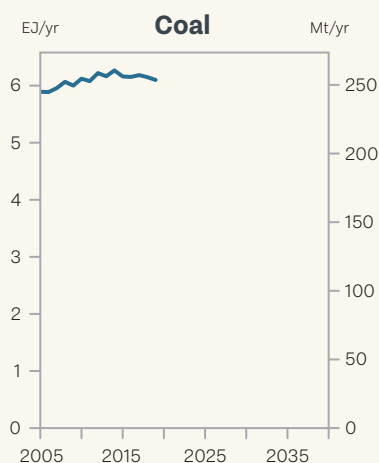
No policies or discourses to actively phase out coal production were identified.

Policies and discourses supporting a just and equitable transition away from fossil fuel production

South Africa's first NDC mentioned the broad concept of a just transition (Government of South Africa, 2015). Its draft updated NDC elaborates on this issue, noting that the country "will need to put measures in place that plan for... diversifying coal dependent regional economies, and developing labour and social plans as and when ageing coal-fired power plants and associated coal production infrastructure are decommissioned" (Government of South Africa, 2021, p. 4). Many high-level political discourses are actively taking place on the importance of, and how to implement, a just transition to a low-carbon, resilient, and inclusive economy and society, including for the coal mining and power sector (Department of Environmental Affairs, 2018; GreenCape, 2021; Joubert, 2019; The Presidency of the Republic of South Africa, 2020, 2021; TIPS, 2020).

Figure 4.11

Historical coal production for South Africa. Government projections are not available. Oil and gas production are small (<0.5 EJ/yr) and not shown. Source: IEA (2021).



Brazil

Announced climate ambitions

In its updated NDC, released in 2020, the Brazilian government maintained its earlier targets of reducing GHG emissions by 37% and 43% from 2005 levels by 2025 and 2030, respectively, and stated that it is considering a long-term goal of achieving climate neutrality in 2060 (Government of Brazil, 2020).

Government views on fossil fuel production

With the oil and gas sector making up an estimated 13% of Brazil's GDP, the government views oil exports as critical for economic development, which has resulted in many regulatory changes since 2017 to "encourage new investments" and expand production (ANP, 2018a). In the face of global decarbonization efforts and potential near-term peak oil demand, the Brazilian government intends to boost domestic production in the coming years to maximize the "monetization" of its domestic oil and gas reserves (ANP, 2019; Mariano et al., in press).

Plans and projections for domestic fossil fuel production

The National Energy Plan 2050, approved by the Ministry of Mines and Energy in 2020, shows that the Brazilian government intends to attract investments and ramp up oil and gas production to "become one of the five largest producers in the world" (Ministério de Minas e Energia, 2020c). As shown in Figure 4.12, the Plan foresees production of oil and gas increasing by 60% and 110%, respectively, between 2020 and 2030.

Government support for fossil fuel production

■ The country's tax expenditures and direct budgetary transfers to incentivize oil and gas production were around BRL 10 billion (USD 2.5 billion) in 2019, according to the OECD (OECD, 2021h). The overwhelming majority (99%) of this value comes from one tax break: Repetro, a tax exemption for equipment used in the research and mining of oil and gas. Originally created in 1999, it

was set to expire in 2020 but was renewed until 2040 (Delgado & Cals, 2017; Pedra, 2020; PPI, 2017).

■ The Revitalization of Onshore Oil and Gas Exploration and Production Activities ("REATE") program, first launched in 2017 and updated in 2020, aims to double onshore oil and gas production over the next 10 years (Ministério de Minas e Energia, 2020a).

■ In 2018, the government approved a reduction in the royalty rate from 10% to 5% or less on the incremental production from mature fields, to be applied from 2020 onwards, designed to promote exploration, development, and production (ANP, 2017, 2018b).

■ In 2019, Brazil introduced a new "Open Acreage" program that consists of a continuous offer of exploration blocks (ANP, 2018a, 2021a), designed to attract new private investments, expand exploration and production, and increase government revenues from the hydrocarbon sector (Mariano et al., in press).

■ The Brazilian Development Bank (BNDES) has historically provided extensive support to its domestic oil and gas industry; between 2008 and 2013, it provided loans worth a total of BRL 46 billion (USD 24 billion) (Oliveira, 2015). These loans, including to Petrobras (a state-controlled oil company), have enabled the ramp-up of oil production in Brazil's new frontier basins over the last five years (Barbosa, 2013; Ministério de Minas e Energia, 2019).

Policies and discourses towards a managed wind-down of fossil fuel production

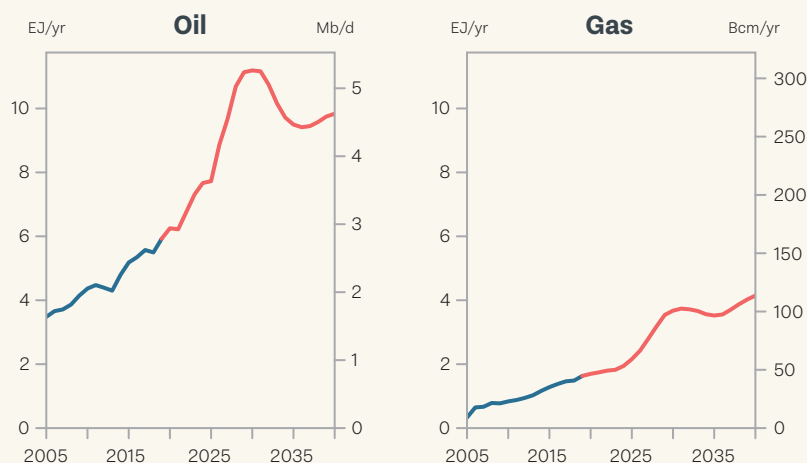
No such government policies or discourses were identified.

Policies and discourses supporting a just and equitable transition away from fossil fuel production

No such government policies or discourses were identified.

Figure 4.12

Historical and projected oil and gas production for Brazil. Brazil's coal production is small (<0.5 EJ/yr) and not shown. Brazil's reported gas production (as shown) includes fractions that are re-injected, self-consumed, and flared, which accounted for around 40% of total production in 2019. Sources: 2021–2025 projections are from the Brazilian National Agency of Petroleum, Natural Gas and Biofuels (ANP, 2021b); 2026–2040 projections are from the 2050 Energy Plan (Ministério de Minas e Energia, 2020b). Historical data are from the Brazilian National Agency of Petroleum, Natural Gas and Biofuels (ANP, 2021c).



Norway

Announced climate ambitions

In its updated NDC, Norway increased its emission reduction targets to 50%–55% by 2030, and 90%–95% by 2050, compared to 1990 levels (Government of Norway, 2020).

Government views on fossil fuel production

With oil and gas making up about half of the total value of Norway's exported goods, the government views oil and gas as "the most important export commodities in the Norwegian economy" (Norwegian Petroleum Directorate, 2021a). The government recently stated that it will "facilitate profitable production of oil and gas in a long-term perspective within the framework of Norway's climate policy," which includes intentions to "continue to pursue its exploration policy with regular concession rounds to ensure that new areas for exploration are made available to the industry" (Norwegian Ministry of Petroleum and Energy, 2021a, 2021d). So far in 2021, the government has issued 61 production licenses and offered 84 new blocks for exploration on the Norwegian Continental Shelf (Norwegian Ministry of Petroleum and Energy, 2021b, 2021c). In April 2021, Norway joined four other countries in establishing the Net-Zero Producers Forum (see chapter introduction).

Plans and projections for domestic fossil fuel production

Due to recent large discoveries, oil production is set to increase for the next few years, before an expected longer-term decline, as shown in Figure 4.13. The government recently argued that its forecasted oil and gas production is compatible with the Paris Agreement's 1.5°C limit, as the projected decline (65% from 2020 to 2050) is broadly in line with the median declines in oil and gas consumption in the IPCC 1.5°C scenarios (Sanner & Bru, 2021). However, the declines reflect the expected resource depletion rates rather than a planned transition (Norwegian Ministry of Petroleum and Energy, 2021a), and Norway's projected production out to 2030 "have consistently been adjusted upwards" (Norwegian Ministry of Finance, 2021a, p. 85; translated from Norwegian).

Government support for fossil fuel production

■ Norway's oil tax scheme for oil is characterized as "investment friendly" by the government. The estimated amount of forgone government revenue in 2020 is NOK 16 billion (USD 1.7 billion), due to a system for accelerated depreciation and high uplift and interest deductions (Norwegian Ministry of Finance, 2020).

■ The government covers significant investments in exploration and field development. For example, exploration costs are fully deductible, with cash refunds available for companies that are in a negative tax position (Norwegian Petroleum Directorate, 2021b). The government also provides funds for geological surveys and for research and development activities. This amounted to NOK 660 million (USD 75 million) in 2019 (OECD, 2021k).

■ In response to the oil price fall in 2020, the government passed several interim tax measures, including deferred taxation on new projects. The total value of these tax breaks is estimated to be around NOK 8 billion (USD 850 million). (Norwegian Ministry of Finance, 2021c).

Policies and discourses towards a managed wind-down of fossil fuel production

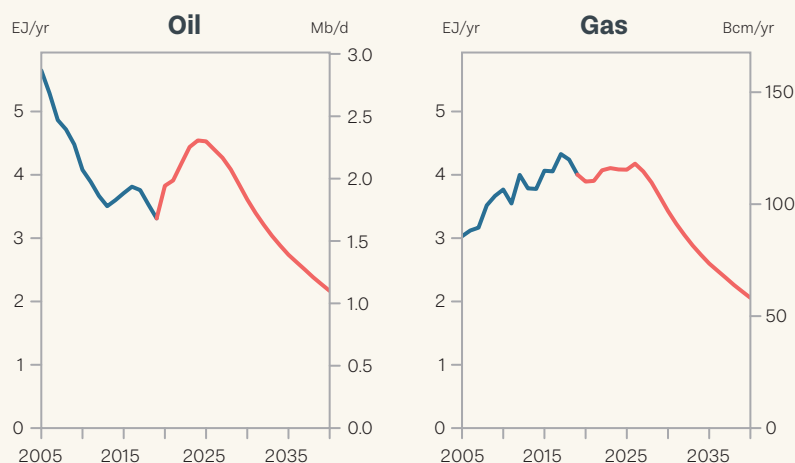
There is increasing awareness that international climate policy may pose economic risks to Norway's oil and gas production (Bang & Lahn, 2019). To date, the most direct response measure has been the divestment of Norway's USD 1 trillion sovereign wealth fund from coal and certain upstream oil and gas companies (Norwegian Ministry of Finance, 2019; Norwegian Parliament, 2015). The government will also require oil and gas companies to disclose climate risk in development plans for new projects (Norwegian Ministry of Petroleum and Energy, 2021a, p. 161).

Policies and discourses supporting a just and equitable transition away from fossil fuel production

No specific government policies were identified beyond Norway's general system of workers' rights, including financial and retraining assistance.

Figure 4.13

Historical and projected oil and gas production for Norway. Coal production is small (<0.5 EJ/yr) and not shown. The 2026–2040 oil and gas projections are estimated from the source document's reported total, assuming the liquids-to-gas ratio remains constant at average 2020–2025 values. Sources: 2026–2050 are from the Norwegian Ministry of Finance (2021). 2021–2025 projections and historical data are from the Norwegian Petroleum Directorate (2021c).



Mexico

Announced climate ambitions

Mexico's updated NDC, submitted in 2020, maintained the same targets as its 2015 NDC — a 22% (unconditional) and 36% (conditional) reduction of greenhouse gas emissions by 2030 relative to business-as-usual — while it increased the business-as-usual value for 2030 from 973 MtCO₂e to 991 MtCO₂e (Government of Mexico, 2015, 2020).

Government views on fossil fuel production

Pemex, a state-owned enterprise, accounts for 97% of Mexico's oil and gas production (Sistema de Información de Hidrocarburos, 2021). In March 2021, Pemex published its Business Plan for 2021–2025, signalling its intent to boost oil and gas production and reverse the significant decline of the past 15 years (PEMEX, 2021). This is in line with the current government's priorities of "energy sovereignty" and increased oil production as a lever for national development (Government of Mexico, 2019a, 2019b).

Plans and projections for domestic fossil fuel production

The Ministry of Energy's most recent annual outlooks on oil and gas production, last updated in 2018, provide production projections under a "maximum" and "minimum" scenario (Secretaría de Energía SENER, 2018b, 2018a). As shown in Figure 4.14, under the maximum scenario, oil and gas production would increase by 66% and 89%, respectively, from 2018 to 2032. Under the low scenario, oil production would decline by 3% and gas production would increase by 25% over the same period.

Government support for fossil fuel production

■ Mexico provides tax allowances and relief for oil and gas production, which totalled MXN 31 billion (USD 1.6 billion) in 2019 (OECD, 2020). Most of this is attributed to an increase in the tax deduction cap from 12.5% to 40% of the value of onshore production (35% for offshore) (Diario Oficial de la Federación, 2019a)

■ In 2019, the Mexican Congress reduced Pemex's minimum mandated dividend to the federal government for oil and gas extraction activities, from 65% to 58% in 2020 and to 54% in 2021 and onwards (Diario Oficial de la Federación, 2019b). Pemex has estimated that this reduction will grant savings of up to MXN 45 billion (USD 2.3 billion) in 2020 and MXN 83 billion (USD 4.3 billion) in 2021, which would be used to boost hydrocarbon extraction (PEMEX, 2019).

■ In response to the drop in global oil prices at the beginning of 2020, the Mexican government provided a tax credit for oil producers for the 2020 fiscal year of up to MXN 65 billion (USD 3 billion), to account for lost profits (Diario Oficial de la Federación, 2020). In early 2021, the tax credit was extended for the 2021 fiscal year, though at a lower rate, with a maximum credit set at MXN 73 billion (USD 3.7 billion) (Diario Oficial de la Federación, 2021).

Policies and discourses towards a managed wind-down of fossil fuel production

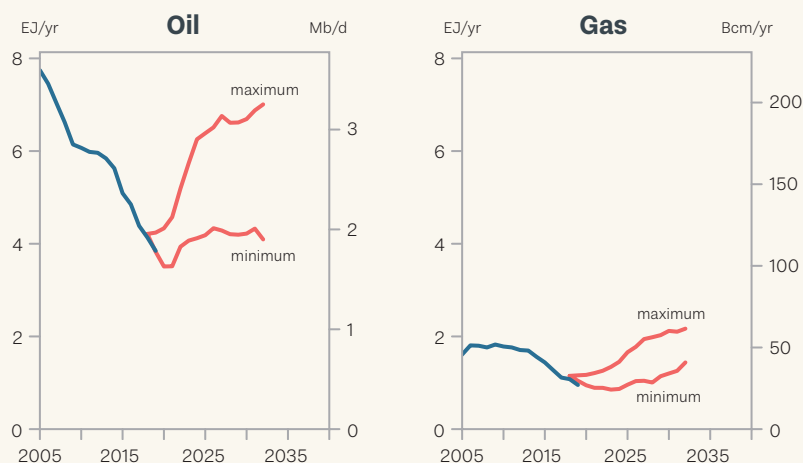
No such government policies or discourses were identified.

Policies and discourses supporting a just and equitable transition away from fossil fuel production

No such government policies or discourses were identified.

Figure 4.14

Historical and projected oil and gas production for Mexico. Mexico's coal production is small (<0.5 EJ/yr) and not shown. Two scenarios, "maximum" and "minimum", are reported in the 2018 Outlooks. Mexico's reported gas projections likely include natural gas liquids (NGLs). The raw data are therefore reduced by 20% in this figure, which is the fraction of NGLs between 2016–2021 reported by the government of Mexico (Sistema de Información de Hidrocarburos, 2021). Sources: 2018–2032 projections are from the 2018 Oil Outlook (Secretaría de Energía SENER, 2018b, p. 60) and the 2018 Gas Outlook (Secretaría de Energía SENER, 2018a, p. 71). Historical data are from the IEA (IEA, 2021).



United Kingdom

Announced climate ambitions

In its latest NDC, the UK pledged to reduce its emissions by 68% by 2030, compared to 1990 levels, with a further announcement in 2021 of 78% reductions by 2035 (UK Government, 2020a, 2021b). In 2019, the country set a target of net-zero greenhouse gas emissions by 2050 (UK Government, 2019).

Government views on fossil fuel production

Oil and gas policy is governed by a statutory duty to “maximise economic recovery” (UK Parliament, 2015, Section 41), and the government has indicated its aim to “extract every drop of oil and gas that it is economic to extract” (UK Parliament, 2017). Climate change concerns have featured prominently in deliberations around the local approval of a new coal mine in the north of England; the national government launched an inquiry to consider whether to uphold the approval given its climate change impact (Ministry of Housing, Communities & Local Government, 2021).

Plans and projections for domestic production

After peaking at the turn of the century, UK oil and gas production dropped steeply until 2014. In response to a government-commissioned report on maximizing oil and gas recovery (Wood, 2014), the UK government instituted regulatory changes and tax cuts to spur production, and production grew steadily from 2014 to 2019. According to the UK’s Oil and Gas Authority (OGA), these changes are expected to lead to 30% more oil and gas production from 2016 to 2050 than would have otherwise occurred (OGA, 2018). While the OGA projects oil production to decline by 58% for oil and by 70% for gas from 2021 to 2040 (OGA, 2021a), as shown in Figure 4.15, its 2035 Vision, described in OGA’s 2019 Corporate Plan, is for production to exceed these and prior projections (OGA, 2019, p. 7).

Government support for production

■ In 2019, the UK provided tax allowances and relief for oil and gas production totalling GBP 3.7 billion (USD 5.1 billion) (OECD, 2021e).

■ Between 2020 and 2065, the UK will provide an estimated GBP 18.3 billion (USD 25.3 billion) in tax relief to oil companies for the costs of decommissioning offshore infrastructure (OGA, 2021b). As of December 2020, the UK government had signed 98 Decommissioning Relief Deeds with oil companies, providing companies with certainty on the level of tax relief they will receive on future decommissioning (UK Treasury, 2021, p. 380).

■ In 2020, UK Export Finance approved GBP 300 million (USD 420 million) in loans and GBP 850 million (USD 1.2 billion) in guarantees to a major LNG project in Mozambique, a decision that is under judicial review (Friends of the Earth, 2021). Five months later, in 2021, the UK ended all new bilateral public finance for fossil fuel production overseas, the first G20 government to do so (UK Government, 2020b).

Policies and discourses towards a managed wind-down of production

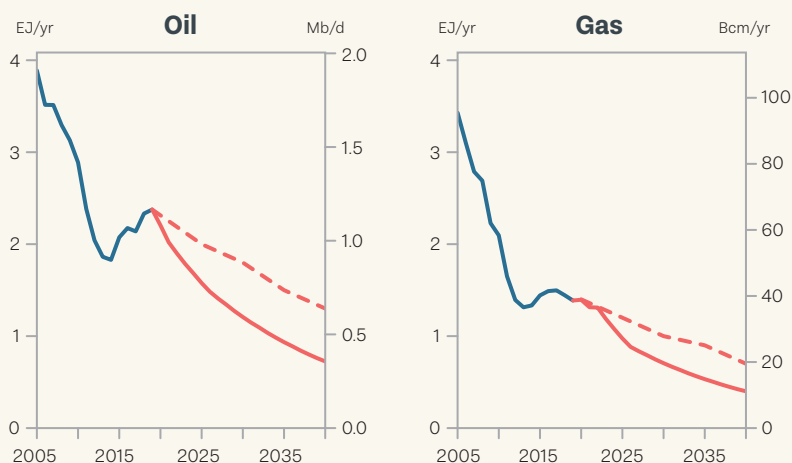
In March 2021, the UK Government announced a North Sea Transition Deal with its offshore oil and gas industry that will not stop national fossil fuel exploration or production (BEIS & OGA UK, 2021; Brooks, 2021). The government announced that a new climate compatibility test will be conducted before future exploration and production licensing rounds, to ensure licenses awarded are “aligned with wider climate objectives, including net-zero emissions by 2050” (UK Government, 2021a).

Policies and discourses supporting a just and equitable transition

The North Sea Transition Deal will invest in skills and job training oriented around CCS and hydrogen, complementing continued oil and gas production and with no plans for a wind-down in production. The Scottish Government has appointed a Just Transition Commission (Just Transition Commission, 2021).

Figure 4.15

Historical and projected oil and gas production for the UK. The UK’s coal production is small (<0.5 EJ/yr) and not shown. Sources: Historical data and projections are from the UK Oil & Gas Authority’s February 2021 oil and gas production projections (OGA, 2021). OGA also published a combined oil and gas production target in its “2035 Vision” document (OGA, 2019, p. 7); individual oil and gas pathways under this scenario are shown by the dotted red lines, assuming that the oil-to-gas ratios projected by OGA (2021) also apply here.



Germany

Announced climate ambitions

In May 2021, the German parliament enhanced the ambitions of the Climate Change Act — the country's first major climate law that entered into force in 2019 — with a goal to reach carbon neutrality by 2045 instead of 2050, and by increasing the 2030 target for GHG emission cuts from at least 55% to at least 65%, relative to 1990 levels (BMU, 2021).

Government views on fossil fuel production

Germany phased out hard coal production in 2018, but remains the world's largest producer of lignite, the most carbon-intensive type of coal (IEA, 2021). In 2020, the German parliament finalized the Coal Phase-out Act, with an end date of 2038 at the latest for both hard coal and lignite power generation (BMW, 2019). This has implications for lignite mining since 100% of supply is currently domestically consumed (IEA, 2021).

Plans and projections for domestic fossil fuel production

Figure 4.16 shows the estimated declines of Germany's fossil fuel production out to 2030, as modelled in the 2019 Integrated National Energy and Climate Plan (NECP) (BMW, 2019, pp. 176–177). Coal and gas production are projected to decrease by around 50%, and oil by 24%, between 2020 and 2030. This figure does not yet reflect the more ambitious climate goals recently adopted by Germany and by the EU's 2030 Climate Target Plan (European Commission, 2021a). The NECP is expected to be revised in 2024.

Government support for fossil fuel production

■ National and subnational subsidies for lignite production amounted to EUR 309 million (USD 346 million) in 2019, according to the OECD. This includes exemptions from mining royalties and water fees for existing production (22% of the total subsidy amount), as well as financing for lignite mine rehabilitation in East Germany (78%) (LMBV, 2017; OECD, 2021j).

■ Germany's development bank, KfW, is Europe's top national development finance institution for international oil and gas financing, providing a total of USD 1.4 billion in 2015–2018 (Erzini

et al., 2020). It supports conventional oil and gas and unconventional gas investments, and actively promotes gas imports as being a “bridging technology on the path to climate neutrality” (Pflume & Römer, 2021; translated from German). In 2019, KfW excluded financing for new projects related to the exploration and extraction of coal and unconventional oil (KfW, 2019).

■ In 2019, Germany's export credit agency provided EUR 1.3 billion (USD 1.5 billion) of support for international fossil fuel projects (Euler Hermes Aktiengesellschaft, 2021). Although there is a lack of transparency on which and what types of projects were supported, the agency's latest policies exclude new coal plants and oil production with routine flaring (Investitionsgarantien, 2021).

Policies and discourses towards a managed wind-down of fossil fuel production

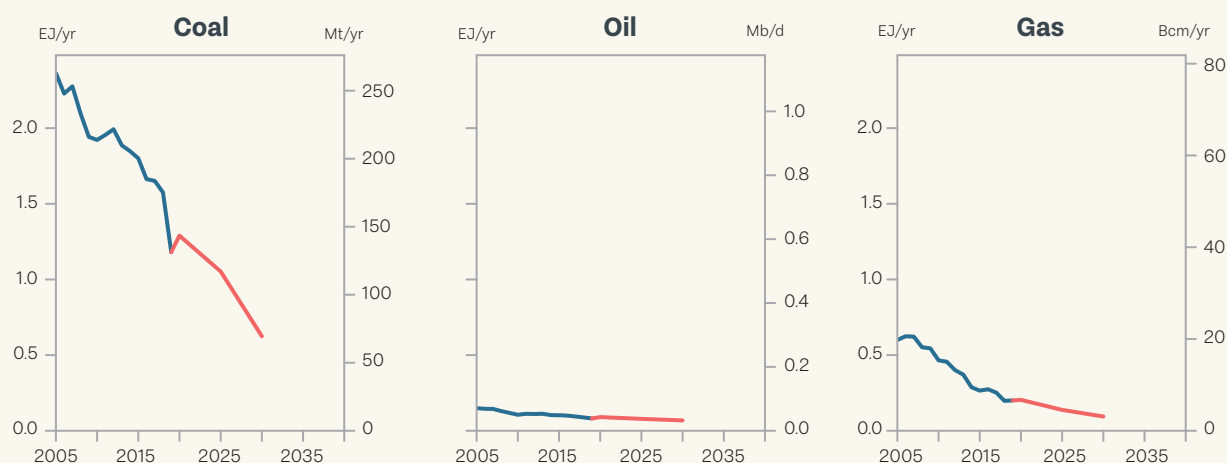
Germany's 2019 NECP considered the implications of the country's and the EU's climate goals on domestic fossil fuel production out to 2030 (BMW, 2019, pp. 176–177). The Coal Phase-out Act further commits power generation from coal to be phased out by 2038 at the latest, but does not explicitly mention production (BMW, 2019).

Policies and discourses supporting a just and equitable transition away from fossil fuels

Germany passed the Structural Development Act alongside the Coal Phase-out Act to provide up to EUR 40 billion (USD 46 billion) between now and 2038 for directly affected coal-mining areas (Government of Germany, 2020). This includes close-down premiums for hard-coal-fired power plant operators and direct compensation payments totalling EUR 4.35 billion (USD 5 billion) for lignite-fired power plant operators. These contracts remain a subject of conflict, with the European Commission currently investigating whether compensation for forgone profits has been kept to the minimum necessary, as required by EU state aid rules (European Commission, 2021b; Heilmann & Popp, 2020).

Figure 4.16

Historical and projected coal production for Germany. Sources: Projections are from the “climate action plan scenario” from the 2019 National Energy and Climate Plan (BMW, 2019). Historical data are from the IEA (IEA, 2021).





5

The critical role of transparency in addressing the production gap

Key Messages

Verifiable and comparable information on fossil fuel production and support — from both governments and companies — is essential to addressing the production gap.

Existing transparency initiatives shed some light on fossil fuel production and its implications for meeting climate goals, but available information is incomplete, often inconsistent and scattered across various, mostly voluntary, government-driven and non-governmental efforts.

Governments should strengthen transparency by disclosing their fossil fuel production plans and projections, and how these align with climate goals. They should do this in their published national climate and energy plans, including in their nationally determined contributions (NDCs) and their long-term, low-emission development strategies under the Paris Agreement.

Governments should require that both private- and state-owned fossil fuel companies disclose their spending, project plans, emissions, and climate-related financial risks, and do so in a consistent manner across countries.

5. The critical role of transparency in addressing the production gap

The public disclosure of verifiable and comparable information by governments and corporations is key to addressing the fossil fuel production gap. Such information can reveal the extent to which governments are supporting fossil fuel production, and provide insights into how countries can wind down production in light of the Paris Agreement's goals.

Transparency strengthens climate and energy policy-making in several ways. It helps policymakers better understand the scope of a problem, clarifying the social, economic, and environmental consequences at stake. Openness and disclosure can also encourage more inclusive and participatory decision-making. Moreover, transparency can help hold governments, companies, and other actors accountable, driving them to modify their behaviour by facilitating market pressure, public shaming, or litigation. When countries seek to simultaneously expand fossil fuel production and achieve greenhouse gas (GHG) emissions targets, transparency can highlight the inconsistencies in these domestic policies, and draw attention to the risk of stranded assets and communities.

Transparency further matters for international climate cooperation. It can reveal whether collective climate goals are being met, help identify which actors are making progress, which ones are lagging, and which ones require support, and facilitate learning between countries (Gupta & Mason, 2014; Hale, 2008). Moreover, countries tend to be more willing to increase policy ambition when their performance is verified by other countries (Bell et al., 2012; Chayes & Chayes, 1998; Victor, 2011). In the context of the production gap, transparency entails reporting production levels, plans, and support, in addition to the emissions-focused information covered by the international climate regime under the United Nations Framework Convention on Climate Change (UNFCCC).

This chapter highlights transparency initiatives and information gaps relevant to fossil fuel production (Section 5.1), and discusses how governments, companies, and other actors can strengthen transparency around fossil fuel production (Section 5.2).

5.1 Existing transparency initiatives and information gaps

Transparency is central to many international initiatives related to fossil fuels. International organizations such as the International Energy Agency (IEA) emerged with the



specific aim of improving information sharing and collective action among fossil fuel consumer countries (Van de Graaf, 2015). The growing number of transparency and data collection efforts (summarized in [online Appendix C](#)) have diverse rationales and objectives for improving fossil fuel transparency, including: reducing fossil fuel price volatility through more accessible production data (e.g. the Joint Organisations Data Initiative, or JODI); removing fossil fuel market distortions (such as through data collection on fossil fuel subsidies by various international organizations); and improving extractive industry governance (e.g. the Extractive Industries Transparency Initiative, or EITI).

These transnational initiatives have not, historically, focused on climate change. More recently, however, non-governmental organizations (NGOs) and the private sector have launched initiatives that can help to better understand the impacts of fossil fuel production on the climate. This has included the development of frameworks to assess climate-related financial risks through the Taskforce for Climate-Related Financial Disclosures (TCFD), understand fossil fuel industry emissions through the Climate Change Reporting Framework of the Inter-

national Petroleum Industry Environmental Conservation Association (IPIECA), and monitor infrastructure development through trackers such as those developed by the non-profit Global Energy Monitor.

Governments are slowly beginning to take up various transparency initiatives related to fossil fuels and climate. For instance, G20 and other governments have begun to report their fossil fuel subsidies, while the EITI board (which includes government representatives) has resolved to advance work on the transparency of climate and energy transitions (Bradley, 2020; Clark, 2020).

Existing transparency initiatives already capture a lot of information relevant for assessing and addressing the production gap (see [online Appendix C](#)). However, this data is spread across an array of initiatives and is often not standardized or comparable; it also only exists for a portion of fossil fuel producers (for example, the EITI does not include several major fossil fuel producers among its implementing countries). Moreover, these initiatives are largely voluntary, making it challenging to assess progress on aligning fossil fuel production with climate goals, and to identify transition needs.

To better understand the extent of the production gap, improved transparency about fossil fuel production is urgently needed, including the disclosure of information on:

- **National plans and policies for fossil fuel production**, including: production data; licensing of fossil fuel resource exploration or extraction; plans and policies for future production, including underlying economic and technological assumptions; production levels implied by climate targets; GHG emissions embedded in fossil fuel exports; plans for decommissioning existing fossil fuel infrastructure; and assessments of whether production plans are equitable in the context of global climate objectives.
- **Government support for production**, including: fossil fuel production subsidies; domestic and international public finance for fossil fuel infrastructure; and other non-fiscal measures to promote or expedite production (e.g. fast-track approvals and regulatory exemptions).
- **Fossil fuel companies' plans and strategies**, including: information on the economic viability of fossil fuel reserves under different price conditions; details on investment and production plans and strategies, including underlying assumptions; end-use emissions from the coal, oil, and gas produced; and exposure to climate-related financial risk.

In addition, further information is necessary to enable a well-managed and equitable transition away from fossil fuel production, including on: laws and policies to manage



future fossil fuel production; estimates of the revenues that may be needed to replace lost fossil fuel rents and royalties; and data on the scale of the economic transition at national and subnational levels, including specific data on workforce transition needs. Information is also needed on the costs and liabilities associated with decommissioning fossil fuel production sites, and on the benefits of the transition (such as cost savings and public health benefits).

5.2 Strengthening transparency

If governments strengthened transparency around their fossil fuel production, they would facilitate the assessment of whether and how production plans align with climate goals. Moreover, such transparency can benefit a country's own citizens (see Box 5.2). In this section, we outline how governments can boost transparency by:

1) publicly releasing plans and policies for fossil fuel production, 2) reporting financial and non-financial support to production, and 3) mandating the disclosure of fossil fuel companies' plans and strategies, to assess their (mis)alignment with climate goals (see Figure 5.1).

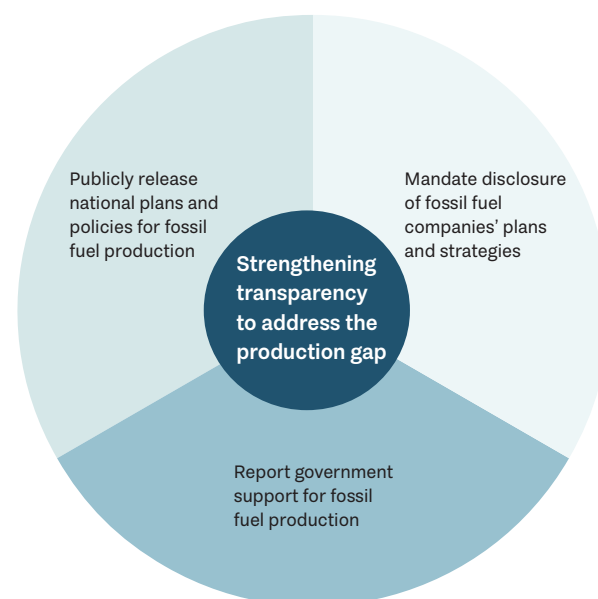
Transparency of national plans and policies for fossil fuel production

At present, only a handful of small producer countries have spelled out a strategy for aligning domestic fossil fuel production with international climate goals in their national climate and energy plans (Jones et al., 2021). There is a need for governments to provide clearer information in these plans about current and future fossil fuel production, and how they will manage the energy transition away from fossil fuels. Ideally, comprehensive climate and energy plans would include: details on historical and planned fossil fuel production; clear targets and timelines for bringing production in line with agreed climate goals; descriptions of planned or enacted policies to wind down fossil fuel production; measures introduced to support a just transition and economic diversification; and information on international cooperation to wind down fossil fuel production.

Governments have already committed to reporting climate-related information as part of the Paris Agreement, and thus could include information on fossil fuel production through the same reporting process (see Box 5.1). Governments could further strengthen transparency through initiatives outside of the UNFCCC process. For instance, the EITI could be used as a mechanism for governments to disclose intended production plans, along with the assumptions underlying these plans; this would provide citizens with a better understanding of the relative

Figure 5.1

Governments can help to assess and address the production gap by strengthening transparency for three types of information.



levels of risks governments are incurring. Requirement 5.3.c of the EITI Standard already encourages governments to disclose information about assumptions related to projected fossil fuel production and commodity prices; extractive sector revenue forecasts; and the proportion of future fiscal revenues expected to come from fossil fuels (EITI, 2019). The multi-stakeholder nature of the EITI also makes the initiative a possible forum for discussing plans for a just transition away from fossil fuel production. Another option — which would provide a more targeted focus on fossil fuels and climate change — would be for governments to jointly create an independently managed registry, through which they can report and review information on fossil fuel production plans and policies (Byrnes, 2020).

There is also a need for transparent information on fossil fuel projects and infrastructure. NGOs have begun to track the development of fossil fuel production infrastructure, which is relatively easy to monitor and verify (Green & Kuch, 2021). However, more and better information from governments would boost transparency. The need for public information about new or expanded fossil fuel production infrastructure is especially acute. Such transparency would mean governments publishing information on each new project, including: the project proponents; expected and permitted annual production volumes; the expected and permitted project lifetimes; GHG emissions, including end-use emissions from the fossil fuels

Box 5.1 Reporting on fossil fuel production under the UNFCCC process

The UNFCCC is a key forum through which governments can inform the international community about their fossil fuel production plans and supporting policies. Parties to the Paris Agreement can include existing production plans and projections, as well as targets and policies to wind down fossil fuel production, in their nationally determined contributions (NDCs), their long-term, low-emission development strategies (LT-LEDS), and their progress reports on implementing and achieving their NDCs.

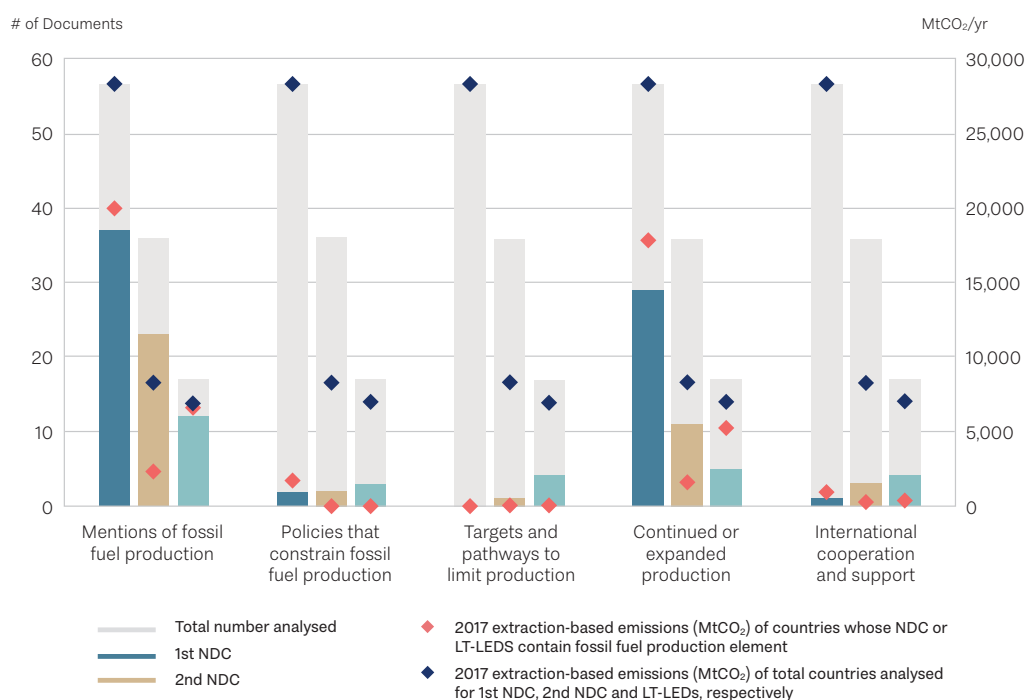
More countries are beginning to include fossil-fuel-supply-focused policies, measures, targets, and pathways in their NDCs and LT-LEDS. Of the NDCs and LT-LEDS submitted by fossil-fuel-producing countries to date, 34 of the 56 new and updated NDCs and 13 of the 20 LT-LEDS include a mention of fossil fuel production, although many of these reference plans to continue or increase production, as seen in Figure 5.2. Eight Parties (including the EU) have included measures to constrain or

disincentivize fossil fuel production in their NDCs or LT-LEDS — six more than in 2019 (Jones et al., 2021). However, these Parties are responsible for considerably less production than those that reference continued or expanded production (see red and purple diamonds in Figure 5.2).

Parties can also report on production in the biennial transparency reports that must be submitted from 2024 onwards under the Paris Agreement's enhanced transparency framework. They could use these reports to share information on their fossil fuel production levels and expected growth; their policies and public finance that support fossil fuel production; and their plans to wind down and transition away from fossil fuel production. Doing so would provide other governments and stakeholders with insights into the alignment of fossil fuel production with a country's NDC and the Paris Agreement goals (Piggot et al., 2018; SEI et al., 2019).

Figure 5.2

Inclusion of supply-side elements in relevant UNFCCC documents. Each set of three bars indicates the total number of 1st NDCs, 2nd NDCs, and LT-LEDS that includes the respective element shown on the x-axis (e.g. mentions of fossil fuel production), relative to the total number of documents analyzed, as measured on the left y-axis. The diamonds show the total extraction-based emissions, as measured in MtCO₂/yr on the right y-axis. Figure and data are updated from Jones et al. (2021) and include all NDCs and LT-LEDS published as of 31 July 2021.



produced; the total amount of capital invested; and the assumptions about future resource prices, carbon prices, and other variables on which the investment was made. Since governments also need to wind down existing fossil fuel production to meet climate goals, transparency on existing production sites and infrastructure would likewise be important, including: the expected or scheduled wind-down rate and closure date; the emissions implications of the infrastructure's remaining operational life; and the estimated costs and assignment of liabilities associated with closure and site decommissioning (Eisen et al., 2021). International standardization of all such information could pave the way to a global registry of fossil fuel production sites and infrastructure, building on NGO-driven initiatives (Byrnes, 2020).

Transparency of government support for fossil fuel production

Governments also can strengthen transparency around their financial support for fossil fuel production, which they provide through government finance ministries, national development banks, export credit agencies (ECAs), and other public finance institutions. Very few of these institutions publicly report project-level information. ECAs, for example, do not provide comprehensive and fully comparable data for fossil fuel projects, nor are there universal definitions of sectors and financial support metrics (Shishlov et al., 2020). Multilateral development banks (MDBs), by contrast, are more transparent, with many providing project-level information and a joint commitment in recent years to report on how bank activities help countries meet and exceed their climate goals (E3G, 2020; MDBs, 2019).

It can be difficult to obtain a full picture of public finance investments in fossil fuel projects, due to data gaps and limited accessibility of ECA and MDB data. For example, researchers were unable to include any ECA transactions for Argentina, Saudi Arabia, or Turkey for 2016–2018 in a recent study on the G20 governments' financing for fossil fuels (Tucker et al., 2020). Moreover, neither ECAs nor MDBs provide reliably accessible information about their funding of fossil fuel production through financial intermediaries, despite intermediaries channelling a large and increasing portion of development finance (E3G, 2020; Tucker et al., 2020). The International Finance Corporation (IFC), the World Bank Group's private-sector lending arm, has started to address this by asking financial intermediary clients to voluntarily disclose high-risk sub-projects, and in March 2020 the Bank itself committed to disclosing certain categories of sub-projects. However, the IFC has not yet done that consistently across projects and years when reporting to the Organisation for Economic

Co-operation and Development's (OECD) Development Assistance Committee (E3G, 2020). Moreover, voluntary disclosure — while enabling the rapid diffusion of reporting frameworks — nevertheless risks pre-empting regulatory requirements that would be stricter.

It is therefore vital for public finance institutions to publicly share the total amounts of finance by fossil fuel, production stage, and type of financing mechanism. Ideally, they would use their annual reports to disclose project-level data, as well as activities that receive financing through the main bank and their financial intermediaries. This reporting could draw on existing frameworks, such as the EU's sustainable finance taxonomy (European Commission, 2020) or the OECD format for reporting development finance (OECD, 2021a).

Governments also must provide greater transparency on fiscal support and other subsidies to fossil fuel production. Several efforts to strengthen transparency are already underway. Members of the OECD and several other countries report tax expenditures and budgetary transfers in support of fossil fuel production, as summarized in Chapter 3 (OECD, 2021b). However, as the country profiles in Chapter 4 show, some countries do not report this at all (such as Saudi Arabia and UAE), while other countries do not report all forms of support. The information collected by the OECD on subsidies, along with that gathered by the IEA and the International Monetary Fund, is collated through the Fossil Fuel Subsidy Tracker to provide a global picture of subsidies directed towards fossil fuels (Coady et al., 2019; Fossil Fuel Subsidy Tracker, 2021; IEA, 2021). A small number of countries have further chosen to submit their fossil fuel subsidies to a voluntary peer review by other countries, in the context of commitments made under the G20 and the Asia-Pacific Economic Cooperation (APEC) (Verkuijl & van Asselt, 2020). World Trade Organization (WTO) members are required to report ("notify") subsidies that meet the definition of the WTO Agreement on Subsidies and Countervailing Measures and are specific to certain enterprises. However, notification rates on subsidies have generally been low, and the WTO's surveillance mechanism rarely leads to questioning (Casier et al., 2014; Collins-Williams & Wolfe, 2010). Governments can also report fossil fuel production subsidies on a voluntary basis under Sustainable Development Goal (SDG) target 12.c.

Despite these efforts, transparency on fossil fuel production subsidies remains problematic in many countries (Skovgaard & van Asselt, 2018). Governments can therefore strengthen the effectiveness of these transparency arrangements by: providing comprehensive information

on fossil fuel production subsidies through the voluntary reports submitted under SDG 12, following the methodology created by UNEP et al. (2019); strengthening their notifications to the WTO, and using the WTO's Trade Policy Review Mechanism to draw attention to their own or other Members' production subsidies; and undergoing a voluntary self- or peer-review of their fossil fuel subsidies (van Asselt & Moerenhout, 2020).

Transparency of fossil fuel companies

Notwithstanding some positive steps forward, fossil fuel companies — including publicly traded companies and state-owned enterprises (SOEs) — still exhibit major gaps in their transparency around their investment and production plans and, more generally, their climate-related financial risks. Governments can play a key role in improving and enhancing the transparency of fossil fuel companies.

Fossil fuel companies have faced calls for transparency from civil society and investor groups, such as Climate Action 100+. More recently, calls for mandatory disclosure and reporting have come from market regulators, including governments and international organizations. The EU's Non-Financial Reporting Directive, for example, has sought to shed light on whether the business practices of fossil fuel companies are sustainable. Furthermore, G20 central banks (through the TCFD) have pointed to individual company transparency as a starting point in

addressing the potential economic impact of unabated climate change and an abrupt and disorderly transition away from fossil fuels. This has led to calls to incorporate the TCFD standards into national corporate reporting regimes, including by the G7 (G7, 2021b), as well as a call for the establishment of a new "International Sustainability Standards Board" that would develop baseline rules for climate-related reporting (G7, 2021a).

A closer look at current disclosures by companies, as well as civil society recommendations to regulatory bodies such as the U.S. Securities and Exchange Commission, reveals fruitful areas for regulators to explore (SEC, 2021). Regulators could insist that fossil fuel companies disclose the emissions associated with the end-use of their products. They could also provide greater clarity on what constitutes a fossil fuel reserve, which is subject to a range of subjective assumptions and uncertainties, yet forms a critical part of oil and gas companies' *financial* reporting (Green & Kuch, 2021). Some regulators, such as the SEC, already define "proven reserves", whereas other jurisdictions allow firms to rely on industry classification systems. Overall, regulators must ensure that climate constraints are considered in evaluating potential reserves, which are supposed to represent geologically and economically producible resources. Regulatory standards for evaluating reserves would generate comparable information regarding climate-related financial risk. It is unlikely that volun-



Box 5.2 Protecting civic space for transparent decision-making

Ambiguity about energy planning, fossil fuel project licensing, and infrastructure permitting processes can pose barriers for civil society to engage in decision-making. A lack of transparency also provides an opening for regulatory capture and corruption that could undermine climate policy objectives and a just transition (Graham et al., 2020; Sovacool, 2020). This calls for increased transparency around decision-making processes surrounding fossil fuel production.

Transparency initiatives — accompanied by appropriate participation mechanisms — would allow the public to provide input into decision-making on fossil fuel development, as well as to fully participate in planning for the low-carbon energy transition. This could include the monitoring of contracts and concessions awarded by governments to fossil fuel production firms, improved community consultations, and strengthening environmental impact assessment (EIA) laws.

Improving transparency around fossil fuel production may have limited impact if civil society lacks the capacity to engage or the power to challenge decision-making processes (Ostrowski, 2020; Sovacool, 2020). Indeed, the opportunity for civil society to contribute to decision-making around fossil fuel development is shrinking in many countries, with a wave of new regulations prohibiting protest or dissent against fossil fuel development (Nosek, 2020; Temper et al., 2020). Strengthening civil society capacity and creating open governance structures are therefore crucial to realizing the potential of transparency.

Governments also have a responsibility to provide information about fossil fuel development to affected communities, and, in particular, to the Indigenous communities inhabiting a significant portion of the land worldwide where fossil fuel reserves are held.³⁰ The UN Declaration on the Rights of Indigenous Peoples and International Labour Organization (ILO) Convention 169 require States to consult and cooperate

in good faith with Indigenous peoples to obtain their free, prior, and informed consent (FPIC) before undertaking projects that may affect their land, territory, or resources (United Nations Declaration on the Rights of Indigenous People, 2007). While many countries have not translated FPIC into a legal requirement, almost all countries have provided for public participation under their EIA laws (Glucker et al., 2013; UNEP, 2018). However, the required level of participation varies considerably, and only a few countries' national EIA legislation includes provisions on the participation of Indigenous peoples (UNEP, 2018).

EIA is an important planning, decision-making, and management tool, through which climate change can be addressed (Mayer, 2019; Sok et al., 2011). EIA laws have led to the public highlighting the potential climate impacts of fossil fuel production, as evidenced in court rulings requiring climate impact assessments for new fossil fuel development (Aydos et al., 2020). However, public participation in the context of EIA can still be strengthened, with the scope of participation restricted and fraught with procedural challenges in many countries (UNEP, 2018).

Transparency is further needed when both governments and companies are planning for a fossil fuel wind-down, to ensure that stakeholders can participate in decision-making around reducing coal, oil, and gas production. In Germany, for example, the government formed a multi-stakeholder “coal commission” to determine how and when the country would move away from coal (Egenter & Wehrmann, 2019). Similarly, the South African government's National Planning Commission convened dialogues on pathways for a just transition (Strambo et al., 2019). Creating opportunities for civil society to weigh in on government energy plans and policies can help ensure that climate concerns — along with other social and environmental issues — play a role in the decision-making process.

³⁰ For example, in the United States, Native American reservations (2% of the land area), hold about 20% of the country's fossil fuel reserves, including coal, oil, and gas (Osborne, 2018). The Bowen Basin in Australia, which has the country's largest coal reserves, as well as oil and gas reserves, is a land of several Aboriginal communities (Petkova et al., 2009). In Nigeria, the Niger Delta, having the largest deposits of oil and gas and fraught with conflict, is home to numerous ethnic minorities (Naanen, 2012). In India, the largest coal deposits are in the states with the highest proportion of Scheduled Tribe population (Bhushan et al., 2020).

tary initiatives can achieve the same level of disclosure, given the low historic levels of company participation and compliance in voluntary mechanisms such as the EITI. Regulators should require the disclosure of forward-looking assumptions around, for example, future commodity prices, the useful lives of fossil fuel infrastructure, and the expected costs of complying with decommissioning obligations, since in many cases these items underpin the asset valuations presented in financial statements.

Considering the role SOEs play in fossil fuel markets, it is critical for these companies, their governments, and international initiatives to strengthen transparency standards on SOE spending, production projections, GHG emissions, and exposure to climate-related financial risk. National oil companies (NOCs) produce more than half the world's oil and gas, and invest around 40% of the total capital in the sector (Manley & Heller, 2021). They can be major players in the economies of their home countries; in at least 25 countries, NOCs collect revenues equivalent to more than 20% of all government revenues (Heller & Mihalyi, 2019).

Most NOCs report little about their operations and finances to the public. Of the 52 NOCs assessed in the 2017 *Resource Governance Index* from the Natural Resource Governance Institute (NRGI), 62% had “weak”, “poor”, or “failing” transparency (NRGI, 2017). Some have improved recently: Colombia's Ecopetrol and Malaysia's Petronas now release detailed information, while Saudi Aramco and the Nigerian National Petroleum Corporation have begun

publishing financial reports. In addition, the EITI and the OECD's Working Party on State Ownership and Privatization Practices have strengthened standards for SOE reporting (EITI, 2019; OECD, 2019). Still, major gaps remain, including in reporting on how NOCs plan to navigate the energy transition.

As of June 2021, more than half of the 71 NOCs in NRGI's *National Oil Company Database* had not published their total capital expenditure for 2019, including major players such as the Abu Dhabi National Oil Company (ADNOC), Iraq's Basra Oil Company, and Petr leos de Venezuela, S.A. (PDVSA) (NRGI, 2021). Without this information, it is difficult to understand the drivers of the production gap and what is needed to close it, or how their spending exposes the public to climate-related financial risk. Even NOCs that do report their aggregate investments tend to disclose few details on projects or infrastructure spending, on the carbon intensity of production, or on the price required to avoid stranded assets. State-owned coal enterprises are also far from transparent. With few exceptions, the largest coal SOEs report little about their plans or expenditures, or about the impact of climate change on their viability (OECD, 2020).

5.3 Conclusions

Improved transparency plays an essential role in both assessing and closing the fossil fuel production gap. It can provide governmental and non-governmental stakehold-



ers with the needed information to support improved decision-making on fossil fuel production, infrastructure development, investment, and policies, thereby strengthening the accountability of governments' actions in light of climate goals. Moreover, transparency can facilitate international cooperation by building trust and promoting compliance with international commitments.

Various government-driven and non-governmental initiatives have begun to shed light on fossil fuel production and its impacts on climate goals. However, the available information is spotty and incomplete: many producer countries and companies have yet to participate, key types of information are not reported, the data are scattered across various initiatives, and initiatives are largely voluntary or driven by civil society. The lack of available and consistent information makes it difficult to properly assess the production gap and the extent to which governments are driving this gap, as well as identify opportunities for governments to close it.

Governments and other actors can work together to boost transparency, including by:

- disclosing plans and projections for fossil fuel production and for a just transition in NDCs, LT-LEDs, and UNFCCC national reports.
- providing information on fossil fuel infrastructure at various stages of development.
- divulging information on public finance for fossil fuels by production stage and financing mechanism.
- mandating that investor-owned and state-owned fossil fuel companies disclose their spending, project plans, GHG emissions (including end-use emissions), and climate-related financial risks.
- ensuring that the decision-making processes both for fossil fuel infrastructure and for winding down production are open and transparent, and that civil society has adequate capacity to engage.
- ensuring that relevant information on fossil fuel production is not only available, but also understandable, usable, and timely.

Governments can strengthen existing transparency initiatives, or create new ones. On the international stage, countries can make better use of existing mechanisms; for instance, they can convey information on fossil fuel



production through the UNFCCC, and improve subsidy reporting under the WTO and the SDGs. Multi-stakeholder initiatives such as the EITI can use their long-standing experience in the sector to strengthen transparency on the climate impacts of fossil fuel production, including by proposing uniform standards for information disclosure. New transparency initiatives may be warranted, however. Specifically, governments should consider establishing a dedicated platform for reporting and reviewing information on fossil fuel production, which would bring the dispersed information together in a harmonized and standardized manner, building on advances made by civil society organizations.

6

Closing the fossil fuel production gap

Key Messages

Governments have a primary role to play in closing the production gap and ensuring the transition away from fossil fuels is just and equitable.

Few countries have acknowledged the need to wind down fossil fuel production. Doing so can provide the impetus for governments to develop plans and implement policies that align their production with climate goals and commitments.

Governments can restrict fossil fuel exploration and extraction, phase out producer subsidies and public finance for fossil fuel projects, and re-direct support towards decarbonization and just transition efforts.

International cooperation can support a more effective and equitable transition away from fossil fuels.

6. Closing the fossil fuel production gap

Over 75% of global GHG emissions stem from fossil fuels (SEI et al., 2019). Meeting the agreed objectives of the Paris Agreement — and achieving net-zero emissions by mid-century — thus requires dramatic and sustained reductions in fossil fuel use and extraction. Existing national energy plans and outlooks, however, take the world in the opposite direction.

It has been six years since the adoption of the Paris Agreement. The continued presence of a wide production gap underscores the urgency with which **countries must align their fossil fuel production plans with global climate goals and commitments**. Thus far, most countries have focused their climate policies on reducing the *demand* for coal, oil, and gas, with their actions on the *supply* side of fossil fuels largely restricted to promoting carbon capture and storage and addressing emissions from extraction, processing, and distribution processes.

Governments can do much more, as they have a primary role to play in closing the production gap and in ensuring that the transition away from fossil fuels is just and equitable. State-owned enterprises (SOEs) control more than 50% of global fossil fuel production (see Chapter 3). While privately-owned fossil fuel companies also have important roles to play, and can take important steps to increase their alignment with climate objectives (Coffin, 2021; World Benchmarking Alliance, 2021), governments wield great influence: they drive private-sector exploration and extraction through their policies, permitting, and investments. The extent of COVID-19 recovery spending on fossil fuel energy since the start of the pandemic demonstrates how entrenched these industries remain.

Only a handful of countries clearly **acknowledge the need to wind down fossil fuel production to achieve the objectives of the Paris Agreement**. None are top producers. Such an acknowledgement is important: it can provide the impetus for developing plans for a managed wind-down of production and for implementing specific policy measures. Two policy areas for governments to pursue are:

- **Placing restrictions on fossil fuel exploration and extraction** to avoid locking in levels of fossil fuel supply that are inconsistent with climate goals. Examples of relevant policies include moratoria, bans, or limits on all or certain types of fossil fuel exploration and extraction (such as offshore or unconventional drilling) or infrastructure (such as oil pipelines or liquefied natural gas (LNG) terminals). Countries with higher financial and institutional capacity should lead the way with these



restrictions, as they are better equipped for a rapid and sustained decline (Muttitt & Kartha, 2020; SEI et al., 2020).

- **Phasing out government support and financing for fossil fuel production.** As detailed in Chapter 3, governments continue to support domestic coal, oil, and gas production through fossil fuel subsidies, regulatory exemptions, aid to SOEs, and public funds, including those committed through COVID-19 recovery packages. In addition, support for overseas fossil fuel production provided through bilateral export credit agencies (ECAs), development finance institutions (DFIs), and multilateral development banks (MDBs) play a significant role in shaping the international energy landscape. Therefore, a key step towards closing the production gap is for governments to phase out their production support policies, ramp up the exclusion of fossil fuel projects from public finance institutions, and re-direct support towards decarbonization and just transition efforts.

Table 6.1 and Appendix A provide examples of governments and international financing institutions that have adopted these types of policies.

Table 6.1

Examples of actions that can support a managed wind-down of fossil fuel production (for a more detailed overview, see Appendix A).

Action area	Examples
1. Place restrictions on fossil fuel exploration and extraction	Bans and moratoria on the exploration of certain fossil fuel resources have been enacted in Belize, Bulgaria, Costa Rica, Denmark, France, Ireland, the Netherlands, New Zealand, Portugal, Spain, and Zimbabwe, among other countries.
2. Phase out government support and financing for fossil fuel production	Numerous national public finance institutions and multilateral development banks have committed to ending future financing for coal, oil, or gas production projects, such as the European Investment Bank and the Agence Française de Développement Group (see Figure 3.4).
3. Provide local and international support for diversification and a just and equitable transition	- Countries and regions such as the EU, Germany, Spain, and China have introduced just transition plans and measures to support affected workers, communities, and regions in transitioning away from coal, including through unemployment relief, retraining, and compensation. - Canada, New Zealand, Scotland, the US, and South Africa have set up bodies to support governments in designing policies that mitigate the social repercussions of the transition away from fossil fuels.

It is also critical that governments ensure the wind-down of fossil fuel production is just and equitable, minimizing economic and social disruption for workers, enterprises, communities, and other stakeholders. In recent years, the concept of a “just transition” to a low-carbon society has gained significant traction, driven by ethical as well as strategic imperatives (Atteridge & Strambo, 2020; ILO, 2019; ITUC, 2017; Jenkins et al., 2020; UNFCCC, 2016). Indeed, a just and equitable transition is pivotal to reaching the level of consensus and social acceptability that is needed for the deep changes required to limit global warming to 1.5°C or well below 2°C (Green & Gambhir, 2019; Jakob et al., 2020; Robins, 2020; Winkler & Klinsky, 2018).

Increasingly, governments have made commitments to a just transition. The Paris Agreement formally recognized the imperative of a just transition (Paris Agreement, 2015 Preamble, Para.10), over 50 heads of state signed the Solidarity and Just Transition Silesia Declaration in 2018, and 46 countries have committed to place jobs at the heart of ambitious climate action (UNFCCC, 2018). Numerous countries have put in place national commissions, task forces, dialogues, and other policies. For example, in 2020, Germany approved the Structural Development Act, which provides financial support of up to EUR 40 billion (USD 46 billion) to mitigate the social and economic repercussions of the Coal Phase-out Act (Government of Germany, 2020). Also in 2020, South Africa established a Presidential Climate Change Coordinating Commission to advise the government on how to ensure a just and fair transition for communities and workers reliant on the coal sector (Lo, 2021; The Presidency of the Republic of South

Africa, 2020). These and other examples are described in more detail in Appendix A.

Still, as the country profiles in Chapter 4 show, most major producing countries have not yet implemented strategies for workers, businesses, and communities to transition away from dependence on fossil fuel production. Given the pace of decline needed to meet climate goals, governments will need to act more swiftly and comprehensively to adopt and accelerate transition planning processes. They will need to dedicate greater resources to economic diversification and worker re-training. These steps increase the chances of a successful transition and can help to avoid leaving behind fossil-fuel-dependent workers, communities, and businesses; this includes the highly vulnerable informal sector, which is the source of many fossil fuel production jobs, especially for coal, but has yet to receive much attention in just transition efforts (see Box 6.1). Such strategies will also need to address the needs of communities that have borne the negative socio-economic and health impacts of production (Healy et al., 2019; Hernández, 2015; O’Rourke & Connolly, 2003).

Finally, **international cooperation can support a more effective and equitable transition away from fossil fuels.** Through international processes such as the UNFCCC, governments can enhance transparency and ambition by communicating plans to align their fossil fuel production and climate goals, including through their NDCs and long-term low emissions development strategies under the Paris Agreement (see Chapter 5). Additionally, countries can also engage in other forms of cooperation, such as multi-lateral clubs and treaties, to coordinate the winding down

of fossil fuel production (Green, 2018; Newell & Simms, 2019). Some countries, such as Costa Rica and Denmark, have begun paving the way for more ambitious, coordinated action by jointly announcing commitments to phase out fossil fuel production (Jørgensen & Murillo, 2020).

Through international cooperation, countries can also seek to ensure that declines in fossil fuel production are distributed as equitably as possible, while minimizing the risks of disruption and maximizing the participation of affected stakeholders (Achakulwisut & Erickson, 2021; Green & Denniss, 2018). International cooperation can also direct support to countries that face the most risk in a transition, due to their limited financial and institutional capacity and high dependence on fossil fuel production (SEI et al., 2020).

International financial institutions also have a key role to play: they can restrict financing for fossil fuel projects and direct it to just transition measures (SEI et al., 2020). As shown in Chapter 3, an increasing number of MDBs and bilateral DFIs are enacting or considering policies to limit or exclude financing for fossil fuel production. Countries can accelerate this process for multilateral institutions, and expand it to include export credit agencies and other vehicles for public finance.

As the impacts of climate change become even clearer and starker, citizens will be looking to their governments to put the world on a net-zero emissions trajectory as rapidly as possible. To do so, governments will need to reckon with the production gap, and in short order, take the steps needed to close it.



Box 6.1. A just and equitable transition for the informal economy

Just transition efforts to date have focused heavily on the needs of those in the formal economy, who are employed with regular hours and wages in positions subject to tax and legal requirements. However, many fossil-fuel-production-related activities take place in the informal economy. This is especially true in some coal-dependent regions of the global South. In India, for example, nearly 360,000 people work in formal coal mining operations (Bhushan et al., 2020), while over 15 million depend on coal for income (Chandra, 2019), many by gathering coal manually and selling it at local markets (Lahiri-Dutt, 2014). Informal coal mining for subsistence use and small-scale commerce is also common in South Africa, and informal employment plays a key role in the main coal-producing regions of Colombia (Burton et al., 2018; DANE, 2021).

The informal workforce is generally poorer, with lower life expectancies, fewer years of schooling, and greater socio-economic challenges than the formal

workforce. Consequently, it has less capacity to adapt to the types of economic and social changes that a rapid transition away from fossil fuels would bring (Bhushan et al., 2020). Therefore, where the informal sector is a significant part of the economy, just transition efforts should place a particular focus on it, providing skills, mobility, and alternative livelihood opportunities — for example, in agriculture, forestry, and fisheries or in mine closure and rehabilitation — with pathways to join the formal economy. Engagement, through social dialogue with representatives of the informal sector, particularly the Indigenous communities and women who often make up a significant part of the informal economy, is critical to ensure that their needs are met (NSO, 2020). Addressing energy poverty and providing households with access to modern energy services, as well as providing other social and physical infrastructure, is another key step in building community resilience for the transition.



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Appendix A

Examples of actions towards a managed wind-down of fossil fuel production

Place restrictions on fossil fuel exploration and extraction			
Year	Country	Jurisdiction	Example
2021	Spain	National	Spain ended all new exploration and extraction of oil and gas, as well as “high volume” fracking. ^{A1}
2021	Denmark	Subnational	Greenland banned all future oil and gas exploration. ^{A2}
2021	Ireland	National	Ireland ended new licenses for oil and gas exploration and extraction, following a 2017 ban on exploration and extraction of onshore petroleum by hydraulic fracturing. ^{A3}
2021	United States	Local	Whatcom county in Washington State prohibited new fossil fuel infrastructure, including ports, refineries, and power plants. ^{A4}
2021	United States	Subnational	The State of California will stop issuing fracking permits by 2024 and is analyzing pathways to phase out oil extraction by 2045. ^{A5}
2020	Zimbabwe	National	Zimbabwe announced a ban on coal mining in national parks. ^{A6}
2020, 2018	Denmark	National	Denmark ended new licensing for oil and gas extraction and exploration in the North Sea in 2020. Previously, in 2018, Denmark banned exploration and drilling for oil, gas, and shale gas on land and in inland waters. ^{A7}
2020	Portugal	National	Portugal announced the end of contracts for oil and gas exploration. ^{A8}
2019	Costa Rica	National	Costa Rica extended its moratorium on oil exploration and extraction until 2050. The moratorium was first enacted in 2002 and extended in 2011. ^{A9}
2019	Brazil	Subnational	The State of Paraná prohibited the exploitation of shale gas using the fracking technique. ^{A10}
2019	The Netherlands	National	The Netherlands banned shale gas exploration in 2013 and is expected to complete the phasing out of gas extraction in the province of Groningen by 2022. ^{A11}
2018	Australia	Subnational	The State of Tasmania extended its moratorium on fracking for hydrocarbon resource extraction until March 2025. ^{A12}
2018	Uruguay	National	Uruguay issued a four-year moratorium on hydraulic fracturing (2018 – 2021), with proposed legislation to extend the moratorium for 10 years. ^{A13}
2018	New Zealand	National	New Zealand ended new offshore oil and gas exploration permits. ^{A14}
2018	Belize	National	Belize adopted a moratorium on offshore oil exploration and drilling. ^{A15}
2012	Bulgaria	National	Bulgaria adopted a ban on shale gas exploration and production, and a conditional ban on hydraulic fracturing methods. ^{A16}

Phase out public support and financing for domestic and overseas fossil fuel production			
Year	Country	Jurisdiction	Example
2021	United Kingdom	Bilateral	The UK government ended new support for overseas fossil fuel projects. ^{A17}
2021	Inter-governmental	Multilateral	Under a draft energy policy expected to be approved after the release of this report, the Asian Development Bank commits not to finance any fossil fuel exploration or production, nor coal-power and heat plants or facilities associated with new coal generation. ^{A18}
2021	United States	Multilateral	The US Treasury provided guidance restricting its support for coal and gas financing at multilateral development banks. ^{A19}
2019	IGO	Multilateral	The European Investment Bank Energy will no longer consider new financing for unabated, fossil fuel energy projects, including gas, from the end of 2021 onwards. ^{A20}
2019	France	Bilateral	France’s state-owned development agency Agence Française de Développement (AFD) Group ceased new finance for coal projects and fossil fuel transport. ^{A21}

2019	Germany	Bilateral	Germany's state-owned development and investment bank, KfW group, ceased new finance to coal-related upstream activities, infrastructure associated with coal, and upstream activities related to bituminous shale, tar sands or oil sands. ^{A22}
2018	Ireland	National	Ireland's Fossil Fuel Divestment Act 2018 requires the Ireland Strategic Investment Fund (ISIF) to divest from fossil fuel undertakings. ^{A23}
2017	Sweden	Bilateral	Swedfund (Development Finance Institution of the Swedish government) adopted a ban on fossil fuel investments. ^{A24}

Provide local and international support for diversification and just, equitable transitions			
Year	Country	Jurisdiction	Example
2021	United States	National	The US established the White House Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization to identify and deliver resources to support workers and communities reliant on the fossil fuel sector. ^{A25}
2021	Spain	National	In 2018, Spain established a Just Transition Strategy (2019–2027) that includes early retirement for miners over age 48, retraining for green jobs, and environmental restoration. Spain's 2021 Climate Change and Energy Transition Act requires the government to publish a Just Transition Strategy every five years. ^{A26}
2021	Chile	National	The government is developing a Just Transition Strategy, with local action plans to assess the needs of coal regions, mitigate the socioeconomic repercussions of coal-fired power plant closures, and maximize the benefits of the transition in affected areas. ^{A27}
2021	Scotland	National	Scotland's Just Transition Commission called for the introduction of just transition plans in high-emitting industrial sectors and support measures for workers in carbon-intensive sectors. ^{A28}
2021	United States	Subnational	The State of California, by Executive Order mandate, is designing a Just Transition Roadmap focusing on workers and communities reliant on fossil fuel industries. ^{A29}
2021, 2020	United States	Subnational	The State of Colorado developed a just transition action plan in 2020, with USD 15 million committed in 2021 toward just transition of coal-dependent communities and associated workers including economic diversification efforts. ^{A30}
2020, 2019	South Africa	National	South Africa established a Presidential Climate Change Commission to advise the government on how to ensure a just transition for communities and workers reliant on the coal sector. South Africa also includes just transition considerations as part of its energy planning. ^{A31}
2020	Germany	National	Germany's Structural Development Act provides financial support for regions affected by coal phase-out of up to EUR 40 bn (USD 46 bn) to support investments in clean energy, infrastructure, research and innovation, and labour market policies. ^{A32}
2020	Greece	National	Greece established a Just Transition Development Plan running from 2021–2027. Assistance for coal-dependent regions includes income support, social protection policies, reskilling and entrepreneurship development. ^{A33}
2020	Ireland	National	Ireland established the National Just Transition Fund (JTF) with EUR 12.5 million committed to projects related to retraining and sustainable employment as of July 2021. ^{A34}
2020	Poland	Subnational	The region of Eastern Wielkopolska set a just transition plan assuming that coal mining will be discontinued in 2030. ^{A35}
2020	Inter-governmental	Multilateral	The European Bank for Reconstruction and Development's just transition initiative aims to help those whose livelihoods are affected by the transition process through reskilling and enhancing entrepreneurship, and support for regional economic development. ^{A36}
2019	EU	Supra-national	The EU's Just Transition Mechanism offers targeted support to regions most affected by the transition, including knowledge, technical and advisory support, and the expected mobilization of at least EUR 65-75 billion over the period 2021–2027. ^{A37}
2018	Canada	National	Canada established a Task Force on Just Transition for Canadian coal power workers and communities. The government dedicated CAD 35 million (USD 26 million) over five years to support skills development and economic diversification activities. ^{A38}
2016	China	National	China's 13th Five-Year Plan for the Coal Industry included just transition support measures such as support for workers, unemployment relief, and training and job placement services (2016–2020). ^{A39}

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