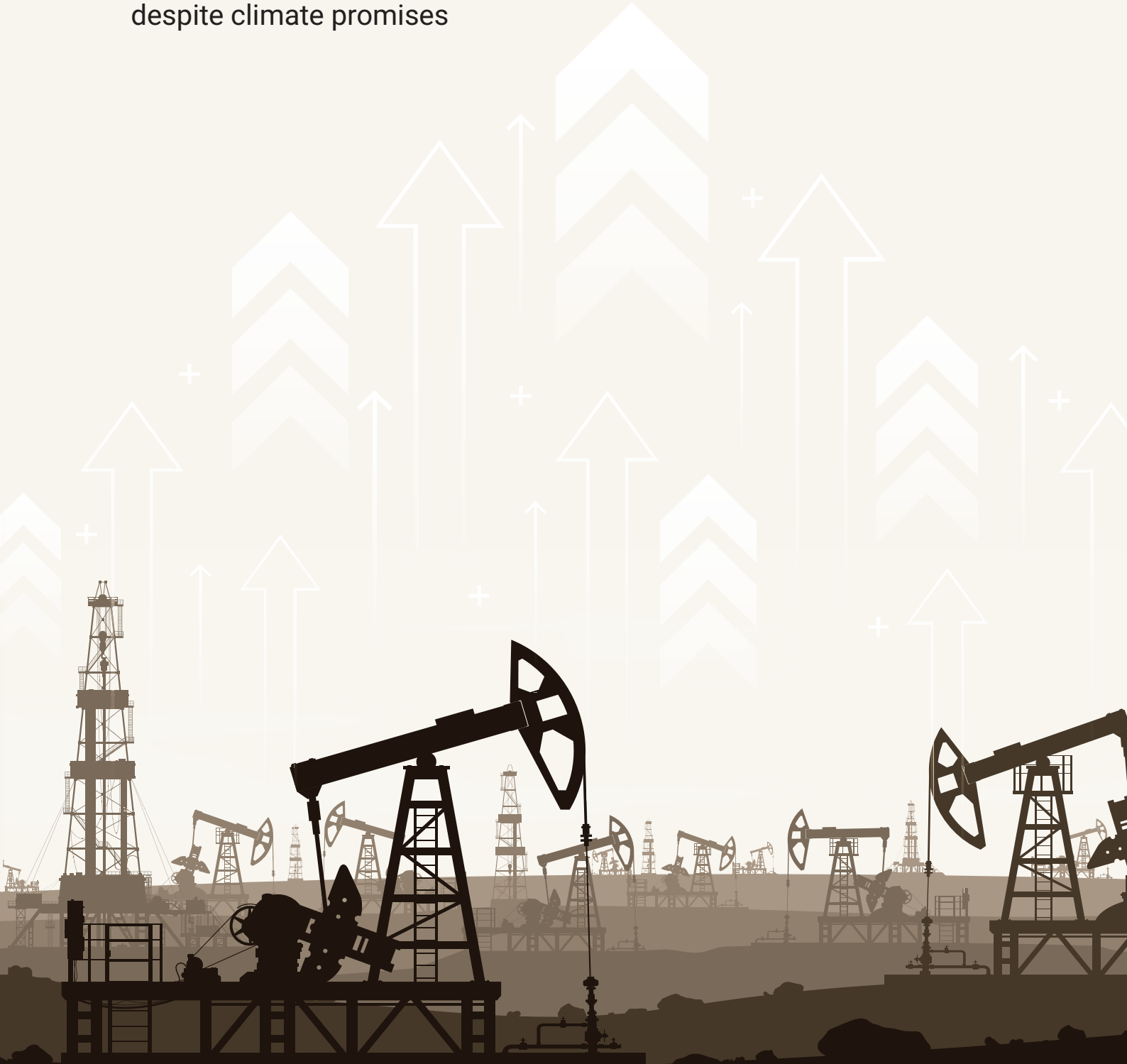


Phasing down or phasing up?

Top fossil fuel producers plan even more extraction despite climate promises



About This Report

This is the fourth edition of the Production Gap Report, first issued in 2019. The report tracks the misalignment between governments' planned fossil fuel production and global production levels consistent with limiting global warming to 1.5°C or 2°C. The report represents a collaboration of several research and academic institutions, including inputs and reviews from more than 80 experts from 30 countries spanning the Global North and Global South. The report is externally peer-reviewed, with additional guidance and support from the United Nations Environment Programme, and review by the United Nations Framework Convention on Climate Change's government focal points.

This year's report features two major updates to the production gap analysis, drawing on the new mitigation scenarios database compiled for the Intergovernmental Panel on Climate Change's Sixth Assessment Report and changes in government plans and projections since August 2021. The report also provides individual country profiles for 20 major fossil-fuel-producing countries, evaluating governments' latest climate ambitions and their plans, policies, and strategies that support fossil fuel production or the transition away from it.

The production gap analysis is based on recent and publicly accessible plans and projections for fossil fuel production published by governments and affiliated institutions. Other information presented throughout the report, such as details on fossil fuel investments and policies is supported by a mix of government, intergovernmental, peer-review, and other research sources listed in the references.

The report and its materials can be accessed online at <https://productiongap.org/2023report>.

Citation

This document may be cited as: SEI, Climate Analytics, E3G, IISD, and UNEP. (2023). *The Production Gap: Phasing down or phasing up? Top fossil fuel producers plan even more extraction despite climate promises*. Stockholm Environment Institute, Climate Analytics, E3G, International Institute for Sustainable Development and United Nations Environment Programme. <https://doi.org/10.51414/sei2023.050>

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Erratum: The colour coding of some countries in Figure 2.3 was corrected on 24 Nov 2023.

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Acknowledgements

We would like to thank the following contributors for their input:

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Translations

ION Translations provided translations of the Executive Summary in Arabic, Indonesian, Chinese, French, Russian, and Spanish.

Thanks also to:

John Christensen (UNEP), Maarten Kappelle (UNEP), Christophe McGlade (International Energy Agency), Anne Olhoff (CONCITO – Denmark's green think tank), Mark Radka (UNEP), Kaisa Uusimaa (UNEP), Patrick Heller (NRGI), and Emma Dahmani (NRGI); and national government UNFCCC focal points and their colleagues who provided feedback on Chapter 3.

Thanks to the KR Foundation, the Netherlands Ministry of Economic Affairs and Climate Policy, the Rockefeller Philanthropy Advisors, and the Swedish International Development Agency (Sida) for funding and supporting the work of the Production Gap Report.



Glossary

Carbon dioxide equivalent (CO₂eq)

The amount of carbon dioxide (CO₂) emissions that would cause the same warming over a given time horizon as an emitted amount of greenhouse gases.

Fossil fuel production

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

Government plans and projections (GPP)

A global pathway of future fossil fuel production estimated in this report, based on the compilation and assessment of recent national energy plans, strategy documents, and outlooks published by governments and affiliated institutions. This term was formerly called the “countries’ plans and projections (CPP)” pathway in the 2021 PGR.

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 — and benefits maximized — for workers, communities, consumers, and other stakeholders who may be disproportionately affected.

Long-term low-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 light of different national circumstances.

Multilateral development bank (MDB)

An international financial institution chartered by multiple countries to support economic and social development in lower-income countries.

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 governments’ planned/projected 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 action.

Subsidy

A financial benefit accorded to a specific interest (e.g. an individual, organization, company, or sector) by a government or public body.

Abbreviations

AR6	Sixth Assessment Report (from the IPCC)	IEA	International Energy Agency
Bcf	Billion cubic feet	IPCC	Intergovernmental Panel on Climate Change
Bcm	Billion cubic meters	JETP	Just Energy Transition Partnership
BECCS	Bioenergy with carbon capture and storage	LNG	Liquefied natural gas
CCS	Carbon capture and storage	LT-LEDS	Long-term, low-emission development strategies
CCUS	Carbon capture, utilization, and storage	Mb/d	Million barrels per day
CDR	Carbon dioxide removal	Mt	Million tonnes
CO ₂	Carbon dioxide	NDC	Nationally determined contribution
CO ₂ eq	Carbon dioxide equivalent	NZE	Net Zero by 2050 pathway for the energy sector (from the IEA)
COP	Conference of the Parties (to the UNFCCC)	OECD	Organization for Economic Co-operation and Development
°C	Degrees Celsius	PGR	Production Gap Report
DACCS	Direct air carbon capture and storage	SOE	State-owned enterprise
EJ	Exajoule	Tcm	Trillion cubic meters
EU	European Union	UAE	United Arab Emirates
G7	Group of Seven	UN	United Nations
G20	Group of Twenty	UNFCCC	United Nations Framework Convention on Climate Change
GDP	Gross domestic product	UK	United Kingdom of Great Britain and Northern Ireland
GHG	Greenhouse gas	US	United States of America
GPP	Government plans and projections		
Gt	Gigatonne (billion tonnes)		
IAM	Integrated assessment model		

Foreword

Climate change has battered the world's most vulnerable for years. Now, wealthier nations and communities find themselves taking hits as heatwaves, droughts, wildfires and storms grow.

The whole world is clinging to the handrails on a boat that is lurching through increasingly turbulent seas. Nobody is safe.

The escalating frequency and intensity of these events are a direct result of anthropogenic climate change, which is driven by humanity's addiction to fossil fuels. By committing to limiting global temperature rise through the Paris Agreement, governments have shown they understand this. They have shown they want to change.

Yet, as this report shows, the addiction to fossil fuels still has its claws deep in many nations. Governments are planning to produce, and the world is planning to consume, over double the amount of fossil fuels in 2030 than is consistent with the pathway to limiting global temperature rise to 1.5°C. These plans throw the global energy transition into question. They throw humanity's future into question. Governments must stop saying one thing and doing another, especially as it relates to the production and consumption of fossil fuels.

Powering economies with clean and efficient energy is the only way to end energy poverty and bring down emissions at the same time. Starting at COP28, nations must unite behind a managed and equitable phase-out of coal, oil and gas — to ease the turbulence ahead and benefit every person on this planet.



Inger Andersen

Executive Director
United Nations Environment Programme



The recent global energy crisis and the worsening climate crisis have a common root: our excessive dependence on fossil fuels.

This root must now be severed to achieve real energy security and climate security. From the latest IPCC report to the latest climate disaster headlines, the message is clear: Governments must lead a swift and just transition away from fossil fuels towards clean energy.

And yet as this year's report shows, the world's governments still, in aggregate, plan on increasing coal production out to 2030 and increasing oil and gas production out to at least 2050. Most have pledged net-zero emissions by mid-century: a necessary target, but one that can only become a reality if translated into concrete plans and actions to reduce production and use of coal, oil, and gas.

Wealthier countries that are less dependent on fossil fuels for livelihoods and revenues will need to reduce faster. Other countries will require support. And none want to act alone. That's why all eyes will be on governments as they convene in Dubai this December to take on the long-overdue work of phasing out fossil fuels fairly and equitably.



Måns Nilsson

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Executive Summary

Key Findings

Governments, in aggregate, still plan to produce more than double the amount of fossil fuels in 2030 than would be consistent with limiting warming to 1.5°C. The persistence of the global production gap puts a well-managed and equitable energy transition at risk.

Taken together, government plans and projections would lead to an increase in global coal production until 2030, and in global oil and gas production until at least 2050. This conflicts with government commitments under the Paris Agreement, and clashes with expectations that global demand for coal, oil, and gas will peak within this decade even without new policies.

Major producer countries have pledged to achieve net-zero emissions and launched initiatives to reduce emissions from fossil fuel production, but none have committed to reduce coal, oil, and gas production in line with limiting warming to 1.5°C.

Governments should be more transparent in their plans, projections, and support for fossil fuel production and how they align with national and international climate goals.

There is a strong need for governments to adopt near- and long-term reduction targets in fossil fuel production and use to complement other climate mitigation targets and to reduce the risks of stranded assets.

Given risks and uncertainties of carbon capture and storage and carbon dioxide removal, countries should aim for a near total phase-out of coal production and use by 2040 and a combined reduction in oil and gas production and use by three-quarters by 2050 from 2020 levels, at a minimum. The potential failure of these measures to develop at scale calls for an even more rapid global phase-out of all fossil fuels.

An equitable transition away from fossil fuel production must recognize countries' differentiated responsibilities and capabilities. Governments with greater transition capacity should aim for more ambitious reductions and help finance the transition processes in countries with limited capacities.

Executive Summary

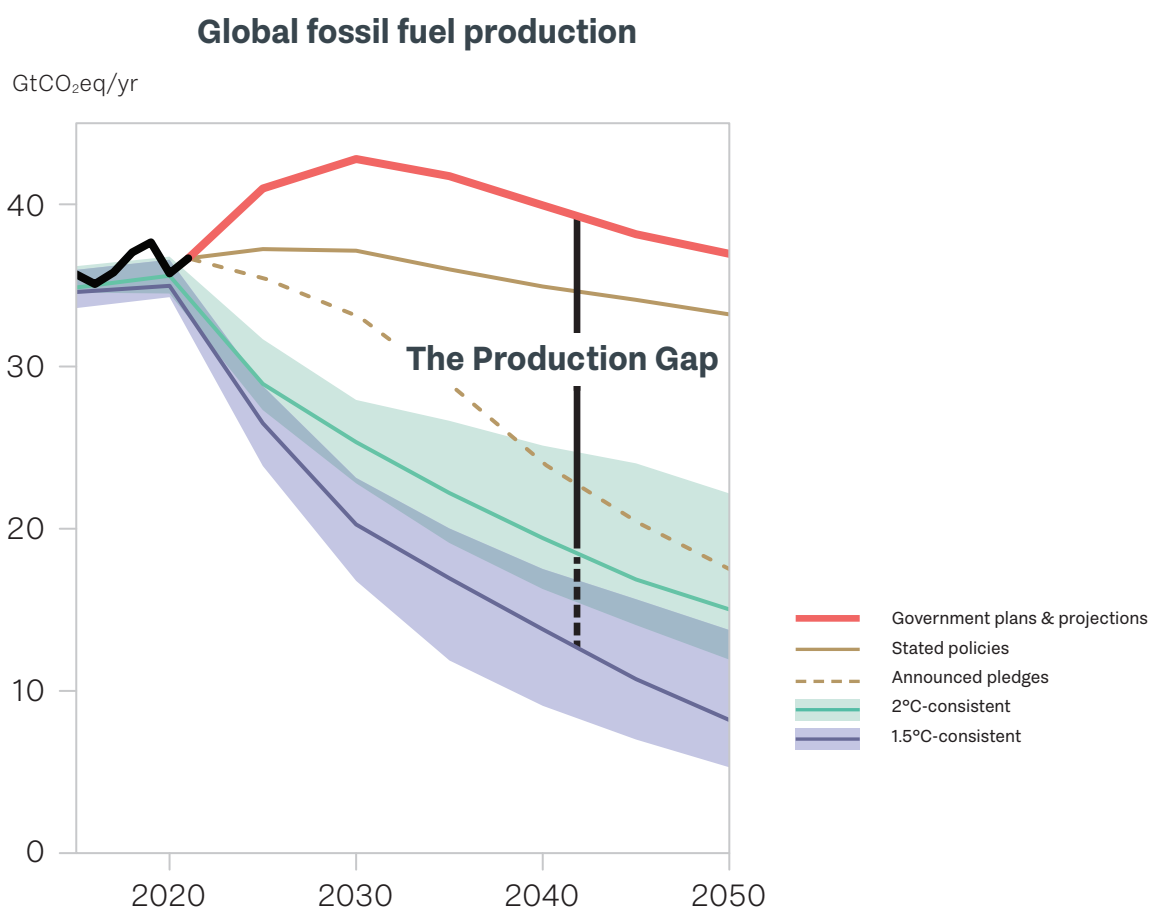
Soon after the release of the 2021 Production Gap Report, governments agreed to accelerate efforts towards “the phasedown of unabated coal power” at the 26th Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) in Glasgow. It was a significant milestone in the history of international climate governance: for the first time, an explicit reference to fossil fuels appeared in a COP decision text.

Yet since that time, the production and use of fossil fuels have reached record high levels. If global carbon dioxide (CO₂) emissions — of which close to 90% stem from fossil fuels — continue at the current pace, the world could exceed the remaining emissions budget compatible with a 50% chance of limiting long-term warming to 1.5°C by 2030.

Both global CO₂ emissions and fossil fuel production need to peak and swiftly decline to keep the Paris Agreement’s temperature goal within reach. Informed by the latest scientific evidence, this report identifies global pathways for coal, oil, and gas production from now until 2050 that are consistent with this goal. It then assesses governments’ plans, projections, and policies for fossil fuel production and how aligned — or misaligned — they are with respect to these pathways.

Figure ES.1

The fossil fuel production gap — the difference between governments’ plans and projections and levels consistent with limiting warming to 1.5°C and 2°C, as expressed in units of greenhouse gas emissions from fossil fuel extraction and burning — remains large and expands over time. (See details in Chapter 2 and Figure 2.1.)



The report's main findings are as follows:

Since it was first quantified in 2019, the global production gap has remained largely unchanged. Despite encouraging signs of an emerging clean energy transition, the world's governments still plan to produce more than double the amount of fossil fuels in 2030 than would be consistent with limiting warming to 1.5°C.

The production gap is the difference between governments' planned fossil fuel production and global production levels consistent with limiting global warming to 1.5°C or 2°C. This year's production gap assessment features two major updates. First, the "government plans and projections" global pathway reflects how major fossil-fuel-producing countries have adjusted their coal, oil, and gas production targets in light of developments since late 2021, including a global energy crisis and increased climate mitigation ambitions. Second, global pathways for fossil fuel production consistent with limiting warming to 1.5°C or 2°C have been updated using the new scenario database compiled for the Working Group III contribution to the Intergovernmental Panel on Climate Change (IPCC)'s Sixth Assessment Report (AR6).

The resulting analysis finds that, in aggregate, governments are planning on producing around 110% more fossil fuels in 2030 than would be consistent with limiting warming to 1.5°C, and 69% more than would be consistent with

limiting warming to 2°C, as shown in Figure ES.1. The magnitude of the production gap is also projected to grow over time: by 2050, planned fossil fuel production is 350% and 150% above the levels consistent with limiting warming to 1.5°C or 2°C, respectively.

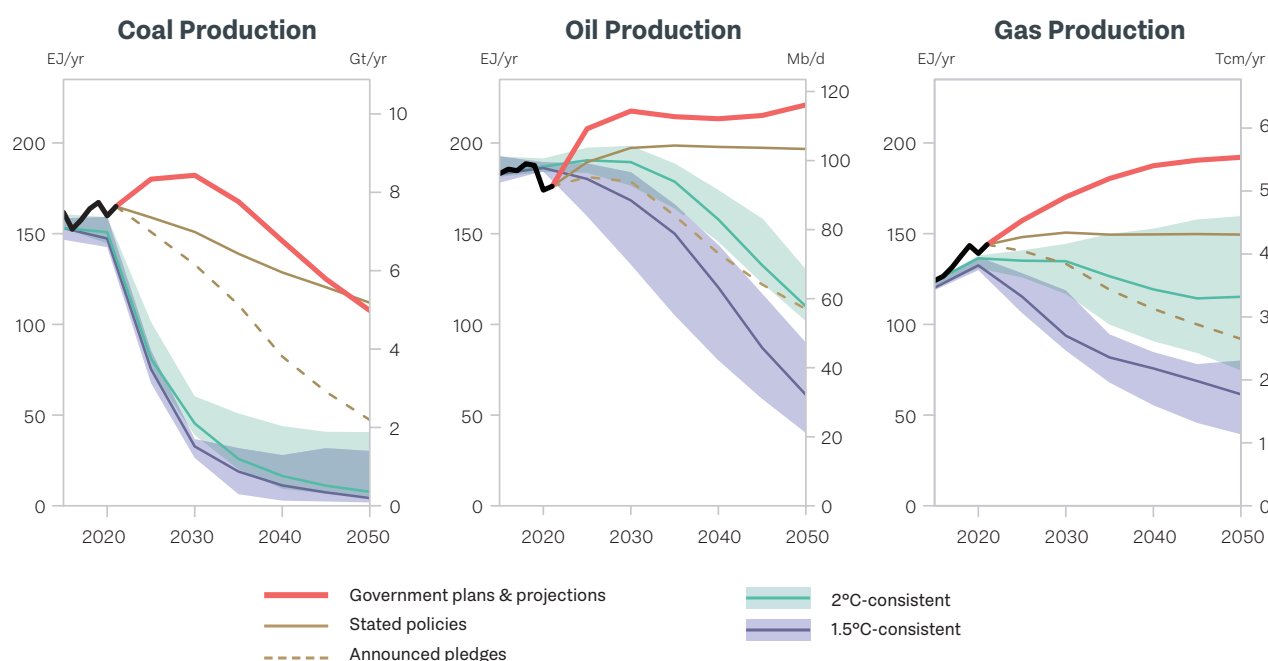
The global levels of fossil fuel production implied by governments' plans and projections, taken together, also exceed those implied by their stated climate mitigation policies and implied by their announced climate pledges as of September 2022, as modelled by the International Energy Agency. As discussed below, few countries have developed fossil fuel production projections that are aligned with their national climate goals or with limiting warming to 1.5°C.

Many major fossil-fuel-producing governments are still planning near-term increases in coal production and long-term increases in oil and gas production. In total, government plans and projections would lead to an increase in global production until 2030 for coal, and until at least 2050 for oil and gas, creating increasingly large production gaps over time.

To be consistent with limiting warming to 1.5°C, global coal, oil, and gas supply and demand must instead decline rapidly and substantially between now and mid-century. However, the increases estimated under the government plans and projections pathways would lead to global production levels in 2030 that are 460%, 29%, and 82%

Figure ES.2

Government plans and projections would lead to an increase in global coal production until 2030, and in global oil and gas production until at least 2050. (See details in Chapter 2 and Figure 2.2.)



higher for coal, oil, and gas, respectively, than the median 1.5°C-consistent pathways, as shown in Figure ES.2. The disconnect between governments' fossil fuel production plans and their climate pledges is also apparent across all three fuels.

The size and nature of the global production gap also raise the question of how it can be closed in a managed and equitable way, especially given that countries are expected to uphold "the principle of equity and common but differentiated responsibilities and respective capabilities, in light of different national circumstances" under the UNFCCC framework.

As explored in the 2020 Production Gap Report and informed by emerging literature on this topic, an equitable transition should recognize that countries' circumstances differ widely depending on their financial and institutional capacity, as well as their level of socioeconomic dependence on fossil fuel production. Based on these principles, one might expect higher-income countries and those less dependent on fossil fuel production to lead the transition, while lower-capacity countries will require assistance and finance to pursue alternative low-carbon and climate-resilient development pathways.

However, the combined levels of coal, oil, and gas production being planned/projected by 10 high-income countries alone would already exceed 1.5°C-consistent pathways for each fuel by 2040. Similarly, the trajectories of oil and gas production being planned and projected by 12 countries with relatively lower levels of economic dependence on their production would exceed the respective 1.5°C-consistent pathways by 2040 (see Section 2.5). Without active dialogue and engagement between higher- and lower-income countries, these inequities may continue to exist and to erode trust in global cooperation on climate action.

In addition to government plans and projections for fossil fuel production that inform the global production gap analysis in Chapter 2, this report also reviews, in Chapter 3, the climate ambitions and fossil fuel production policies and strategies of 20 major producer countries: Australia, Brazil, Canada, China, Colombia, Germany, India, Indonesia, Kazakhstan, Kuwait, Mexico, Nigeria, Norway, Qatar, the Russian Federation, Saudi Arabia, South Africa, the United Arab Emirates, the United Kingdom of Great Britain and Northern Ireland (UK), and the United States of America (US). Altogether, these countries account for 82% of production and 73% of consumption of the world's fossil fuel supply. The status of discourses and policies towards a managed and equitable transition away from fossil fuel production in these countries is also evaluated.

While 17 of the 20 countries profiled have pledged to achieve net-zero emissions, and many have launched initiatives to reduce emissions from fossil fuel production activities, most continue to promote, subsidize, support, and plan on the expansion of fossil fuel production. None have committed to reduce coal, oil, and gas production in line with limiting warming to 1.5°C.

As shown in Table ES.1, some countries are planning on increasing their coal production until 2030, banking on continued and growing domestic and international coal markets. Meanwhile, the majority of oil and gas producers anticipate increasing their production between 2021 and 2030, and some until 2050.

The war in Ukraine, the ensuing pressures on global energy supply, and record high prices for internationally traded gas have further spurred plans for and investment in liquefied natural gas infrastructure by exporters and importers alike. Many countries are promoting gas as a "bridge" or "transition" fuel, but with no apparent plans to transition away from it. Eight countries profiled in Chapter 3 project relatively flat or increasing gas production from 2021 until 2035–2050. However, gas could hinder or delay the transition to renewable energy systems by locking in fossil-fuel-based systems and institutions. Moreover, despite some local air pollution benefits when substituting for coal, advances in the quantification of methane leakage along the gas supply chain have substantially reduced the expected climate benefits of replacing coal with gas (see Chapter 3).

In recent years, many governments have launched initiatives to reduce emissions from fossil fuel production activities. As shown in Table ES.1, 14 of the 20 countries profiled in Chapter 3 have signed onto the Global Methane Pledge to collectively reduce global methane emissions from all sources by 30% by 2030 compared to 2020 levels. Six major oil- and gas-producing countries, all of which are among the 20 profiled in Chapter 3, have also launched the Net Zero Producers Forum aimed at reducing emissions from the sector. Such efforts, while important, are also deeply insufficient. In the pathways consistent with limiting warming to 1.5°C explored in this report, global methane emissions from the energy sector decline by more than 60% between 2020 and 2030. Furthermore, and perhaps most importantly, these initiatives fail to recognize that reducing fossil fuel production itself is also needed to limit warming to 1.5°C.

Table ES.1

A large majority of countries profiled in this report have made net-zero pledges and signed onto the Global Methane Pledge and the Glasgow Statement on international finance. Most are also planning to increase oil and gas production, and some are planning to increase coal production, until 2030. (See details in Chapter 3 and Tables 3.2–3.3.)

Country	Status of national net-zero commitment; net-zero target year	Signatory of Global Methane Pledge	Signatory of Glasgow Statement	Planned change in annual fossil fuel production for 2030 relative to 2021 (EJ)		
				Coal	Oil	Gas
Australia	In law 2050	✓		▲ 0.2	■ 0 ^b	▲ 0.7
Brazil	NDC objective 2050	✓		No data	▲ 5.2	▲ 1.0 ^d
Canada	In law 2050	✓	✓	No data	▲ 3.0	▲ 0.6
China	NDC objective 2060			▼ 5.3	■ 0	▲ 2.6
Colombia	In law 2050	✓		▲ 1.7	▼ 0.1	■ 0
Germany	In law 2045	✓	✓	▼ 0.5	■ 0	▼ 0.1
India	NDC objective 2070			▲ 10.7	No data	No data
Indonesia	In strategy document 2060	✓		▲ 2.5	▼ 0.2	▲ 1.1
Kazakhstan	In strategy document 2060			▼ 0.2	▲ 0.4	▲ 0.1 ^d
Kuwait	Political pledge 2050 (oil & gas sector) 2060 (rest of economy)	✓		No production	▲ 2.1	▲ 0.1
Mexico	No commitment	✓		No data	▲ 1.4	▲ 0.6
Nigeria	In law 2060	✓		No data	▲ 1.3	▲ 2.6 ^d
Norway	No commitment ^a	✓		No data	▼ 0.5	▼ 0.3
Qatar	No commitment			No production	No data	▲ 3.9 ^c
Russian Federation	In strategy document 2060			▲ 3.2	▲ 2.9	▲ 3.3
Saudi Arabia	Political pledge 2060	✓		No production	▲ 5.5	▲ 1.3
South Africa	In strategy document 2050			No data	No data	No data
UAE	NDC objective 2050	✓		No production	▲ 1.8 ^c	▲ 0.4 ^b
UK	In law 2050	✓	✓	No data	▼ 0.7	▼ 0.6
US	In policy document 2050	✓	✓	▼ 5.1	▲ 5.2	▲ 2.5

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

^b Planned change for 2028, furthest year for which data is available.

^c Planned change for 2027, furthest year for which data is available.

^d Excluding gas that is re-injected, consumed by producers, and/or flared.

Sources: Net Zero Tracker (2023) and own analyses (see Chapter 3).

Governments should be more transparent in their plans, projections, and support for fossil fuel production and how they align with national and international climate goals.

Governments play a central role in setting the direction of future fossil fuel production. State-owned entities control half of global production for oil and gas and over half for coal. Governments' existing targets, policies, and support for fossil fuel production help to influence, legitimize, and enable continued investments in domestic and international fossil fuel projects, which are undermining the transition to renewable energy and global climate mitigation efforts. At the same time, many fossil fuel projects planned and under development are now at risk of becoming stranded assets as the world decarbonizes and global demand for coal, oil, and gas are expected to peak and decline within this decade, even without additional policies.

Nevertheless, there are some encouraging signs of movement. Thirty-four countries, including four profiled in Chapter 3 (Table ES.1), have signed onto the Glasgow Statement on International Public Support for the Clean Energy Transition to end international public financing for “unabated” fossil fuel projects by the end of 2022 and to redirect investments into clean energy. It is important to note though that while the term “unabated” (see Box 2.1) is being increasingly used in policy commitments related

to fossil fuel reductions, it is often highly contested, poorly defined, and open to interpretation regarding the required rate of carbon capture for abatement.

Since the 2021 Production Gap Report, two more countries (Canada and China) — in addition to Germany and Indonesia — have begun to develop scenarios for domestic fossil fuel production that are consistent with national or global net-zero or carbon-neutrality targets. Meanwhile, discourses on just transitions for fossil-fuel-dependent workers and economies are advancing in many countries, though these are still mostly limited to coal-fired power generation. Among the 20 countries profiled, Colombia recently signed on to an international initiative targeted at phasing out fossil fuel production (see Table 3.2).

There is a need for governments to adopt both near- and long-term reduction targets for fossil fuel production and use to complement other climate mitigation benchmarks and reduce the risks of stranded assets. Countries with greater transition capacity should aim for faster reductions than the global average.

The current misalignment of climate ambitions and fossil fuel production plans undermines efforts to reduce fossil fuel use and emissions by sending mixed signals about countries' intentions and priorities and by locking in new fossil fuel production infrastructure that will make the



energy transition more costly, difficult, and disruptive. The almost-exclusive focus of climate policy on the demand for fossil fuels and on the territorial emissions associated with their combustion over the past decades has proven to be insufficient. Ultimately, the global energy landscape is shaped by both demand and supply. A well-managed energy transition will thus require plans and actions to reduce both fossil fuel production and consumption in a coordinated fashion.

Combining targets and policies to actively phase out fossil fuel production with other important climate mitigation and just transition measures — such as reducing fossil fuel consumption, expanding renewable energy, reducing methane emissions from all sources, and targeting investments and social protection for affected communities — can reduce the costs of decarbonization, promote policy coherence, and ensure that renewables replace, rather than add to, fossil fuel energy.

The long-term, cost-optimized mitigation scenarios selected and analysed in this report from the IPCC AR6 database suggest that, to limit warming to 1.5°C, global coal, oil, and gas production should decline rapidly and substantially between now and mid-century, in parallel with other key mitigation strategies.

The selected scenarios differ substantially with respect to their reliance on carbon capture and storage (CCS) and carbon dioxide removal (CDR). The median 1.5°C-consistent global fossil fuel production pathways shown in Figures ES.1–ES.2 assume that, by mid-century, 2.1 billion tonnes of CO₂ per year (GtCO₂/yr) of fossil-fuel-combustion emissions will be captured and stored, 2.2 GtCO₂/yr of atmospheric CO₂ will be sequestered by conventional land-based CDR methods (afforestation, reforestation, and management of existing forests), and over 3 GtCO₂/yr will be sequestered by novel CDR methods (CCS coupled to bioenergy or direct air capture), on average.

However, there are large uncertainties in the technical, economic, and institutional feasibility of developing and deploying novel CDR and fossil-CCS technologies at the extensive scale envisioned in these scenarios. Around 80% of pilot CCS projects over the last 30 years have failed, with annual capacity from operational projects resulting in dedicated CO₂ storage currently amounting to less than 0.01 GtCO₂/yr (see Section 2.4). There are also widespread concerns around the potential negative impacts arising from extensive land-use for conventional or novel CDR, which could affect biodiversity, food security, and the rights of Indigenous peoples and traditional land users.

Given risks and uncertainties of CCS and CDR, countries should aim for a near total phase-out of coal production and use by 2040 and a combined reduction in oil and gas production and use by three-quarters by 2050 from 2020 levels, at a minimum. The potential failure of these measures to become sufficiently viable at scale, the non-climatic near-term harms of fossil fuels, and other lines of evidence, call for an even more rapid global phase-out of all fossil fuels.

While the above reduction targets are derived from 1.5°C-consistent scenarios that align with taking a precautionary approach to limiting reliance on CCS and CDR, they still assume that these measures will become available at scale to some degree (see Section 2.4). Ultimately, the pace and extent of the required reductions in global coal, oil, and gas production will also depend on many normative and values-based choices. For example, one mitigation scenario that relies only on conventional CDR and no CCS coupled to fossil fuels, bioenergy, or direct air capture sees reductions in global oil and gas production of 90% and 85%, respectively, between 2020 and 2050.

There are additional compelling reasons to strive for an even faster global phase-out of all fossil fuels. Research has found that the committed emissions of CO₂ expected to occur over the lifetime of existing fossil-fuel-producing infrastructure already exceed the remaining carbon budget for a 50% chance of limiting warming to 1.5°C by 2100. This implies that no new coal mines and oil and gas fields can be developed unless existing infrastructure is retired early, a task that is hard to achieve in practice.

Moreover, fossil fuel extraction and burning are associated with many near-term and localized non-climatic social, economic, and environmental harms that are rarely accounted for in climate mitigation scenarios, including the ones analysed in this report (see Section 2.4).

Continued production and use of coal, oil, and gas are not compatible with a safe and livable future. Achieving net-zero CO₂ emissions by 2050 requires governments to commit to, plan for, and implement global reductions in the production of all fossil fuels alongside other climate mitigation actions, beginning now.



1

Introduction

1. Introduction

For over a century, energy from fossil fuels has helped to deliver jobs, revenue, and economic growth around the world. Consequently, most governments view coal, oil, and gas as sources of geopolitical power, energy security, and development. Forgoing such resources — as will be necessary to retain a liveable climate — is neither easy nor conventional. Thus, it is not surprising that many governments continue to support, finance, and expand fossil fuel production. However, such policies are irreconcilable with global climate commitments and the plummeting cost of renewable energy. Amid growing calls from citizens and scientists for a fossil-fuel-free future, it is important for governments to recognize that while energy is essential to the fabric of society, fossil fuels are not.

This report examines how governments — particularly those responsible for producing much of the world's coal, oil, and gas — are reckoning with the need to rapidly transition away from fossil fuel production. While the global energy landscape is shaped by both demand and supply, this report series focuses on the latter, given its notable absence in national and international climate policymaking until recent years. The report assesses governments' plans and projections for coal, oil, and gas production and the extent to which, taken together, they exceed levels consistent with the Paris Agreement's goal of "holding the increase in global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels" (Paris Agreement, 2015, art. 2.1). This misalignment, referred to as the "production gap", is a metric that this report series has tracked since 2019.

In the two years since the last report was released, the global energy landscape has shifted significantly. On top of supply chain disruptions — in part due to extreme weather events and a rapid economic rebound following the COVID-19 pandemic — the outbreak of war in Ukraine catalysed a global energy crisis and a global food crisis (IEA, 2023c). Oil prices rose to almost USD 140 per barrel, a level last seen in 2008 (Brower, 2022). These developments prompted countries to rethink their energy plans, bringing the geopolitical risks of fossil fuel dependence into sharp focus. Energy security emerged as a top policy concern for many countries, especially those reliant on fossil fuel imports or facing growing energy needs.

On the one hand, oil and gas companies increased their upstream investments by 39% to nearly USD 500 billion in 2022 worldwide, the highest level since 2014 (IEF & S&P Global, 2023). Some major energy companies have abandoned or slowed plans to reduce oil and gas production and shift investments towards renewables (Bousso & Adomaitis, 2023; Reed, 2023; Visavadia, 2023).



On the other hand, the energy crisis has helped to accelerate the broader transition to clean sources. For example, the global pace of vehicle electrification has vastly exceeded prior expectations (IEA, 2023b). In Europe, renewable power capacity is expected to double over the 2022–2027 period (IEA, 2023c). Australia and the United States of America passed landmark climate laws in 2022, China is on track to double its wind and solar energy capacity by 2025 instead of 2030, and India earmarked over USD 4 billion for clean energy in its national budget (Mei et al., 2023; REN21, 2023). Since 2021, several Just Energy Transition Partnerships (JETPs) have been launched, with wealthier governments committing tens of billions of US dollars to support the shift away from fossil fuels in four emerging and developing countries (see Box 3.2). Thirty-four countries and five public finance institutions have committed to end international public finance for fossil fuels and prioritize clean energy (see Chapter 3).

Despite these encouraging signs, the overall size of the production gap, particularly out to 2030, has not discernibly changed since the first assessment in 2019.



Governments offer various rationales for continuing to support and expand fossil fuel production: meeting expected demand; reducing dependency and foreign exchange costs on imports; generating revenue for government services through taxes and royalties; following through on legal obligations under existing statutes and treaties; or confidence in winning out as one of the last producers in a dwindling market. Some also argue that producing their country's oil and gas with relatively lower upstream emissions will lead to an overall reduction in global greenhouse gas (GHG) emissions. However, research shows that curtailing production of fossil fuels, especially oil, will reduce global consumption and thereby also reduce global GHG emissions, regardless of who the producer is and after accounting for substitution by other producers (Erickson & Lazarus, 2018; Prest et al., 2023).

While these rationales for supporting fossil fuels may have merit in some limited circumstances, wide adoption of such policies results in the persistent production gap identified in this report. This gap “locks in” unsustainable levels of fossil fuel production that impede the energy transition and undermine climate goals in the near term. In the longer term, economies and communities risk seeing costly fossil fuel investments turn into liabilities, as markets

for coal, oil, and gas shrink and prices drop (Mercure et al., 2018). The president of COP28 and head of the United Arab Emirates’ national oil company has acknowledged that “phasing down fossil fuels is inevitable and essential” (Alkousaa, 2023).

Indeed, all fossil fuels must be effectively phased out to secure a safe and liveable future. The scientific evidence on this is clear. The production and use of fossil fuels are the predominant driver of the climate emergency, accounting for close to 90% of human-made carbon dioxide (CO₂) emissions (Friedlingstein et al., 2022). If global GHG emissions continue at current levels, the remaining “carbon budget” of allowable emissions for a 50% chance of limiting warming to 1.5°C is likely to be exceeded by 2030 (Forster et al., 2023).

Furthermore, the CO₂ emissions expected to occur over the lifetime of existing fossil fuel infrastructure already exceeds the remaining 1.5°C carbon budget (IPCC, 2023; Tong et al., 2019; Trout et al., 2022). This leaves no room for new coal mines, oil and gas fields, or fossil-fuel-burning power plants, unless existing infrastructure is retired early (IEA, 2022).

Finally, carbon capture and storage (CCS) technologies — which can be coupled to fossil fuel combustion to reduce CO₂ emissions, or coupled to bioenergy or direct air capture to remove CO₂ from the atmosphere — could play a role in addressing residual emissions for hard-to-transition sectors. However, they are not a free pass to carry on with business as usual. Even if all CCS facilities planned and under development worldwide become operational, only around 0.25 GtCO₂ would be captured in 2030 (IEA, 2023a), less than 1% of 2022 global CO₂ emissions (Liu et al., 2023). The track record for CCS deployment has been poor to date, with around 80% of pilot projects ending in failure over the past 30 years (Wang et al., 2021). Counting on these largely unproven and relatively costly technologies being rolled out at scale is thus a potentially risky and dangerous strategy.

Beyond climate, there are many other social, economic, and environmental reasons to accelerate the phase-out of fossil fuel production. The extraction and distribution of coal, oil, and gas are associated with toxic pollution and harms to public health, human rights violations and environmental injustices, and ecosystem degradation and biodiversity loss. The adverse impacts on communities living near oil and gas extraction “sacrifice zones”, where they are exposed to routine flaring and other sources of air and water pollution, have been documented from the shale fields of the US to the Niger Delta of Nigeria, with studies showing increased risks of pre-term birth, respiratory and skin diseases, cancer, and premature death (Clark et al., 2022; Cushing et al., 2020; Nwosisi et al., 2021). The communities exposed to these harmful impacts are often Indigenous people, communities of colour, or low-wealth

communities (Donaghy et al., 2023; Gonzalez et al., 2023). Over the past decade, at least 1,733 land and environmental defenders, many of whom are from Indigenous communities, have been killed while trying to protect their land from extractive industries (Global Witness, 2022). Furthermore, while fossil fuel extraction can result in economic and development benefits, they are not guaranteed. Dependency on oil and gas production and export has deepened the indebtedness, corruption, and instability of many lower- and middle-income countries (Frynas & Buur, 2020; Gaventa, 2021; Ross, 2012).

While countries have signed on to numerous climate targets and initiatives to reduce emissions and promote clean energy, few have agreed to limit fossil fuel expansion, or supported initiatives to manage its decline, beyond committing to phase down “unabated” coal power. Over 100 countries have now pledged or proposed net-zero emissions targets and also endorsed the Global Methane Pledge to cut methane emissions by 30% from 2020 to 2030, while 48 countries are part of the Powering Past Coal Alliance (Net Zero Tracker, 2023; US Department of State, 2022). Furthermore, the COP28 presidency is advancing new targets, including tripling renewable energy capacity and doubling energy efficiency and hydrogen production by 2030, as well as ending the use of “unabated” fossil fuels by mid-century (Al Jaber, 2023; Civillini, 2023; Reuters & Lo, 2023). To date, only about a dozen countries are members or endorsers of two initiatives to facilitate the managed phase-out of fossil fuel production: the Beyond Oil and Gas Alliance or the Fossil Fuel Non-Proliferation Treaty. Except for Colombia, the world’s top 35 fossil fuel producers are not among these countries.



Given the persistence of the production gap, and the urgency of limiting climate damages, now is the time for countries to acknowledge that focusing on emissions alone is insufficient. As this report and other analyses show, the production of fossil fuels must also decline at a rapid pace (see Chapter 2). Planning for a well-managed decline in the production of, and reliance on, fossil fuels is critical to ensuring an effective and equitable energy transition. Key steps in that direction are for countries to increase their investments in renewable energy and to align their fossil fuel production plans and projections with the Paris Agreement's temperature goal, as well as with their own net-zero commitments. As discussed in this report, several major fossil fuel producers have begun to develop such production projections. While still limited to scenario exercises at this stage, they nonetheless signal change and provide a positive example that other countries can follow.

Progress here would pave the way towards implementing ambitious and concrete policies for a just transition away from fossil fuels. Countries can restrict the development of new oil and gas fields and new coal mines, redirect subsidies, adopt near- and long-term targets to reduce the production and use of coal, oil, and gas, and provide support to affected communities and workers. Reduction targets for fossil fuel production can serve as an important complement to existing emissions reduction goals. However, as with tackling climate change itself, phasing out fossil fuels is a collective problem that requires governments to cooperate — a particular challenge given the highly competitive nature of international fossil fuel markets, the incentives to increase production, and countries' differentiated responsibilities and capacities to transition (Karthi et al., 2018; Pye et al., 2020).

As discussed in the 2020 Production Gap Report and elsewhere, not all countries can phase out fossil fuels at the same pace. Countries that have higher financial and institutional capacity and are less dependent on fossil fuel production can transition most rapidly, while those with lower capacity and higher dependence will require greater international support. They will require assistance and finance to pursue alternative development models, which can help break cycles of fossil fuel dependency

and indebtedness, and forge new, climate-resilient paths to prosperity (Sokona et al., 2023; Steadman et al., 2023; Winkler et al., 2022). The recently launched JETPs, which span long-time coal-dependent and coal-exporting countries (Indonesia and South Africa) as well as a potential emerging oil and gas producer (Senegal), are an important innovation in this direction (See Box 3.2).

Finally, closing the production gap will require transparent, verifiable, and consistent information on countries' plans and support for fossil fuel production. As underscored in the 2021 Production Gap Report, such information is currently incomplete, inconsistent, and scattered; instead, governments should share this information as part of their regular reporting under the United Nations Framework Convention on Climate Change.

The impacts of climate change, long predicted by scientists, are now manifesting and wreaking havoc in every corner of the planet. The fast-shrinking carbon budget means that all countries must rapidly diversify or leapfrog their energy needs and economies away from fossil fuels (CSO Equity Review, 2021; Dubash, 2023; Sokona et al., 2023). The task is unprecedented but not impossible (IPCC, 2022). It will require political will, determined implementation, and international cooperation, especially to provide support to lower-income countries. As a starting point, governments should name and confront the challenge at COP28 and beyond: the need to phase out all fossil fuels, starting now.

The remainder of this year's report is split across two chapters. Chapter 2 provides an updated assessment of the global production gap and explores the global coal, oil, and gas reduction pathways that would be consistent with the Paris Agreement's long-term temperature goal. Chapter 3 homes in on 20 major fossil-fuel-producing countries, profiling their governments' climate ambitions and existing plans, policies, and strategies that support fossil fuel production or the transition away from it.

While forgoing fossil resources will not be easy — and for many countries there is disappointingly little to report on transition plans — it will be essential if we are to avoid the worst impacts of the climate crisis.



2

The Production Gap

Key Messages

In aggregate, governments plan to produce, in 2030, around 110% more fossil fuels than would be consistent with limiting warming to 1.5°C (i.e. more than double), and 69% more than would be consistent with limiting warming to 2°C. These global production gaps grow wider out to 2050.

Government plans and projections would lead to an increase in global coal production until 2030, and in global oil and gas production until at least 2050. These production levels correspond in 2030 to 460% more coal, 29% more oil, and 82% more gas than global levels consistent with limiting warming to 1.5°C.

For each fossil fuel, the combined levels of production being planned by 10 high-income countries alone would already exceed global 1.5°C-consistent pathways by 2040, putting an equitable transition at risk.

Cost-optimized mitigation scenarios suggest that, to limit warming to 1.5°C, global coal, oil, and gas production and use should decline rapidly and substantially, starting now, alongside other key mitigation strategies such as expanding renewable energy and reducing methane emissions from all sources.

There is a strong need for governments to establish near- and long-term reduction targets for fossil fuel production and use to complement other climate mitigation benchmarks and reduce the risks of stranded assets. Countries with greater transition capacity should aim for faster reductions than the global average.

Given risks and uncertainties of carbon capture and storage and carbon dioxide removal, countries should at a minimum aim for a near total phase-out of coal production and use by 2040 and a combined reduction in oil and gas production and use by three-quarters by 2050 from 2020 levels. The potential failure of these measures to develop at scale calls for an even more rapid global phase-out of all fossil fuels.

2. The Production Gap

Since the release of the 2021 Production Gap Report, the political landscape for fossil fuels has begun to shift. After decades of negotiations, the first direct call to address fossil fuels made it into a cover decision text of the Conference of Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC). At COP26 in late 2021, governments committed to accelerate efforts towards “the phasedown of unabated coal power and phase-out of inefficient fossil fuel subsidies”, though they did not agree to address oil and gas or the production of fossil fuels (UNFCCC, 2021).

The 2022–2023 global energy crisis subsequently highlighted the geopolitical risks of fossil fuel dependence, helping to fast-track the deployment of renewable technologies and to bring peak coal, oil, and gas demand into sight (IEA, 2023c). At the same time, global fossil-fuel-derived carbon dioxide (CO₂) emissions reached a record high in 2022 (Friedlingstein et al., 2022). And although the disconnect between the continued expansion of fossil fuels and climate mitigation ambition is gaining increasing visibility and attention, few national governments are committing to and planning for a managed reduction of coal, oil, and gas production in line with a net-zero future.

This chapter assesses the collective implications of governments’ national outlooks for fossil fuel production between now and 2050 at a global level. Section 2.1 quantifies the fossil fuel production gap: the discrepancy between the global levels of fossil fuel production implied by government plans and projections and the levels consistent with limiting global warming to 1.5°C or 2°C. This represents a comprehensive re-analysis of the production gap that incorporates updated government projections as well as new mitigation scenarios assembled in the Working Group III (WGIII) contribution to the Intergovernmental Panel on Climate Change (IPCC)’s Sixth Assessment Report (AR6) (IPCC, 2022). Section 2.2 discusses the major trends and drivers of the gap and how it has changed compared to the 2021 assessment. Explored next in Section 2.3 are the global reduction pathways of coal, oil, and gas production that would be consistent with limiting warming to 1.5°C, including their sensitivity to the success of other climate mitigation measures. Section 2.4 then explores the policy implications of these findings and other lines of evidence to derive recommended global reduction targets for fossil fuel production. Section 2.5 ends with a discussion of why an equitable transition away from fossil fuel production is at risk.



2.1 The fossil fuel production gap

The analysis of the global production gap rests on the determination of two elements. The first is the pathway of fossil fuel production implied by the plans and projections of national governments. The second is the pathway of fossil fuel production consistent with the Paris Agreement’s goal of “holding the increase in global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C” (Paris Agreement, 2015, art. 2.1).

The first element relies on a compilation of government plans and projections for future fossil fuel production, featuring the most recent national outlooks from 19 of the 20 major fossil-fuel-producer countries individually profiled in Chapter 3 (outlooks for South Africa were not available) as of August 2023. Together, these 19 countries accounted for around 80% of global fossil fuel production, on a primary energy basis,¹ in 2021. Their combined production trajectories are scaled up to a global estimate, based on these countries’ projected future shares of global production (see Section 2.2 and the report’s Appendix, available [online](#)). The result is the estimated global “government plans and projections” (GPP) pathway.² This updated GPP pathway therefore reflects — to the varying

¹ Coal, oil, gas production can be quantified in terms of physical units (e.g. barrels of oil), the amount of contained energy (e.g. exajoules), or the amount of greenhouse gases released during production activities and combustion. Primary energy represents the amount of energy that can be harvested directly from fossil fuels prior to any conversion.

extent captured within each of the underlying projections — how these governments have adjusted their fossil fuel production targets in light of the evolving global energy landscape, national and international fossil fuel demand expectations, climate mitigation policies and pledges, and other factors.³

The second element — pathways for global fossil fuel production consistent with the Paris Agreement's temperature goal — is derived from long-term greenhouse gas (GHG) mitigation scenarios generated by process-based integrated assessment models (IAMs).⁴ This analysis relies on the mitigation scenarios compiled by the IPCC AR6 WGIII, focusing on two scenario categories: "C1", which limits warming to 1.5°C in 2100 with a likelihood greater than 50%, with no or limited overshoot throughout the 21st century;⁵ and "C3", which limits peak warming throughout the 21st century to 2°C with a likelihood greater than 67% (Byers et al., 2022 ; IPCC, 2022). One of the modelled outputs of these scenarios is "primary energy supply" from coal, oil, and gas. Since this variable typically accounts for both energy and non-energy uses of fossil fuels (see Appendix), it is interpreted as total fossil fuel production intended for all uses.

There are a wide variety of modelling approaches and assumptions underlying different C1 and C3 scenarios, which have important implications for the resulting fossil fuel reduction pathways (Achakulwisut et al., 2023). Consequently, a three-step scenario-selection approach has been developed and applied here.

First, the majority of the AR6-assessed scenarios rely on extensive carbon dioxide removal (CDR), mostly through bioenergy combined with carbon capture and storage (BECCS) and afforestation/reforestation (A/R) (Creutzig et al., 2021; Fuss et al., 2018). Based on a systematic literature review, Fuss et al. (2018) estimated upper "sustainable" limits of 5 billion tonnes of CO₂ per year (GtCO₂/yr)

for BECCS and 3.6 GtCO₂/yr for A/R by mid-century, due to their negative side-effects such as competition for land and loss of biodiversity. Thus, C1 and C3 scenarios relying on BECCS and A/R exceeding these levels were excluded.

Second, most IAMs do not adequately capture real-world constraints on regional CO₂ storage potential and injection rates, which influence model reliance on CCS coupled to fossil fuel use (fossil-CCS), BECCS, and direct air carbon capture and storage (DACCS) (Grant et al., 2022). Therefore, a mid-century limit of 8.6 GtCO₂/yr for total CCS has also been imposed, based on the "investable" CCS potential as estimated by Grant et al. (2022) when accounting for real-world financial, contractual, and institutional constraints.

Finally, scenarios have been selected only if they feature immediate rather than delayed climate action,⁶ and if they are compatible with achieving net-zero GHG emissions by 2100. Reaching net-zero GHGs will lead to declining long-term temperatures, which can limit the long-term impacts of climate change (IPCC, 2023). The selected 36 C1 scenarios are classified as "1.5°C-consistent" and the 64 C3 scenarios as "2°C-consistent", in keeping with previous editions of the Production Gap Reports to define pathways consistent with two different temperature outcomes (SEI et al., 2019, 2020, 2021). (See detailed methods in the Appendix; and see Box 2.1 for CCS, CDR, and abatement terminology.)

The "1.5°C-consistent" set is arguably most aligned with the Paris Agreement's long-term temperature goal and its other objectives based on the rationale and interpretation proposed by Schleussner et al. (2022), while the "2°C consistent" set is arguably not compatible with limiting warming to "well below" 2°C and does not align with the 1.5°C temperature limit.⁷ Given this, the 2021 Glasgow Climate Pact's emphasis on the 1.5°C limit, and the significant amplification of adverse climate impacts at 2°C

² The GPP pathway was called the "countries' plans and projections (CPP)" pathway in the 2021 Production Gap Report.

³ There are varying levels of detail, certainty, and intent associated with fossil fuel production targets published by governments and affiliated institutions. These targets are collectively referred to here as "plans and projections". 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, foreseeable dynamics of domestic and international demand, and/or national and international climate mitigation ambitions. Where available, the over-arching assumptions underlying a given country's projections are described in each of the country profiles featured in Chapter 3 or in the Appendix.

⁴ Process-based IAMs project cost-optimized mitigation pathways under what-if assumptions or subject to pre-defined outcomes such as carbon budget constraints consistent with limiting global warming to 1.5°C with a certain likelihood, through modelling linkages and trade-offs between energy, land use, climate, economy, and development (Wilson et al., 2021).

⁵ C1 scenarios also limit peak warming to 2°C throughout the 21st century with close to, or more than, 90% likelihood (IPCC, 2022). C2 scenarios, which limit warming to 1.5°C in 2100 with a likelihood greater than 50% but exhibit high overshoot (i.e. exceeding 1.5°C by 0.1°C–0.3°C for up to several decades), are excluded from this analysis, given their extensive reliance on long-term carbon dioxide removal; see Section 2.4.

⁶ Some scenarios in the AR6 database are designed to follow current policies or NDCs out to 2030 before starting globally coordinated mitigation. These scenarios therefore do not truly explore cost-effective pathways to limit warming to a given temperature with action starting as soon as possible. Such "delayed action" scenarios are excluded, leaving only scenarios that give the models full flexibility on the timing and extent of reductions in fossil fuel production.

relative to 1.5°C of warming (IPCC, 2018; UNFCCC, 2021), this report primarily focuses on results with respect to the 1.5°C-consistent pathways.

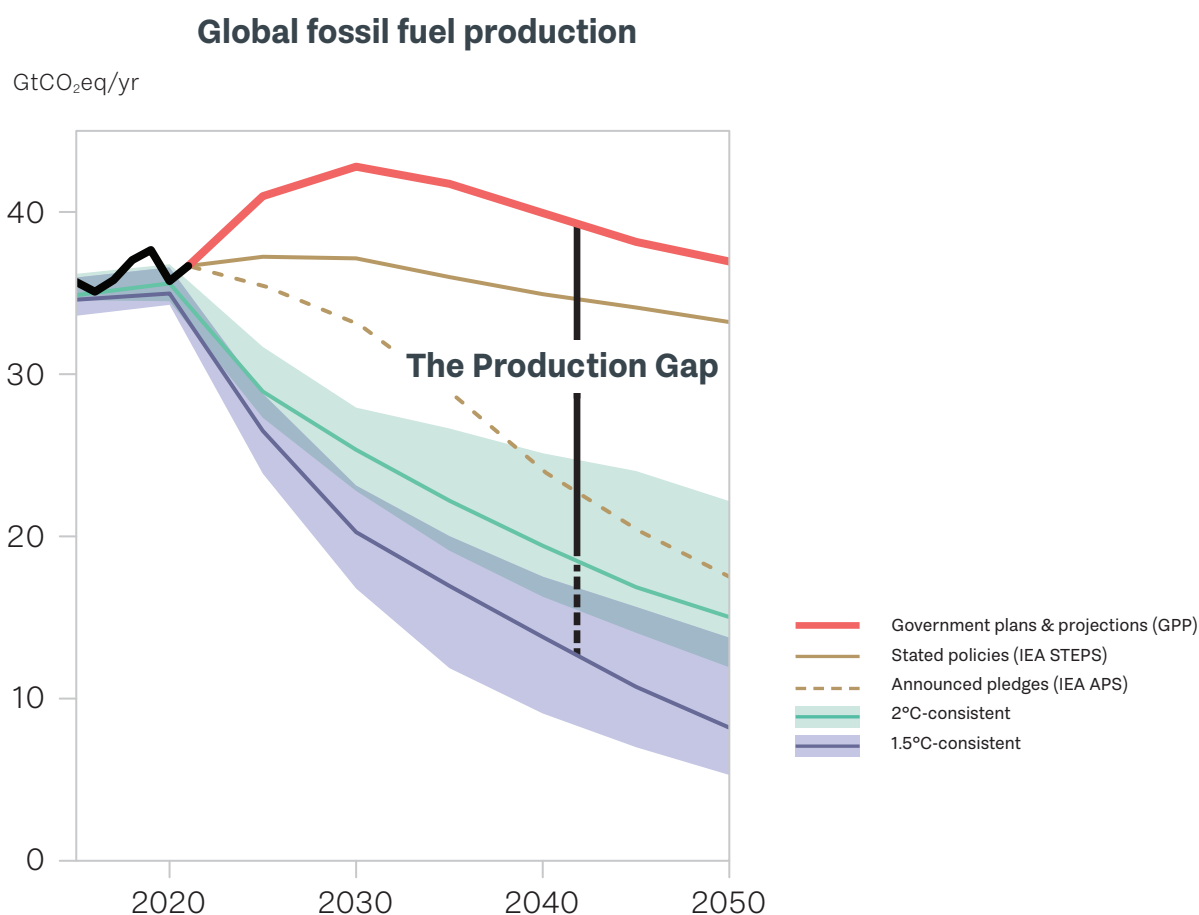
The production gap is the difference between the global level of fossil fuel production under the GPP pathway and that under the 1.5°C- or 2°C-consistent pathway in any given year, as shown in Figures 2.1 and 2.2 and summarized in Table 2.1. Two other global production pathways are shown in these figures: the pathway implied by governments' stated climate mitigation policies and

the pathway implied by governments' announced climate pledges, both as of September 2022, as modelled by the International Energy Agency (IEA, 2022c).⁸

In Figure 2.1, the production gap is denominated in billions of tonnes of CO₂ equivalent (GtCO₂eq), representing the amount of GHG emissions expected to be released from the production and combustion of extracted coal, oil, and gas.^{9,10} As shown, governments are planning on producing, in 2030, more than double the amount of fossil fuels than would be consistent with the median 1.5°C pathway

Figure 2.1

Global fossil fuel production under five pathways from 2015 to 2050, denominated in units of billion tonnes of CO₂ equivalent per year (GtCO₂eq/yr) — the amount of GHG emissions expected to be released from the production and 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 selected scenarios are shown. The black trend line shows historical 2015–2021 annual production; all other pathways are plotted at 5-year resolution.



⁷ The Paris Agreement does not provide a precise definition of what "well below 2°C" means and how these temperature limits should be used in climate policymaking (Rogelj et al., 2017; Schleussner et al., 2016). However, it has been interpreted as limiting peak warming to below 2°C with >90% likelihood (Schleussner et al., 2022), which translates to being "very likely" to limit warming to 2°C in IPCC uncertainty language. This is higher than the 67% probability that the 2°C-consistent scenarios achieve.

⁸ The IEA's Stated Policies Scenario (STEPS) is "based on a detailed sector-by-sector review of the policies and measures that are actually in place or under development". The Announced Pledges Scenario (APS) "assumes that governments will meet, in full and on time, all of the climate-related commitments that they have announced, including longer term net-zero emissions targets and pledges in nationally determined contribution (NDCs), as well as commitments in related areas such as energy access".

(i.e. around 110% more), and 69% more than would be consistent with the median 2°C pathway. These percentages translate to production gaps of 22 GtCO₂eq and 17 GtCO₂eq, respectively. The magnitude of the production gap is projected to increase over time, reaching around 29 GtCO₂eq and 22 GtCO₂eq, respectively, in 2050.

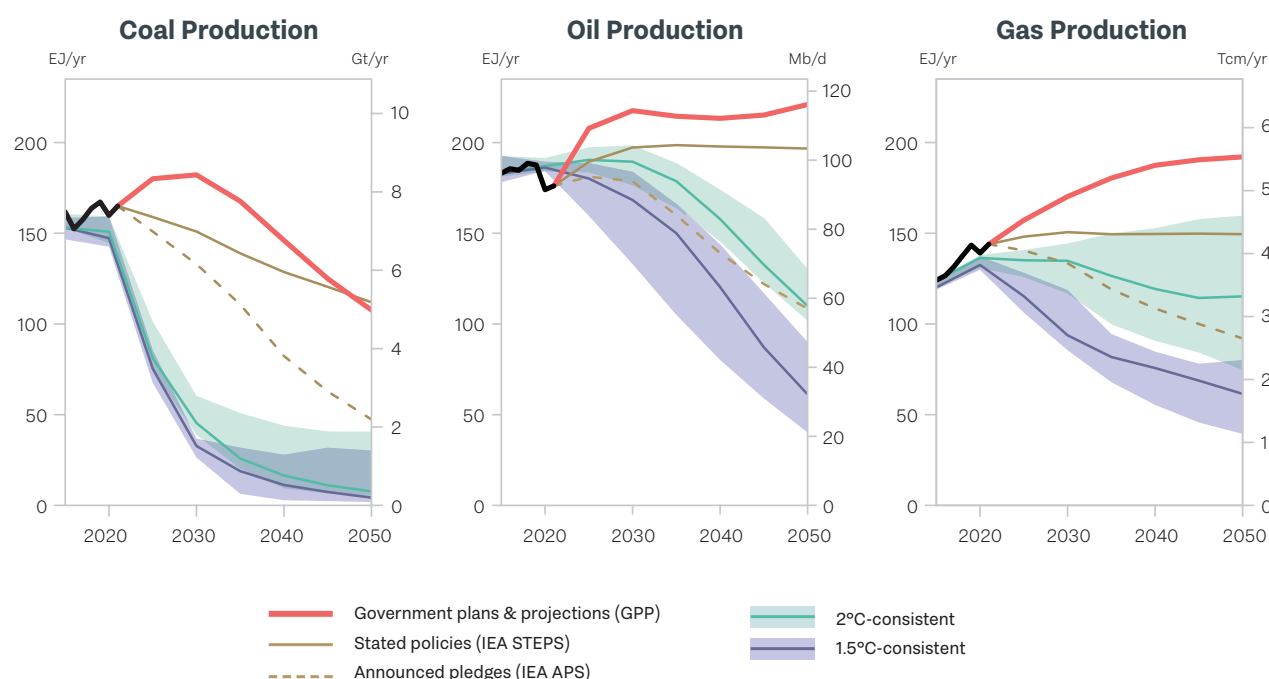
Governments' fossil fuel production plans and projections also exceed the global levels of production implied by their stated climate mitigation policies (solid gold line) by around 11–16% between 2030 and 2050 (Figure 2.1). Compared with the global production pathway implied by governments' announced climate pledges (dashed gold line), the GPP pathway is 29% higher in 2030, and 110% higher in 2050.¹¹

The production gap can also be quantified in terms of its component fuels, as shown in Figure 2.2, given that each mitigation scenario outputs primary energy supply from coal, oil, and gas explicitly. In this figure, the amounts of fossil fuel production under the five different pathways are calculated and shown in energy-based units. This enables a direct comparison of the levels of production under the GPP pathway and those under mitigation pathways as originally reported in exajoules by the latter.

Among the selected 1.5°C-consistent pathways, there is strong consensus that global coal, oil, and gas production decline rapidly and substantially between now and mid-century under society-wide decarbonization efforts and falling fossil fuel demand. As a result, the median 1.5°C-consistent pathway shows an almost total phase-

Figure 2.2

Global coal, oil, and gas production under five pathways from 2015 to 2050, denominated in exajoules (EJ) per year. Physical units for each fossil fuel 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 selected mitigation scenarios are shown. The black trend lines show historical 2015–2021 annual production; all other pathways are plotted at 5-year resolution.



⁹ Here, top-down emission factors for each fuel are calculated as the ratio of the global annual sum of GHG emissions from fuel production and combustion to the global annual sum of fuel production based on IEA statistics for 2016–2020 (the most recent five years of data available) (IEA, 2023b, 2023d). These factors account for total GHG emissions from fuel combustion plus CO₂, CH₄, and N₂O emissions from production processes; the IEA uses 100-year Global Warming Potentials (GWPs) from the IPCC's Fourth Assessment Report to calculate CO₂-equivalent emissions (see Appendix for details).

¹⁰ While methodological differences mean that the production gap quantification cannot be directly compared to the "emissions gap" assessments (UNEP, 2022), the production gap effectively represents the portion of the emissions gap attributable to fossil fuels.

¹¹ The IEA estimates that GHG emissions from all sources under its STEPS and APS scenarios would lead to a long-term temperature rise of around 2.5°C and 1.7°C by 2100, respectively (each with a 50% probability) (IEA, 2022c, p. 107). Assuming all other GHG emission sources are equivalent, the levels of fossil fuel production under this report's GPP pathway are higher than those in the STEPS scenario and therefore would likely imply greater warming (unquantified here).

out of coal and deep reductions in oil and gas production in this period. These reductions, and the relative contributions of different fossil fuels, are also contingent on the success of other mitigation strategies, including CDR and fossil-CCS deployment. As explored further in sections 2.3 and 2.4, even deeper fossil fuel reductions would be required if these methods fail to deliver at scale.

In stark contrast, governments are in aggregate planning to increase oil and gas production out to at least 2050, creating ever-widening production gaps (Figure 2.2). The production gap for oil is 26 million barrels per day (Mb/d) in 2030 and 84 Mb/d in 2050. The gap for gas is 2.2 trillion cubic meters (Tcm) in 2030 and 3.8 Tcm in 2050. This translates to oil and gas under the GPP pathway being around 29% and 82% higher than their respective levels under the median 1.5°C-consistent pathway in 2030. By 2050, the respective percentages grow to 260% and 210%.

For coal, the GPP pathway show a short-term increase out to 2030 before a decline (Figure 2.2). Given that all of the selected 1.5°C-consistent pathways show very rapid and deep reductions in coal between now and 2030, the production gap for coal is largest in magnitude in the near-term: 6.9 billion tonnes of coal in 2030 and 4.8 billion tonnes in 2050. In relative terms, global coal production

under the GPP pathway is around 460% higher in 2030 and 2400% higher in 2050 than the median 1.5°C-consistent pathway.

As shown in Figure 2.2, global coal, oil, and gas production levels under the GPP pathways also each exceed levels implied by governments' stated climate mitigation policies and announced pledges as modelled under the IEA's STEPS and APS scenarios, respectively.

As detailed in Chapter 3, only a few countries have begun to consider the alignment of their fossil fuel production and export targets with national and international climate goals. Given that governments' production plans and targets help to influence, legitimize, and justify continued investments in fossil fuel infrastructure, there is a real risk that current production plans are undermining the energy transition by exacerbating "carbon lock-in" and entrenching fossil fuel dependence (Seto et al., 2016). At the same time, many of these planned production projects could also become stranded assets as the world decarbonizes and fossil fuel extraction targets fail to reflect falling demand and changing sociopolitical realities (Kemfert et al., 2022; Semieniuk et al., 2022). This is especially true given that the committed emissions of CO₂ expected to occur over the lifetime of existing fossil-fuel-production

Table 2.1

The fossil fuel production gaps in 2030, 2040, and 2050. Shown values represent the differences between global production levels under the GPP pathway and the median (and interquartile range, IQR, shown in brackets) levels under the selected 1.5°C- and 2°C-consistent pathways. Values are rounded to two significant figures.

Year	Coal		Oil		Gas		Total	
	EJ/yr	%	EJ/yr	%	EJ/yr	%	GtCO ₂ eq/yr	%
Production gap relative to 1.5°C-consistent pathways								
2030	150 (150–160)	460 (390–590)	49 (38–84)	29 (19–62)	76 (52–85)	82 (43–99)	22 (20–26)	110 (85–150)
2040	130 (120–140)	1200 (420–5100)	93 (70–130)	77 (49–160)	110 (100–130)	150 (120–240)	26 (22–31)	190 (130–340)
2050	100 (77–110)	2400 (260–5800)	160 (130–180)	260 (150–440)	130 (110–150)	210 (140–390)	29 (23–32)	350 (170–600)
Production gap relative to 2°C-consistent pathways								
2030	140 (120–140)	300 (200–370)	28 (20–40)	15 (10–23)	53 (26–170)	26 (18–46)	17 (15–20)	69 (53–87)
2040	130 (100–140)	790 (230–1500)	56 (40–67)	35 (23–46)	97 (35–190)	57 (23–110)	20 (15–24)	110 (59–150)
2050	100 (67–100)	1300 (160–1900)	110 (92–120)	100 (71–120)	120 (32–190)	67 (20–160)	22 (15–25)	150 (67–210)

infrastructure already exceed the remaining carbon budget for a 50% chance of limiting warming to 1.5°C by 2100 (IPCC, 2023; Trout et al., 2022). Moreover, according to the latest IEA projections, global coal, oil, and gas demand are expected to peak within this decade even without any new climate policies (IEA, 2023c).

2.2 A breakdown of the government plans and projections (GPP) pathway

This section discusses the individual plans and projections of major fossil fuel producer countries that underlie the global coal, oil, and gas GPP pathways, and explores how the overall production gap has changed compared to the 2021 assessment.

The 2023 GPP pathways are informed by the plans and projections of 19 of the 20 major producer countries featured in Chapter 3 (data were not available for South Africa; new countries compared to the 2021 production gap assessment are denoted with an asterisk): Australia, Brazil, Canada, China, Colombia*, Germany, India, Indonesia, Kazakhstan, Kuwait*, Mexico, Nigeria*, Norway, Qatar*, the Russian Federation, Saudi Arabia, the United Arab Emirates (UAE), the United Kingdom of Great Britain and Northern Ireland (UK), and the United States of America (US). Among these 19 countries, government plans and projections are available for nine producer countries for coal (accounting for 93% of global production in 2021 on an energy basis), 17 countries for oil (74% of global production), and 18 countries for gas (72% of global production).

Figure 2.3 shows the individual contributions of these 19 countries to the global coal, oil, and gas GPP pathways. The global values shown by the red lines are equivalent to the GPP pathways shown in Figure 2.2 and sum up to the total GPP pathway shown in Figure 2.1. These are estimated by scaling the aggregated production levels of the 19 countries shown, based on their future shares of global coal, oil, and gas production as modelled in IEA STEPS (IEA, 2022c) (see Appendix for further details).¹²

The global GPP pathways show that, compared with 2020 levels, annual oil and gas production are projected to increase by 27% and 25% by 2030, and by 29% and 41% by 2050, respectively. Annual coal production is projected to increase by 10% between 2020 and 2030, before falling by 41% between 2030 and 2050. Under the GPP

pathways for each fuel, the planned/projected production levels by two to five major producer countries would account for around half of the global total between now and 2050.

The near-term increase in coal production is led by India, Indonesia, and the Russian Federation. Other countries (Australia, Colombia, and Kazakhstan) project relatively flat or slightly increasing levels of coal production between 2021 and 2030. The long-term decline in global coal production is led by China, whose domestic coal production is estimated to decrease steeply between 2030 and 2050 in alignment with the country's 2060 carbon-neutrality goal (see China's country profile in Chapter 3).

The projected near-term increase in oil is led by Brazil, Canada, the Russian Federation, Saudi Arabia, and the US. Of the 17 countries assessed, seven foresee relatively flat or increasing levels of annual oil production from 2021 until 2040–2050. For gas, the near-term increase is led by China, Nigeria, Qatar, the Russian Federation, and the US, while eight countries foresee relatively flat or increasing levels of annual gas production from 2021 until 2035–2050. Projected long-term declines in oil and gas production in certain countries, such as Norway and the UK, are primarily due to resource depletion, rather than an active transition (see Chapter 3).

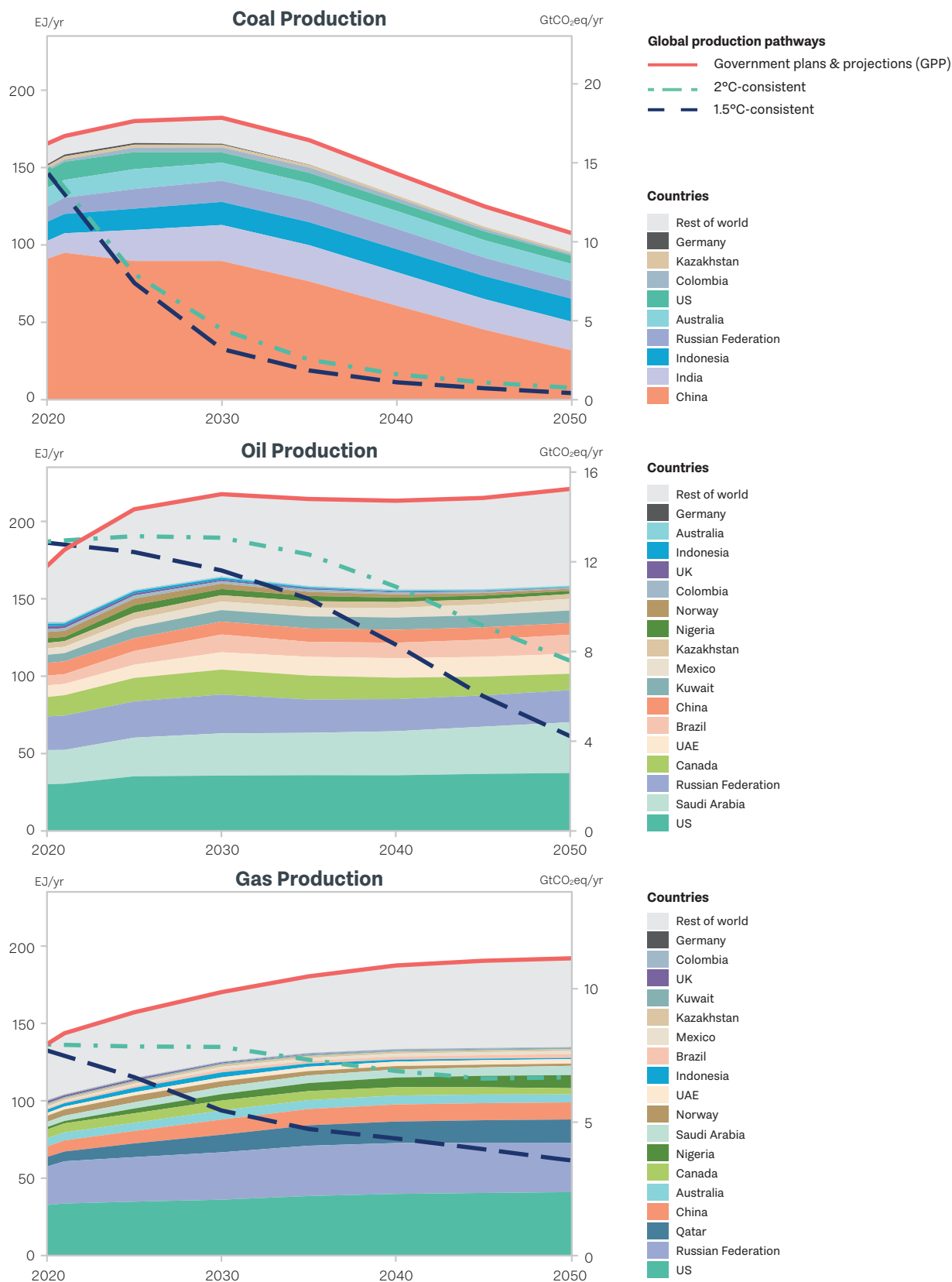
It is challenging to directly compare the 2023 production gap to previous assessments for several reasons. This year's assessment of global GPP pathways is more comprehensive, since it is informed by the plans and projections of four additional countries and now extends to 2050 compared to 2040 previously. The lack of regular, standardized reporting of fossil fuel production projections by countries is another confounding factor.¹³ Furthermore, the mitigation scenarios assessed in AR6 represent a largely different ensemble and are therefore not directly comparable to those assessed in the IPCC Special Report on Global Warming of 1.5°C (SR1.5) (Huppmann et al., 2019), which were used in previous production gap analyses. Additional criteria applied in the mitigation scenario selection, as described above, also have implications for the resulting 1.5°C- and 2°C-consistent median pathways, especially for the latter. Given these considerations, only broad comparisons are drawn below for changes in the production gap with respect to the 1.5°C-consistent pathway (see Appendix for details).

¹² For some countries and fuels, government plans and projections end before 2050. To extrapolate all countries' projections to 2050, this analysis uses the percentage change for a given country and fossil fuel as modelled under the IEA's STEPS. This scenario reflects existing policies as of 2022; thus, this is likely a conservative extrapolation approach, given that estimated global production under the GPP pathway is higher than under the STEPS (as shown in Figures 2.1 and 2.2).

¹³ 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 and/or create new scenarios, which makes comparison over time difficult.

Figure 2.3

Individual countries' contributions (stacked area charts) to global production estimated under the GPP pathways (red lines). For each fuel, countries are plotted in order of decreasing cumulative 2020–2050 production, from bottom to top. The median 1.5°C- and 2°C-consistent global production pathways are overlaid (dashed blue and green lines). 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-equivalent emissions on the secondary axes (GtCO₂eq/yr). (Throughout this report, globally averaged emission factors are applied for each fuel in all countries. See the Appendix for details.)



Compared with the 2021 assessment, the global production gap with respect to the median 1.5°C-consistent pathway for coal is wider by 2030 and remains roughly the same for 2040. Almost half of the increase in the 2030 gap is due to an increase in the underlying government projections. The remaining increase can be explained by a reduction in the modelled level of coal supply under the median 1.5°C-consistent pathway due to a faster coal phase-out in the selected AR6 versus SR1.5 mitigation scenarios. For 2040, the coal production gap has remained almost the same due to almost equivalent reductions in both the GPP and median 1.5°C-consistent levels. For oil, the production gap in the 2023 assessment is narrower in both 2030 and 2040 under the 2023 assessment. This is mainly due to the median 1.5°C-consistent pathway allowing a slightly slower oil decline, which is balanced by a much faster phase-out for coal and a slightly faster near-term reduction for gas. Meanwhile, the gas production gap widens for 2030 and slightly decreases for 2040. The small increase in the 2030 gap is mainly because of the larger near-term gas reduction modelled in the median 1.5°C-consistent pathway. The small decline for 2040 is mainly due to a decrease in the underlying government projections. In sum, these changes largely cancel each other out to leave the overall production gap largely unchanged for both 2030 and 2040 (i.e. differing by no more than 1–3 GtCO₂eq/yr).

2.3 Global coal, oil, and gas reduction pathways consistent with limiting warming to 1.5°C

As previously described, governments' plans and projections, taken together, would lead to global oil and gas production rising out to 2050, while coal increases out to 2030. This section explores in detail the global reduction pathways of coal, oil, and gas production that would be consistent with limiting long-term warming to 1.5°C, including their sensitivity to the success of other climate mitigation strategies and other model assumptions.

Mitigation scenarios generated by process-based IAMs, like those assembled for AR6 and analysed here, have

become widely used to provide policy-relevant insights for how the world's energy and land-use systems can be transformed in the most cost-effective way to limit global warming to a given temperature outcome (Kikstra et al., 2022; McLaren & Markusson, 2020; Riahi et al., 2022; van Beek et al., 2020). Such scenarios generally model different combinations and extents of the following mitigation strategies to achieve net-zero CO₂ emissions: (1) reducing coal, oil, and gas supply and demand; (2) transforming agricultural and other land-use practices; (3) reducing energy and material consumption in end-use sectors; and (4) deploying fossil-CCS and CDR (see Box 2.1). Reducing non-CO₂ GHGs such as methane (CH₄) is another important mitigation lever (UNEP & CCAC, 2021). The relative contributions of these mitigation options reflect differences in the underlying model framework, scenario design, and input parameters and assumptions such as technological performance and adoption, economic relationships, and cost optimization (Achakulwisut et al., 2023; Harmsen et al., 2021).

Figure 2.4 shows the global pathways for coal, oil, and gas production and six other variables modelled under different subsets of or individual scenarios within the selected 1.5°C-consistent set. The pathways plotted in each figure panel are as follows: (1) the median pathway (and percentile ranges) calculated using all of the 36 selected 1.5°C-consistent scenarios; (2) the median pathway calculated from three scenarios that do not rely on CDR beyond their cumulative "feasible potential" based on expert consensus (Grant et al., 2021b),¹⁴ representing a low-CDR-reliance perspective; and (3) three "illustrative mitigation pathways" (IMPs) chosen by IPCC AR6 WGIII to reflect different prominent mitigation strategies for limiting warming to 1.5°C with no or limited overshoot (Riahi et al., 2022).¹⁵ Additionally, given its prominence in energy policy discourses, the figure also features the IEA's 2023 update of its net-zero emissions by 2050 (NZE) scenario (IEA, 2023c). Key statistics from Figure 2.4 are highlighted in Table 2.2, and detailed in Table A.5 in the Appendix.

¹⁴ The cumulative 2020–2100 limits are 224 GtCO₂ for afforestation, 196 GtCO₂ for BECCS, and 320 GtCO₂ for DACCS. Surveyed experts were asked to consider the technical potential for each CDR method (e.g. geological CO₂ storage capacity) as well as non-technical constraints such as sustainability (e.g. large-scale conversion of land to bioenergy crops) and societal and governance considerations (Grant et al., 2021b).

¹⁵ IMP-LD features a strong emphasis on energy demand reduction (Grubler et al., 2018), IMP-Ren relies heavily on renewables deployment and electrification (Luderer et al., 2022), while IMP-SP achieves net-zero emissions in alignment with other sustainable development goals (Soergel et al., 2021).

¹⁶ In this figure, methane (CH₄) emissions from the energy sector are converted to CO₂-equivalent emissions using 100-year time horizon Global Warming Potential values provided in Table 7.15 of the Working Group I contribution to the IPCC AR6: 29.8 for fossil-CH₄ (IPCC, 2021).

Figure 2.4

2010–2050 global pathways of nine variables modelled under subsets of or individual 1.5°C-consistent scenarios (see text for scenario descriptions): (a–c) coal, oil, and gas production; (d) primary energy supply from non-biomass renewables; (e) CO₂ emissions from the energy sector; (f) methane emissions from the energy sector; (g) CO₂ emissions captured and stored from fossil fuel combustion (fossil-CCS); (h) CO₂ captured and stored from bioenergy use (BECCS); and (i) CO₂ removed and sequestered by land use practices. The units and number of scenarios (“n”) reporting each variable are shown inset (not all scenarios report each of the variables shown). In panels a–c, global coal, oil, and gas production under historical (black line) and GPP pathways (red line) are also shown.

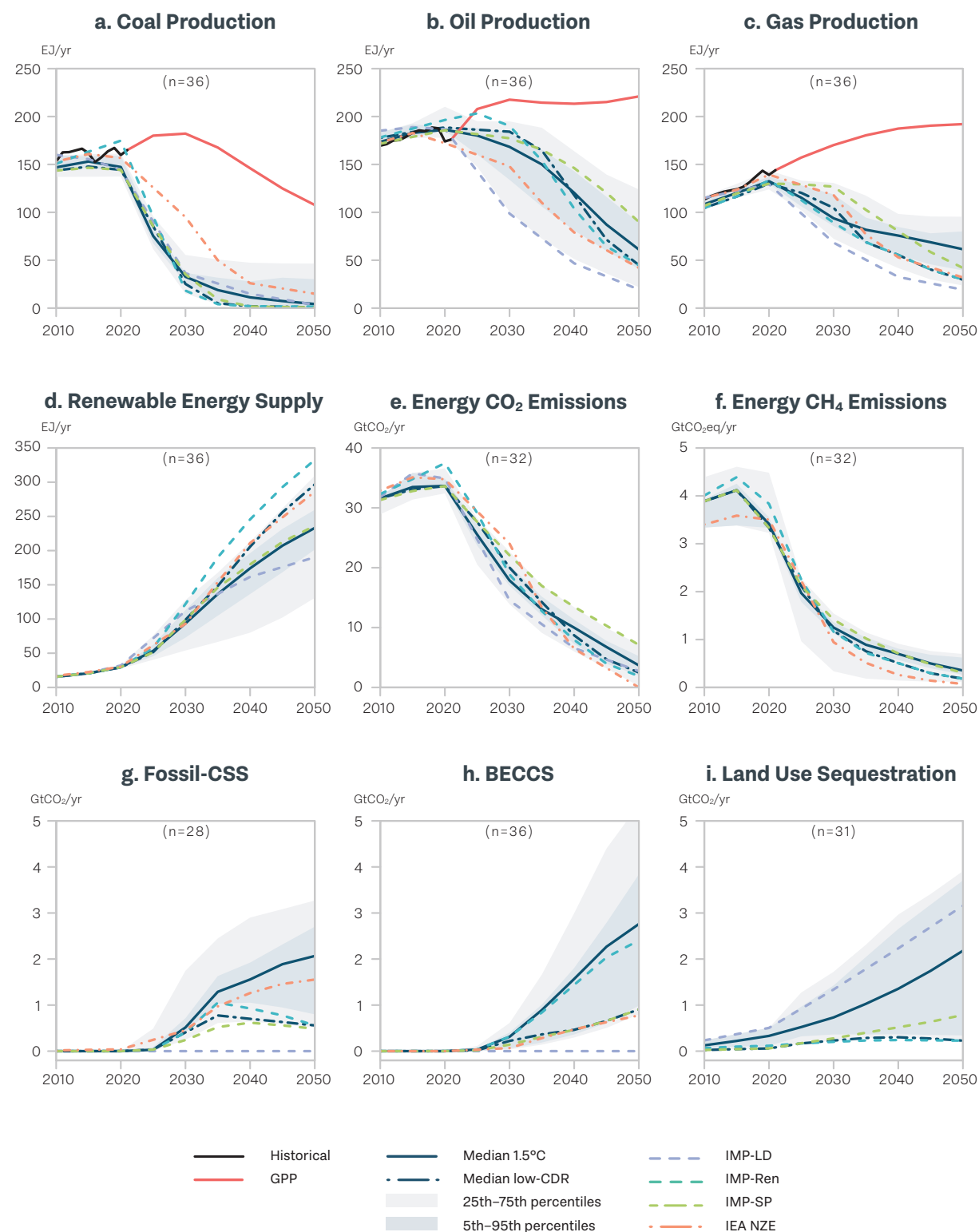


Table 2.2

Summary of values for variables under 1.5°C-consistent pathways shown in Figure 2.4. Values are rounded to two significant figures. (For values from IMP-Ren and IMP-SP, see the Appendix, Table A.5.)

Variable	2030				2040				2050			
	Median pathway	Median low-CDR pathway	IMP-LD	IEA NZE	Median pathway	Median low-CDR pathway	IMP-LD	IEA NZE	Median pathway	Median low-CDR pathway	IMP-LD	IEA NZE
Percent change relative to 2020												
Coal production	-78%	-83%	-75%	-39%	-92%	-99%	-90%	-83%	-97%	-99%	-98%	-90%
Oil production	-10%	-2%	-47%	-14%	-35%	-37%	-75%	-54%	-67%	-76%	-90%	-76%
Gas production	-29%	-19%	-47%	-15%	-43%	-57%	-75%	-62%	-54%	-77%	-85%	-77%
Combined oil and gas production ^a	-18%	-9%	-47%	-15%	-38%	-46%	-75%	-58%	-62%	-77%	-88%	-76%
Renewable energy supply	220%	240%	250%	210%	490%	600%	410%	590%	690%	910%	500%	840%
Energy CO ₂ emissions	-47%	-40%	-58%	-31%	-70%	-74%	-81%	-81%	-89%	-93%	-92%	-100%
Energy CH ₄ emissions	-63%	-65%	No data	-73%	-79%	-85%	No data	-93%	-90%	-95%	No data	-98%
Annual value (GtCO ₂ /yr)												
Fossil-CCS	0.51	0.41	0	0.45	1.6	0.70	0	1.3	2.1	0.56	0	1.6
BECCS	0.31	0.22	0	0.067	1.6	0.46	0	0.47	2.8	0.91	0	0.78
DACCS ^a	0.0029	0	0	0.069	0.043	0	0	0.30	0.25	0	0	0.62
Land use sequestration	0.73	0.23	1.3	N/A ^b	1.4	0.30	2.2	N/A ^b	2.2	0.23	3.2	N/A ^b

^a Not plotted in Figure 2.4.

^b The IEA NZE does not model land-use systems, focusing only on energy. As such, it does not incorporate carbon sequestration via conventional land-based methods.



Also shown in panels a–c of Figure 2.4 are the global coal, oil, and gas production estimated under the GPP pathways, illustrating the sensitivity of the production gap estimate relative to the chosen reference 1.5°C-consistent pathway for each fuel.

Under the median 1.5°C-consistent pathway, global production of coal, oil, and gas — intended for all uses — decreases by 97%, 67%, and 54%, respectively, between 2020 and 2050. These reductions are contingent upon the assumption that, by 2050: 1) fossil fuel abatement technologies will be available and cost-effective at scale, resulting in 2.1 GtCO₂ emitted annually from fossil fuel combustion being captured and stored; 2) conventional and novel CDR measures (see Box 2.1) will remove and sequester around 5.2 GtCO₂/yr from the atmosphere; and 3) roughly 20% of oil and 35% of gas produced will go towards non-energy uses.¹⁷ In parallel, between 2020 and 2050, coal use without CCS is effectively phased out by 2040, while oil and gas use without CCS each decrease by close to 70%. Energy supply from non-biomass renewables increases almost eight-fold, making up 88% of the electricity mix by 2050. Global annual methane emissions are reduced by 58% for all sources, and by 90% from fossil fuel production activities, by 2050 from 2020 levels.

Three key insights emerge from this analysis of different 1.5°C-consistent pathways. First, to stay on track to achieve net-zero CO₂ emissions by mid-century and limit long-term warming to 1.5°C, global production of all three fossil fuels needs to decline substantially between now and 2050, in parallel with other key climate mitigation strategies such as reducing fossil fuel demand, increasing renewable energy generation, and reducing methane emissions from all sources, including oil and gas production activities. In particular, as can be seen from the pathways plotted in Figure 2.4, global coal, oil, and gas production each decrease from 2020 onwards regardless of whether a given pathway deploys fossil-CCS or not.

Second, the extent of the modelled reductions in global coal, oil, and gas production are particularly sensitive to assumptions around fossil-CCS and CDR potential. For example, the IMP-LD (low-energy demand) scenario does not rely on any CCS (coupled to fossil fuels, bioenergy, or

direct air capture) due to concerns over innovation failure, investment risks, and public opposition, and consequently charts out one of the fastest coal, oil, and gas reduction trajectories among the selected 1.5°C-consistent scenarios (though it does rely extensively on conventional CDR). Similarly, imposing “feasible potential” limits on the cumulative 2020–2100 levels of afforestation, BECCS, and DACCS (see footnote 14) would see much larger reductions in coal, oil, and gas between 2020–2050 than the median of all selected 36 scenarios, especially for gas (Figure 2.4 and Table 2.2).

Third, reduction targets for coal, oil, and gas depend on and influence one another. For example, in the near-term out to 2030, the IEA NZE models relatively slower coal and gas reductions than the median 1.5°C-consistent pathway, but faster for oil. In the longer-term, the IEA NZE models relatively larger reductions in oil and gas but a more gradual coal phase-out. Therefore, it is important to establish near- and long-term reduction targets for all three fossil fuels — rather than focusing on coal alone, as in prior COP decision texts (UNFCCC, 2021, 2022) — to stay on track to limiting warming to 1.5°C.

Ultimately, the pace and extent of the required reductions in global coal, oil, and gas production will also depend on many normative and values-based choices, which cannot be adequately informed by scenarios generated by cost-optimized IAMs alone (Smith et al., 2023; Stern et al., 2022; Stoddard et al., 2021). The global reduction targets in coal, oil, and gas production presented in this section, especially under the median 1.5°C-consistent pathway, should be viewed as general guidelines for minimum-ambition-setting rather than definitive benchmarks. Decision makers should also consider other lines of scientific evidence and weigh other factors. The latter include, for example, considering which decarbonization roadmaps may be more feasible to attain given real-world constraints, more desirable with respect to other important societal and environmental outcomes, and more precautionary in terms of safeguarding public and planetary health, as well as how to fairly share the remaining carbon budget in terms of fossil fuel extraction. The next two sections explore these issues further in order to derive recommended targets for reductions in global fossil fuel production.

¹⁷ These estimates are a rough approximation since the relevant variables are inconsistently reported by the scenarios. Non-energy uses can lead to either long-term carbon storage in stable physical products or eventual combustion. For example, up to 40% of discarded plastics are burned globally (OECD, 2022). Estimates suggest that around 0.02% of coal, 8.02% of oil, and 1.86% of gas produced do not lead to eventual carbon emissions (Heede, 2014).

Box 2.1 Carbon dioxide removal (CDR), carbon capture and storage (CCS), and fossil fuel abatement

Following the State of Carbon Dioxide Removal report (Smith et al., 2023), CCS coupled to fossil fuel combustion is referred to in this report as fossil-CCS to distinguish it from the novel CDR methods of CCS coupled to bioenergy (BECCS) or direct air capture (DACCS).

- To count as CDR, a method must be an intervention which captures CO₂ from the atmosphere (Principle 1) and stores it for a long period of time (Principle 2).
- CCS and carbon capture and utilization (CCU) are a set of industrial methods for the chemical capture of CO₂ and its concentration into a pure stream, followed by its subsequent geological storage (CCS) or conversion into products (CCU). Where the CO₂ comes directly from fossil fuels, this process does not meet Principle 1 and counts as an emissions reduction rather than CDR. CCS can, however, also be applied to CO₂ streams generated from biomass or directly from the air, in which cases the overall process meets both

Principle 1 and Principle 2, and counts as CDR. Currently, carbon capture, utilization, and storage (CCUS) costs vary greatly by CO₂ source, ranging from USD 13 to USD 342 per tonne of CO₂ (Baylin-Stern & Berghout, 2021).

- Almost all current CDR of about 2 GtCO₂/yr comes from conventional management of land (e.g. afforestation/reforestation, peatland and wetland restoration); only a tiny fraction — 0.002 GtCO₂/yr — results from novel methods (e.g. BECCS, DACCS, ocean alkalization) (Smith et al., 2023).

Following the IPCC AR6 WGIII definition, fossil fuel abatement in this report refers to human interventions that reduces the release of GHGs from activities during the fossil fuel lifecycle. This includes, for example, capturing 90% or more CO₂ from coal- or gas-fired power plants, or 50–80% of fugitive methane emissions from fossil-fuel-based energy supply (IPCC, 2022).

2.4 Policy implications I: why a global fossil fuel phase-out is needed to limit warming to 1.5°C

There are reasons to phase out all three fossil fuels even more quickly than modelled under the median 1.5°C-consistent pathways plotted in Figures 2.1–2.2. This section explores four key reasons why an accelerated phase-out may be necessary and desirable.

First, even after applying the selection criteria described in Section 2.1 aimed at avoiding excessive CCS and CDR reliance, the majority of the 1.5°C-consistent scenarios analysed in this report still assume that fossil-CCS and CDR can be deployed at significant levels from 2030 onwards (Table 2.2). However, it remains highly uncertain whether these new technologies will become viable at scale (IEA, 2022b; Smith et al., 2023).

As described in the previous section, under the median 1.5°C-consistent pathway, around 2.1 GtCO₂/yr of fossil-fuel-combustion emissions are captured and stored by 2050. However, the track record for CCS deployment has

been very poor to date, with around 80% of pilot projects over the last 30 years ending in failure (Wang et al., 2021). The annual capacity from operational CCS projects that result in dedicated CO₂ storage currently sum up to less than 0.01 GtCO₂/yr (IEA, 2023a). There is concern that a range of institutional, technical, and financial barriers will constrain CCS deployment (Grant et al., 2022; Lane et al., 2021), and rates of CCS deployment continue to fall below expectations and remain far below those modelled in IAMs (IPCC, 2023). Many of the scenarios modelling higher gas levels in the long-term are generated by IAMs that do not impose sufficient constraints on CO₂ storage potential and injection rates (Achakulwisut et al., 2023). If fossil-CCS fails to scale to the levels envisaged by these scenarios, reductions in fossil fuel production and use need to be even faster.

Likewise, if CDR deployment fails to scale to the levels envisaged by these scenarios, deeper cuts in fossil fuels would be required. In particular, the level of long-term gas production modelled in 1.5°C-consistent scenarios is

particularly sensitive to assumptions around fossil-CCS and CDR (see figure A.3 in the Appendix). Under the median 1.5°C-consistent pathway, around 2.2 GtCO₂/yr is sequestered by conventional land-based methods and around 3.0 GtCO₂/yr by novel methods (e.g. BECCS, DACCS) by 2050. Currently, almost all CDR comes from conventional methods (2 GtCO₂/yr), with novel methods contributing 0.002 GtCO₂/yr (Smith et al., 2023). A precautionary approach would involve minimizing CDR reliance, given both the uncertainty in the feasibility of its large-scale deployment (Grant et al., 2021b; Smith et al., 2023) and potential negative impacts including land degradation, food insecurity, biodiversity loss, and water scarcity (Calvin et al., 2021; Fuss et al., 2018; IPCC, 2022). As shown in Table 2.2, if only 1.5°C-consistent scenarios that do not exceed the “feasible potential” limits of A/R, BECCS, and DACCS are considered (see footnote 14), the modelled 2020–2050 reductions become 99%, 76%, and 77% for coal, oil, and gas, respectively. Even if CDR does successfully scale, using CDR to enable continued fossil fuel combustion is arguably a risky and sub-optimal climate mitigation strategy, and CDR should be viewed as a tool to address emissions from hard-to-transition sectors, rather than as an alternative to actual emission reductions (Grant et al., 2021a; Smith et al., 2023).

Second, AR6-assessed mitigation scenarios generally do not adequately capture real-world technology innovation, adoption, diffusion, and path-dependencies. However, the energy transition will be highly path-dependent, with the cost of key fuels and technologies changing as the energy transition develops (Aghion et al., 2019; Mercure et al., 2016). In particular, economies of scale mean that the cost of low-carbon technologies will continue to fall as their deployment expands. This could drive a virtuous cycle of coupled cost reductions and accelerated deployment, which few models account for (Grubb et al., 2021; Way et al., 2022). At the same time, fossil fuels will likely experience diseconomies of scale as the infrastructure required for fossil fuel extraction, distribution, and consumption shrinks (Grubert & Hastings-Simon, 2022; IMF, 2023). This will likely increase the costs of maintaining fossil fuel infrastructure during what some researchers have called the “mid-transition” (20–80% penetration of renewable systems), which could further accelerate the transition towards renewables and increase the economic desirability of phasing out coal, oil, and gas (Grubert & Hastings-Simon, 2022).



Some AR6-assessed mitigation scenarios that model relatively high levels of gas supply in the long term exhibit a gas-rebound trajectory, in which gas supply declines in the near term followed by a revival after around mid-century, enabled by high fossil-CCS and CDR (Achakulwisut et al., 2023). However, such a rebound seems highly questionable given energy system inertia, and is likely partly due to inadequate model representation of technology path-dependencies and lack of constraints on regional CO₂ storage capacity. Omitting such pathways from the selected 1.5°C-consistent set would imply an even larger 2020–2050 reduction in gas production of 68% rather than 54% under the median pathway.

Third, the mitigation scenarios analysed here explore how society can achieve net-zero CO₂ emissions in the most cost-effective way without accounting for the localized and near-term non-climatic harms of coal, oil, and gas extraction and burning. As such, scenarios that rely on CCS and CDR to enable continued fossil fuel production and use, in effect, ignore these harms. For example, exposure to outdoor fine particulate matter pollution from fossil fuel combustion leads to around 8.7 million premature deaths worldwide each year (Vohra et al., 2021). In addition, continued fossil fuel extraction perpetuates toxic air and water pollution and associated health harms (Buonocore et al., 2023; Donaghy et al., 2023; Raimi et al., 2022), human rights violations (Temper et al., 2018), and biodiversity loss and ecosystem degradation (Harfoot et al., 2018) in affected regions. The benefits of an accelerated and complete phase-out of fossil fuels are therefore even more compelling when the non-climatic harms of continued fossil fuel dependence are also accounted for (Achakulwisut et al., 2022).

Finally, other research has shown that the emissions of CO₂ expected to occur over the lifetime of existing fossil-fuel-production (and -combustion) infrastructure already exceed the remaining carbon budget for a 50% chance of limiting warming to 1.5°C by 2100 (IPCC, 2023; Tong et al., 2019; Trout et al., 2022). This leaves no room for new coal mines and oil and gas fields, unless existing infrastructure is retired early. Indeed, the IEA NZE scenario foresees no need for new coal mines or oil and gas fields after 2021 amid declining fossil fuel demand (IEA, 2021, 2023c).

In summary, when real-world constraints are considered for potential fossil-CCS and CDR development and energy system phase-out path-dependencies, cost-optimized scenarios suggest that countries should strive to phase out fossil production even faster than in the median pathways displayed in Figures 2.1–2.2.

For example, as detailed in Table 2.2., the median low-CDR pathway sees combined oil and gas production reducing by 77% by 2050 from 2020 levels, which is similar to the 76% reduction modelled by the IEA NZE. Meanwhile, one mitigation scenario, the so-called IMP-LD, which relies only on conventional CDR and no CCS coupled to fossil fuels, bioenergy, or direct air capture, sees reductions in global oil and gas production of 90% and 85%, respectively, between 2020 and 2050. In the case of coal production, the median low-CDR pathway shows a reduction of 99% by 2040.

These results altogether suggest that countries should be aiming for a near total phase-out of global coal production and use by 2040, and to reduce oil and gas combined by around three-quarters by 2050 from 2020 levels. In light of escalating climate impacts and the considerable non-climatic and near-term harms of fossil fuels, as well as the possibility for fossil-CCS and CDR to not reach their estimated total feasible potential, these reductions should be seen as minimum targets, with countries striving to phase out the production and use of all fossil fuels as soon as possible.

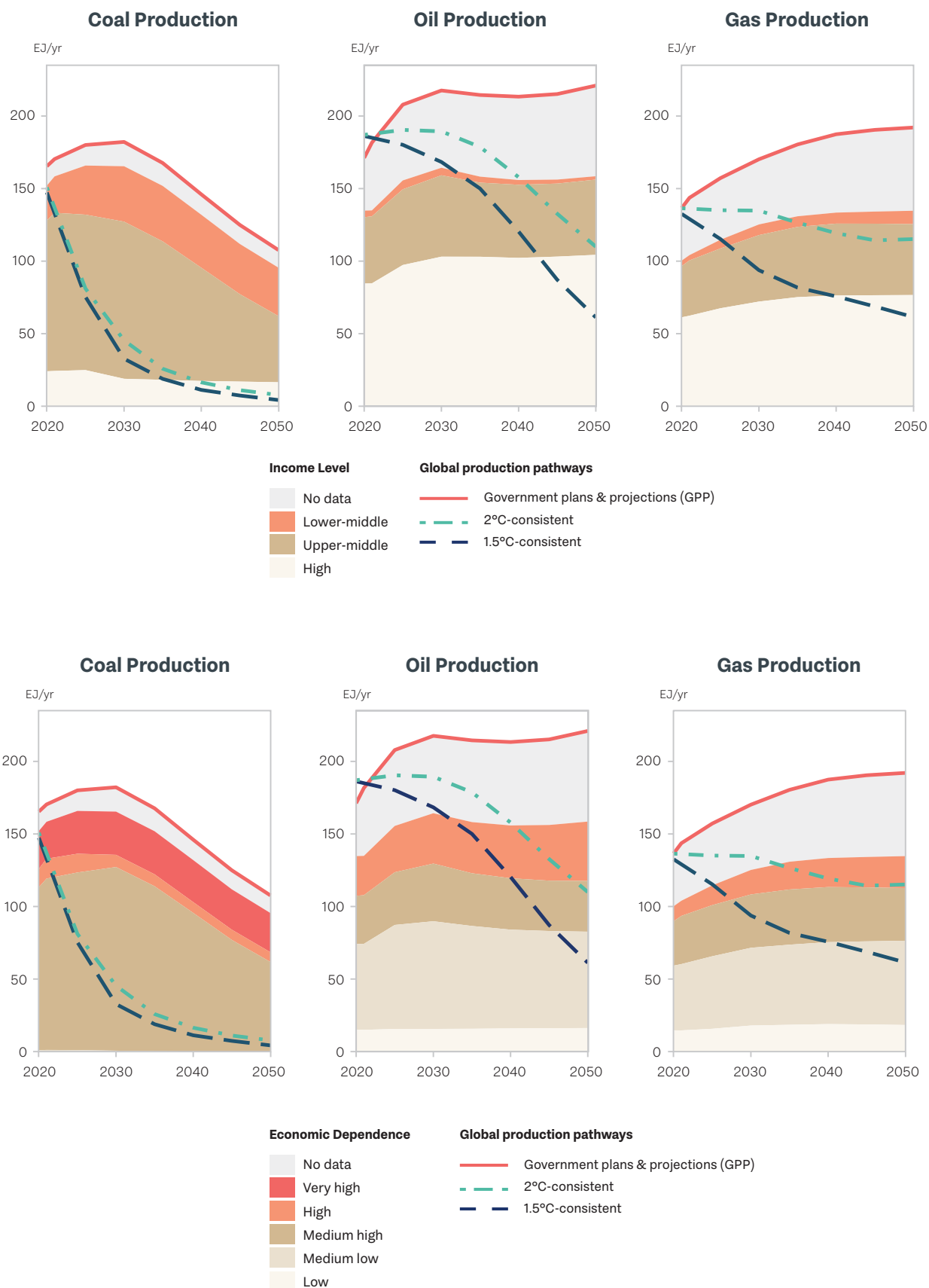
2.5 Policy implications II: why an equitable transition away from fossil fuels is important but at risk

Under the UNFCCC, countries acknowledge that “the global nature of climate change calls for the widest possible cooperation by all countries and their participation in an effective and appropriate international response, in accordance with their common but differentiated responsibilities and respective capabilities and their social and economic conditions” (United Nations, 1992). The vast misalignment between governments’ planned and projected fossil fuel production and levels consistent with the Paris Agreement’s temperature goal raises questions about how countries might cooperate to facilitate a managed and equitable transition.

There is an emerging and growing literature on the principles, approaches, and allocation mechanisms that could be considered for sharing the limited 1.5°C-aligned fossil fuel extraction budget (Armstrong, 2020; Caney, 2016; Kartha et al., 2016, 2018; Le Billon & Kristoffersen, 2019; Lenferna, 2018; Muttitt & Kartha, 2020; Pye et al., 2020). Two factors are predominantly featured: the extent of a country’s socioeconomic dependence on fossil fuel production, and the country’s financial and institutional capacity to transition away from it (Muttitt & Kartha, 2020). It is also important to note that, while fossil fuel

Figure 2.5

The stacked area charts show global 2020–2050 coal, oil, and gas production in exajoules per year (EJ/yr). Production under government plans and projections are aggregated by countries' income level (top row) or relative level of economic dependence on fossil fuel production (bottom row). The median 1.5°C- and 2°C-consistent global production pathways are overlaid (dashed blue and green lines).



production can result in some anticipated development benefits, these are by no means assured, nor is it guaranteed that adverse local impacts will be modest and manageable. The extraction and processing of coal, oil, and gas can deepen existing inequities and indebtedness, is often associated with local pollution, ecological damage, and human rights violations, and comes with long-term liabilities for the public to fund labour and environmental rehabilitation and remediation costs for abandoned coal mines and oil and gas wells (Achakulwisut et al., 2021; Amnesty International, 2017; Gaventa, 2021; Grubert & Hastings-Simon, 2022).

It might be expected that higher-income countries and those less dependent on the fossil fuel economy phase out their domestic production more quickly, while lower-income countries will need international support to achieve a just energy transition (SEI et al., 2020). However, as shown in Figure 2.5, based on government plans and projections assessed in this year's report, the trajectories of coal, oil, and gas production in 10 or fewer high-income countries (Australia, Canada, Germany, Kuwait, Norway, Qatar, Saudi Arabia, the UAE, the UK, and the US) would already exceed the global 1.5°C-consistent pathways for each fuel by around 2040. Similarly, the trajectories of oil and gas production being planned/projected by 12 countries (Australia, Brazil, Canada, China, Colombia, India, Indonesia, Kazakhstan, Mexico, Nigeria, the UK, and the US) with the lowest levels of relative economic dependence on their production would exceed global levels under the respective 1.5°C-consistent pathways by 2040.¹⁸ Note that in Figure 2.5, the order of the stacked area charts representing each group's production trajectories is intended to illustrate the equity implications of existing production plans and projections and not to suggest that the above specific countries are alone responsible for exceeding the 1.5°C-consistent pathways.

Existing mitigation scenarios, including those analysed here, rarely incorporate equity and environmental justice considerations (IPCC, 2023), and so it is beyond the scope of this report's analysis to derive national fossil fuel production phase-out trajectories reflecting equity principles based on the global 1.5°C-consistent pathways identified. Future work will be needed to identify differentiated

phase-out timelines for different countries. Nevertheless, the findings in this section emphasize the critical role that high-income and less-dependent countries should play in leading a global fossil fuel phase-out, and the extent to which they are currently falling short. Without proactive engagement and discussion between parties, there is a risk that a global fossil fuel phase-out will be highly inequitable, fail to support vulnerable communities, and further erode trust in global cooperation on climate action.

Another danger is that governments' existing net-zero pledges will not be fulfilled, with their credibility and implementation being increasingly called into question (Rogelj et al., 2023). As this chapter shows, to limit long-term warming to 1.5°C, fossil-fuel-producing countries need to rapidly decline both the emissions and production of coal, oil, and gas (while fossil-fuel-importing countries also need to rapidly transition to clean energy sources). The lack of attention to a coordinated phase-in of zero-carbon and phase-out of fossil-fuel-based energy systems represents a major risk to a successful, non-disruptive, and just energy transition (Grubert & Hastings-Simon, 2022; Kemfert et al., 2022). Combining targets and policies to actively phase out fossil fuel supply with policies to reduce fossil fuel demand, expand renewable energy, and implement other important mitigation measures can reduce the cost of emissions reduction, promote policy coherence, and directly confront fossil fuel interests who continue to delay and undermine decarbonization efforts (Blondeel et al., 2021; Green & Denniss, 2018; IPCC, 2022; Stoddard et al., 2021). Moreover, it will be important for governments to plan and create support for a managed and just transition away from fossil fuel production to minimize negative social and economic impacts for affected communities and workers (Diluiso et al., 2021; Sanchez et al., 2023).

¹⁸ Fossil-fuel-producing countries are assigned an income level based on their World Bank classification (World Bank, 2022). Relative economic dependence for coal follows the IEA's Coal Transition Exposure Index categorization, which is based on the share of coal in national goods exports and the degree of coal self-sufficiency (IEA, 2022a, Table 5.1). For oil and gas, relative dependence is categorized based on the percentage of GDP from the oil and gas sector (Calverley & Anderson, 2022, Table 7). See the Appendix for details.

2.6 Conclusions

Since the first assessment of the global production gap in 2019, its size has remained largely unchanged. Despite an emerging clean energy transition and peak coal, oil, and gas demand now in sight, global levels of fossil fuel production being planned and projected by governments remain vastly misaligned with levels consistent with achieving the Paris Agreement's long-term temperature goal. The lack of commitments and actions towards reducing coal, oil, and gas production in line with achieving global net-zero CO₂ emissions by 2050 is failing to reflect changing sociopolitical realities and is putting a safe and livable present and future at risk.

There is a clear imperative for governments to adopt national and develop international reduction targets for coal, oil, and gas production and use, and pursue them alongside other climate mitigation strategies. This can help to

promote policy coherence and coordinate the phase-in of zero-carbon technologies and phase-out of fossil fuels to guide the mid- to longer-term energy transition, including maximizing the transition of a skilled fossil-fuel workforce into new jobs.

This chapter's analysis suggests that, to stay on track to limiting long-term warming to 1.5°C, governments should strive for a near total phase-out of coal production and use by 2040 and for cutting combined oil and gas production and use by three-quarters by 2050 from 2020 levels, with reductions for all fossil fuels beginning now. These targets should be viewed as minimum ambitions towards achieving a global phase-out of fossil fuel production and consumption. Higher-income countries with greater financial and institutional capacity could go further than the global average, which would contribute to making the required transition more equitable.



3

Government plans and policies for fossil fuel production

Key Messages

Seventeen of the 20 fossil-fuel-producing countries profiled in this chapter have pledged to achieve net-zero emissions, but most continue to support, invest in, and plan on the expansion of fossil fuel production.

Many governments are promoting gas as an essential “bridge” or “transition” fuel but with no apparent plans to transition away from it later.

Many of the countries profiled have launched initiatives to reduce emissions from fossil fuel production activities, but none have committed to reduce coal, oil, and gas production in line with limiting warming to 1.5°C.

There are some encouraging signs of change. Four countries have begun to develop scenarios for domestic fossil fuel production consistent with national or global net-zero targets.

Support for a just energy transition is growing, although such discourses and policies are still mostly limited to coal-fired power generation.

All governments should be more transparent in their plans, projections, and support for fossil fuel production and how they align with climate goals.

3. Government plans and policies for fossil fuel production

This chapter provides an overview of the climate ambitions and the plans, perspectives, and policies for fossil fuel production of 20 of the world's largest producer countries: Australia, Brazil, Canada, China, Colombia, Germany, India, Indonesia, Kazakhstan, Kuwait, Mexico, Nigeria, Norway, Qatar, the Russian Federation, Saudi Arabia, South Africa, the United Arab Emirates (UAE), the United Kingdom of Great Britain and Northern Ireland (UK), and the United States of America (US). Altogether, these countries accounted for 82% of production and 73% of consumption of the world's supply of primary fossil fuels in 2021 (IEA, 2023a, 2023b).¹⁹

Under an accounting method that allocates the total GHG emissions from fossil-fuel-production and -combustion processes to the producer country (see [online Appendix](#) for details), these 20 countries represent 84% of global extraction-based greenhouse gas (GHG) emissions in 2021, as illustrated in Figure 3.1. Among them, three countries account for about half of global extraction-based GHG emissions: China, the US, and the Russian Federation. China produces, as well as consumes, about half of the world's coal supply (IEA, 2023a). In turn, the US, the Russian Federation, and Saudi Arabia produce about 40% of the world's oil, while the US and the Russian Federation are, by a wide margin, the world's largest gas producers (IEA, 2023a). Other countries profiled here have been major contributors to the growth in coal, oil, and gas production over the past decade, while all but three (Germany, Norway, and the UK) are also poised to maintain or increase production of at least one of the three fossil fuels between now and 2030.

Taken together, governments' plans and policies that support expanding production pose a major challenge to achieving the Paris Agreement's long-term goal to hold the increase in the global average temperature to "well below 2°C above pre-industrial levels" and pursue efforts to limit the increase to 1.5°C (Paris Agreement, 2015). They can undermine efforts and pledges to reduce fossil fuel consumption and emissions, by sending mixed signals about countries' intentions and priorities, as well as by locking in new production infrastructure that will make the energy transition more difficult and more disruptive (Pellegrini & Arsel, 2022). They also pose the risk of stranding assets and investments worth more than USD 1 trillion should countries succeed in reducing global fossil fuel demand in line with net-zero emissions targets (Semieniuk et al., 2022). These are among the key reasons why the



long-standing, almost-exclusive focus of climate policy on the demand for fossil fuels and on the territorial emissions associated with their use is insufficient (Stoddard et al., 2021). A well-managed energy transition will require plans and actions to reduce both supply and demand in a coordinated fashion (Green & Denniss, 2018; Grubert & Hastings-Simon, 2022).

The country profiles in this chapter review governments' climate pledges and their plans and support for fossil fuel production, as well as the status of discourses and policies towards a just and equitable transition away from fossil fuels. The profiles draw heavily on national energy plans and forecasts released by government and affiliated institutions — on which Chapter 2's global gap analysis is also based — along with studies conducted by intergovernmental, government, and other research institutions, as well as other publicly available information as of August 2023.²⁰ Each country profile also includes an infographic with relative rank and share of global fossil fuel produc-

¹⁹ Primary fuels refer to the amount of fuels produced prior to any energy conversion or transformation processes.

²⁰ In cases where the original sources are not in English, quotations that appear throughout this chapter have been translated.

tion, net trade status, and indicators of transition capacity and economic dependence on fossil fuels.²¹ As additional context, Table 3.1 provides further information on production, imports, exports, and net supply for domestic use of fossil fuels by country. Some countries profiled here are net exporters of fossil fuels, with significantly greater production than domestic use. Others are net importers, using more fossil fuels than produced domestically. The country profiles are arranged in decreasing order of extraction-based GHG emissions; in the case where a country exports much more fossil fuels than it consumes domestically, its territorial fossil fuel emissions would be much lower than its extraction-based emissions shown in Figure 3.1.

It is important to underscore that many governments provide very limited public information on plans, projections, subsidies, and other forms of support for fossil fuels. As a result, this report must often rely on other sources, such as research or media reports. Ideally, all governments

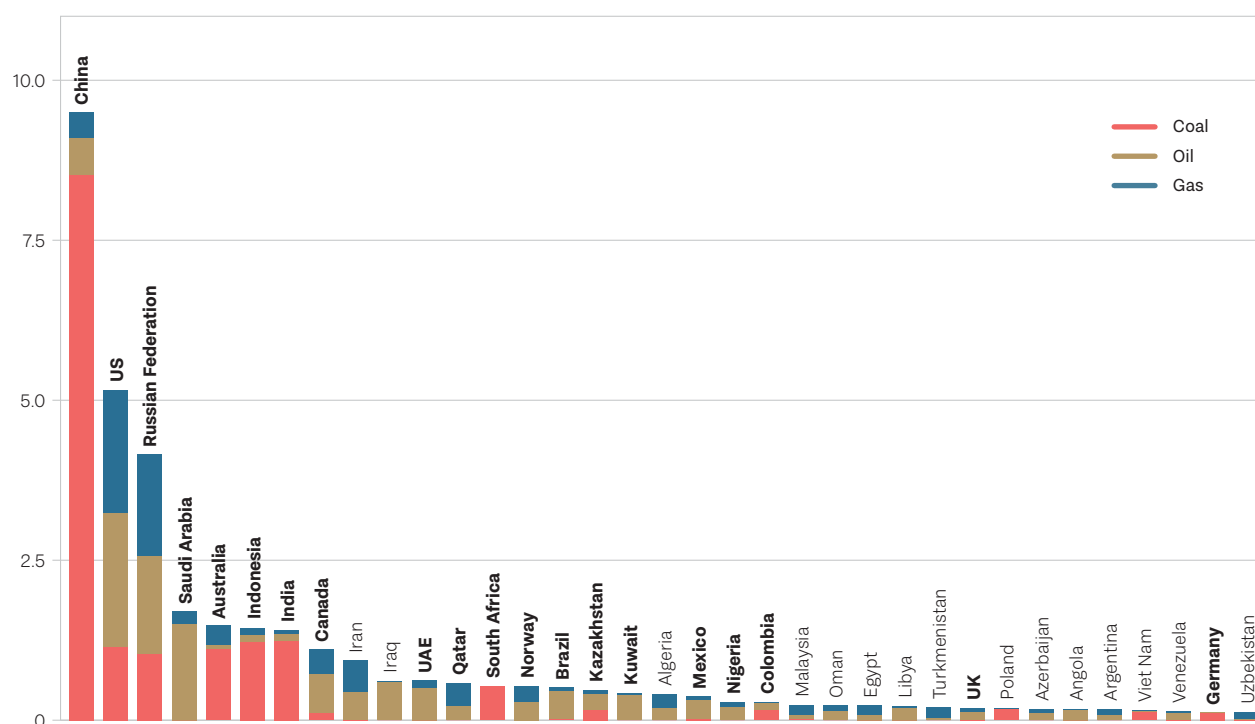
would make this information publicly available. Indeed, governments should strengthen transparency by disclosing fossil fuel production plans, projections, and support through their reporting under the Paris Agreement, as well as in other forums. (See Chapter 5 of the 2021 Production Gap Report for a fuller discussion of the role of transparency in addressing the production gap.)

In the run-up to the COP26 climate talks in Glasgow in November 2021, most countries profiled here updated their nationally determined contributions (NDCs) for 2030 and announced net-zero targets for mid-century or thereabouts. Since then, few countries have increased the ambition of their climate goals, which together fall well short of what is needed to achieve the Paris Agreement's temperature goal; the 2022 Emissions Gap Report estimated that countries' collective mitigation plans will lead to a 66% chance of limiting warming to around 2.6°C by the end of the century (Fransen et al., 2022; UNEP, 2022b).

Figure 3.1

Top 35 countries in terms of extraction-based GHG emissions (billion tonnes of CO₂ equivalent, GtCO₂eq) in 2021.²¹ The top 10 account for 75% of the global total, while the top 35 account for 96%. Countries in bold are profiled in this chapter. See the online Appendix for sources and methods.

2021 extraction-based GHG emissions (GtCO₂eq)



²¹ See the online Appendix for corresponding data sources and notes.

Table 3.1

Production, import, export, and net supply for domestic consumption of primary fossil fuels in exajoules (EJ) by country in 2021. (Values are rounded to one decimal place. Exports are shown as negative values.)

Country	Production	Import	Export	Net supply for domestic consumption
Australia	17.4	0.7	-14.2	3.8
Brazil	7.8	1.5	-2.7	6.6
Canada	19.4	2.5	-12.2	9.8
Colombia	3.6	0.0	-2.8	0.8
Germany	1.4	7.5	-0.1	8.9
India	15.2	14.7	0.0	29.8
Indonesia	16.0	1.1	-10.9	6.2
Kazakhstan	6.3	0.3	-3.9	2.7
Kuwait	6.3	0.3	-3.9	2.7
Mexico	5.4	2.5	-2.4	5.6
Nigeria	4.4	0.0	-3.5	0.9
Norway	8.3	0.1	-7.4	1.1
China	102.3	33.5	-0.3	135.4
Qatar	9.4	0.0	-6.4	3.0
Russian Federation	60.0	0.9	-24.0	36.9
Saudi Arabia	25.3	0.0	-13.3	11.9
South Africa	5.5	0.5	-1.8	4.2
UAE	9.2	1.2	-5.2	5.2
UK	3.0	3.8	-1.7	5.0
US	75.3	17.4	-16.1	76.5

Sources: IEA (2023a, 2023b).

Many fossil-fuel-producing countries mention fossil fuel production in their NDCs and long-term low emission development strategies (LT-LEDs), though in most cases, they point to continued or increased production (Jones et al., 2023). At the same time, several governments have enacted climate policies such as Australia's Safeguard Mechanism and the US's Inflation Reduction Act that could ultimately constrain emissions from, or potentially limit the future development of, fossil fuel resources.

Many countries have launched or joined efforts aimed at reducing the upstream GHG emissions of fossil fuel production activities, often termed Scope 1 and 2 or "operational" emissions, which result from the on-site use of fossil fuels and the leakage, flaring, and venting of

methane. Six countries (all profiled in this chapter) are part of the Net-Zero Producers Forum. One hundred and fifty countries, including 14 of those assessed here, have signed on to the Global Methane Pledge to collectively reduce global methane emissions by at least 30% from 2020 levels by 2030 (Global Methane Pledge, n.d.). However, neither initiative mentions the need to reduce fossil fuel production itself.

Therefore, while most producer countries have committed to reducing — many quite steeply — GHG emissions from upstream fossil-fuel-production activities and from the downstream combustion of fossil fuels, few have acknowledged in their plans and strategies that fossil fuel production must also decline rapidly if climate goals are

to be met. Seventeen of the 20 countries profiled in this chapter have pledged to achieve net-zero emissions. Yet, at the same time, as shown in Table 3.2 and the profiles that follow, most continue to promote, subsidize, invest in, and plan to expand fossil fuel production destined for domestic use and/or export (See Table 3.1 and the country profile infographics for more information on net trade status and import/export amounts).

India, Indonesia, and the Russian Federation all plan significant increases in coal production through 2030. The Russian Federation aims to boost coal production and exports to Asia-Pacific and Atlantic regions. India seeks self-reliance and views the coal industry as currently being of paramount importance for income and employment generation. Indonesia and Kazakhstan plan to continue producing coal with the aim of developing high-value-added coal-based products.

China and the US each foresee declines in annual coal production of about 5 exajoules (EJ) (200 million tonnes, or Mt) by the end of the decade. For China, this represents a 15% drop below 2022 (when coal production reached a record high of 4,500 Mt), whereas for the US it represents more than a 40% decline from current levels. However, these drops in coal production will be more than offset by increases across other major coal-producing countries through 2030, as shown in Table 3.2 and, globally, in Figure 2.2.

In general, countries with significant proven oil and gas reserves plan to increase their near- and long-term production. Only four of the 17 oil-producing countries surveyed here anticipate overall decreases (of 0.1–0.7 EJ/yr) from 2021 to 2030. Government projections for two of these countries — Norway and the UK — have tended to underestimate resource growth and future production (see profiles). In fact, both countries, which are situated in the maturing North Sea basin, have implemented measures to support fossil fuel production in response to recent crises (the pandemic and the war in Ukraine) (Sanchez et al., 2023). The other two countries — Colombia and Indonesia — are smaller oil producers (each accounting for less than 1% of global production) with limited proven reserves.

Meanwhile, three countries — Brazil, Saudi Arabia, and the US — each anticipate growth in annual oil production of over 5 EJ, or 2 million barrels per day (Mb/d), by the end of the decade (Table 3.2); together this would amount to an increase in global oil production of nearly 10% relative to 2021 levels (IEA, 2023a). Despite ambitious climate commitments, many countries express intentions to expand

their share of global oil markets. For example, Brazil aims to become the fourth-largest oil producer in the world, up from eighth in 2021 (IEA, 2023a; MME, 2023c).

The war in Ukraine and the ensuing disruption in gas supplies, including record high prices on international markets, have spurred plans for and investments in liquefied natural gas (LNG) infrastructure by exporters and importers alike. As shown in Table 3.2, four net gas exporters (Nigeria, Qatar, the Russian Federation, and the US) and China, a net importer, are together expected to increase gas production by about 16 EJ by 2030, which is equivalent to around 10% of the 2021 global production level. Qatar, Nigeria, and the US are all targeting exports to Europe to make up in part for Europe's reduced imports from the Russian Federation. The US became the world's largest LNG exporter in 2022, authorized 450 billion cubic meters (Bcm) per year of new LNG export capacity, and is on course to double liquefaction capacity by 2027 (see US profile).

Many gas producers and importers are promoting gas as a “bridge” or “transition” fuel to facilitate a transition away from coal and support greater adoption of solar and wind energy (ADNOC, 2023b; Pinheiro, 2020), or as a “destination fuel you will need for a very long time” (Atlantic Council, 2023). Some emerging or developing economies view their gas resources as important for supporting their national development. The Government of Nigeria, for example, declared 2020–2030 as the “decade of gas” for this purpose (GECF, 2021). Meanwhile, some European governments have invested in gas supply infrastructure and pushed to secure long-term contracts with African nations (Moore & Moss, 2022).

Yet, as discussed in Box 3.1, which considers the challenges facing many gas- and oil-rich developing countries with a focus on sub-Saharan Africa, benefits are not guaranteed and may be difficult to capture due to inadequate governance systems. Investments in gas production may also expose countries to future stranding risks and clean-up liabilities as well as immediate social and environmental harms. Furthermore, gas could hinder or delay renewable energy transitions by locking in fossil-fuel-based technological systems and related institutions (Kemfert et al., 2022). Despite some local air pollution benefits when substituting for coal, gas still leads to high GHG emissions and associated climate impacts, especially when accounting for the estimated methane leakage along the gas supply chain (Kemfert et al., 2022). Indeed, improvements in data and understanding of methane leakage from gas systems have narrowed the expected climate benefits of

Table 3.2

Net-zero commitments and relative changes in planned/projected fossil fuel production for the 20 countries profiled in this chapter.

Country	Status of national net-zero commitment	Net-zero target year	Planned change in annual fossil fuel production for 2030 relative to 2021 (EJ)		
			Coal	Oil	Gas
Australia	In law	2050	▲ 0.2	■ 0 ^b	▲ 0.7
Brazil	NDC objective	2050	No data	▲ 5.2	▲ 1.0 ^d
Canada	In law	2050	No data	▲ 3.0	▲ 0.6
China	NDC objective	2060	▼ 5.3	■ 0	▲ 2.6
Colombia	In law	2050	▲ 1.7	▼ 0.1	■ 0
Germany	In law	2045	▼ 0.5	■ 0	▼ 0.1
India	NDC objective	2070	▲ 10.7	No data	No data
Indonesia	In strategy document	2060	▲ 2.5	▼ 0.2	▲ 1.1
Kazakhstan	In strategy document	2060	▼ 0.2	▲ 0.4	▲ 0.1 ^d
Kuwait	Political pledge	2050 (oil & gas sector) 2060 (rest of economy)	No production	▲ 2.1	▲ 0.1
Mexico	No commitment	—	No data	▲ 1.4	▲ 0.6
Nigeria	In law	2060	No data	▲ 1.3	▲ 2.6 ^d
Norway	No commitment ^a	—	No data	▼ 0.5	▼ 0.3
Qatar	No commitment	—	No production	No data	▲ 3.9 ^c
Russian Federation	In strategy document	2060	▲ 3.2	▲ 2.9	▲ 3.3
Saudi Arabia	Political pledge	2060	No production	▲ 5.5	▲ 1.3
South Africa	In strategy document	2050	No data	No data	No data
UAE	NDC objective	2050	No production	▲ 1.8 ^c	▲ 0.4 ^b
UK	In law	2050	No data	▼ 0.7	▼ 0.6
US	In policy document	2050	▼ 5.1	▲ 5.2	▲ 2.5

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

^b Planned change for 2028, furthest year for which data is available.

^c Planned change for 2027, furthest year for which data is available.

^d Excluding gas that is re-injected, consumed by producers, and/or flared.

Sources: Net Zero Tracker (2023) and own analyses (see country profiles).

replacing coal with gas (Gordon et al., 2023; Kemfert et al., 2022). Among fossil fuels, gas accounted for the largest increase in CO₂ emissions in the last decade (Climate Analytics, 2021), and as Chapter 2 shows, plans for gas expansion far exceed those consistent with limiting global warming to 1.5°C.

Governments play a central role in setting the direction of future fossil fuel production. State-owned enterprises (SOEs) control half of global production for oil and gas (NRGI, 2022) and over half for coal.²² Governments influence the decision-making of private fossil fuel companies and investors through their regulatory approaches, as well as through their plans, targets, and projections for fossil fuel production. Governments also provide direct financial support to fossil fuel producers. As part of COP26's Glasgow Climate Pact, parties (i.e. Member States) to the UNFCCC agreed on "accelerating efforts towards the... phase-out of inefficient fossil fuel subsidies", reiterating a commitment first articulated by the G20 in their 2009 Pittsburgh Summit Leaders' Statement (G20, 2009; UNFCCC, 2021). However, in 2021, governments sharply increased support for fossil fuel producers to USD 64 billion, 17% more than in 2019 and the highest level since the Organization for Economic Co-operation and Development (OECD) began tracking subsidies, while a more recent assessment put the 2021 total at USD 78 billion (OECD, 2022b; OECD and IISD, 2023). Australia, Canada, Colombia, and Mexico saw some of the largest increases in production subsidies between 2019 and 2021. When also accounting for fossil fuel consumption subsidies, total support for fossil fuels doubled between 2020 and 2021 (OECD, 2022b).

In addition to supporting domestic production, many countries provide financial support for international fossil fuel development, as detailed in the profiles. At the same time, 34 countries, including Canada, Germany, the UK, and the US, signed onto the Glasgow Statement on International Public Support for the Clean Energy Transition to end international public financing for unabated fossil fuel projects by the end of 2022 and to redirect investments into clean energy (UK Government, 2021a). Indeed, international public finance for fossil fuels has been on a declining trajectory — down 35% from 2016–2018 levels in the 2019–2021 period — but still stood at twice the level provided to clean energy (O'Manique et al., 2022). However, it is not yet clear that the Glasgow Statement is being fulfilled by all signatory countries (Hodgson &

Kazmin, 2023; McGibbon et al., 2023; New Climate Institute & Climate Analytics, 2023). Moreover, while the term "unabated" (see Box 2.1 in Chapter 2) is being increasingly used in policy commitments related to fossil fuel reductions (e.g. the Glasgow Statement and the decision texts of COP26 and COP27), it is often highly contested, poorly defined, and open to interpretation regarding the required rate of carbon capture for abatement (Civillini, 2023a; IISD, 2022).

At the same time, support for a just energy transition is growing, although such discourses and policies are still mostly limited to coal power generation. As described in Box 3.2, Just Energy Transition Partnerships (JETPs) have been established with Indonesia, Viet Nam, South Africa, and Senegal, with developed nations pledging billions of dollars in climate finance focused on supporting moves away from coal dependence (European Commission, 2023; The White House, 2022c; US Department of the Treasury, 2022; US Embassy Viet Nam, 2022). Official policies or discourses related to just transitions in the oil and gas industry are more limited (Linde et al., 2022).

Some countries, driven by concerns over climate-related risk, have sought to slow further fossil fuel development and to direct support to affected communities. In Colombia, a new administration elected in 2022 announced its intention to cease licensing of new fossil fuel exploration projects, though the government has given mixed signals since, as discussed in the Colombia profile in this chapter. In the US, under a new president, the government paused oil and gas development on federal lands pending comprehensive review of the programme (US DOI, 2021a). However, due to legal challenges and political pushback, lease sales have resumed, and the administration approved the largest single oil project ever on federal lands (The White House, 2023c; US DOI, 2021c, 2022; US BLM, 2023a).

Among the countries profiled here, Colombia is the only country to have signed on to an international initiative targeted at phasing out fossil fuel production (Table 3.3). A mix of smaller and non-oil-and-gas-producing countries, as well as sub-national governments from several major producing countries, have joined the Beyond Oil and Gas Alliance (BOGA), "an alliance of 'first-mover' governments and stakeholders that are working together to facilitate the managed phase-out of oil and gas production" (BOGA, n.d.-a). BOGA has recently launched a fund to help countries in the Global South to explore development pathways that avoid dependence on oil and gas production (BOGA, n.d.-a). As noted in Box 3.1, developing countries

²² SOEs account for almost all of China's coal production, 90% of India's, and smaller shares of Indonesia's (IEA, 2019, p. 242). These countries respectively account for 50%, 10%, and 7% of global coal production (IEA, 2022c).



with major unexploited oil and gas resources face significant economic and other risks as potential late-comers to fossil fuel development. The Fossil Fuel Non-Proliferation Treaty (FFNPT) offers another example of an international initiative to promote a coordinated phase-out of fossil fuel production, endorsed by six Small Island Developing States and 84 city and sub-national governments as of August 2023 (FFNPT, 2023). In August 2023, Colombia joined BOGA as a “friend” but not yet a “core member” (MME, 2023d).

There is now growing interest in what Paris-aligned fossil fuel production pathways might look like at the national level and how they can be made fair and equitable (BOGA, n.d.-b; Calverley & Anderson, 2022; Nacke et al., 2022; United Nations Secretary-General, 2023). Providing country-specific, Paris-aligned fossil fuel decline pathways is beyond the scope of this year’s Production Gap Report. Doing so would require a values-based determination of an equitable distribution of the remaining amount of fossil fuels that could be extracted under the remaining carbon budget, taking into account factors such as countries’ relative capacity to transition away from fossil fuel production, relative economic dependence on fossil fuel production, relative costs of production, and historical responsibility (Caney, 2016; Muttitt & Kartha, 2020; Pye et al., 2020). Nevertheless, as explored in the 2020 Production Gap Report, countries with higher capacity and lower dependence on fossil fuel production are equipped for a faster transition than the global average (SEI et al., 2020, Chapter 4). However, as Chapter 2 of this report details, the combined planned/projected production trajectories

of fossil fuels in 10 high-income countries or in 12 countries with relatively lower economic dependence on fossil fuel production, alone, would already exceed global levels under the 1.5°C-consistent pathways by 2040.

The country profiles that follow show that a transition away from coal is now underway in many parts of world. Some countries, such as Germany, Canada, South Africa, and the US are planning for a continuing or future decline in coal production or exports and are investing domestically and internationally to support alternative development pathways for historically coal-dependent communities. Other countries still anticipate continued and growing domestic and international markets for their coal production, with India aiming to nearly double production this decade (with just transition also emerging on the agenda), and the Russian Federation seeking to increase exports to Asia-Pacific markets.

In contrast, there are few indications that major oil and gas producers are tempering their plans for expansion or preparing oil- and gas-dependent communities for a transition. Most are instead focusing on reducing GHG emissions from production activities, though only slightly over 30% of global production is under comprehensive, measurement-based, reporting systems such as UNEP’s Oil and Gas Methane Partnership 2.0, and companies have thus far reported less than 1% of estimated global methane emissions from oil and gas (UNEP, 2022a). Many are also counting on future large-scale deployment of fossil fuel abatement technologies and/or carbon dioxide removal methods (see Box 2.1) to enable continued or growing oil and gas production. However, even with the successful implementation of these mitigation strategies, global production and use of all fossil fuels must still decline rapidly and substantially by 2050 to limit warming to 1.5°C, starting now, as Chapter 2 shows.

As described above and in the country profiles, there are some encouraging developments compared to the 2021 Production Gap Report. In addition to Germany and Indonesia, more countries (i.e. Canada and China) have begun to develop scenarios for domestic fossil fuel production that are consistent with their national or global net-zero or carbon-neutrality targets. Meanwhile, discourses on just transitions for fossil-fuel-dependent workers and economies are advancing in many countries, though implementation and investments are still lacking. And, as illustrated in Table 3.3, most major fossil-fuel-producing countries have committed to reducing the emissions intensity of their fossil fuel production. However, except for Colombia, these countries have not yet acknowledged, committed to, or prepared for an active transition away from coal, oil, and gas production consistent with national, let alone global, climate goals.

Table 3.3

Membership and signatory status of the 20 countries profiled in this chapter in international climate initiatives related to fossil fuels, as of August 2023.

Country	Net-Zero Producers Forum member	Global Methane Pledge participant	Glasgow State-ment signatory	Powering Past Coal Alliance member	Fossil fuel phase-out alliance or treaty ^a
Australia		✓			
Brazil		✓			
Canada	✓	✓	✓	✓	
China					
Colombia		✓			"Friend" of BOGA ^b
Germany		✓	✓	✓	
India					
Indonesia		✓			
Kazakhstan					
Kuwait		✓			
Mexico		✓			
Nigeria		✓		✓	
Norway	✓	✓			
Qatar	✓				
Russian Federation					
Saudi Arabia	✓	✓			
South Africa					
UAE	✓	✓			
UK		✓	✓	✓	
US	✓	✓	✓		

^a Examples include membership in the Beyond Oil and Gas Alliance (BOGA) or endorsement of the Fossil Fuel Non-Proliferation Treaty (FFNPT)

^b Colombia signed on to the BOGA Declaration but is not yet a "Core Member"; see <https://beyondoilandgasalliance.org/who-we-are/>

Sources: Global Methane Pledge (n.d.); Powering Past Coal Alliance (n.d.); UK Government (2021a); US DOE (2022b)

Box 3.1 Challenges for oil and gas resource holders in Africa: achieving energy access and development in a carbon-constrained world

African governments must make tough and far-reaching decisions as they seek to close energy availability, access, and equity gaps that have hampered social and economic development (ADB, 2022a; Sokona et al., 2023). On one hand, many countries in Africa possess an abundance of both fossil fuel and renewable energy resources that could help meet domestic demand and generate export revenue. On the other hand, their access to the finance needed to develop those resources is limited, and global efforts to reduce GHG emissions create stranding risks for investing in new fossil fuel projects. Under a rapidly shrinking carbon budget to limit global warming to 1.5°C and intensifying climate impacts, achieving global net-zero emissions by mid-century means that African countries will have to develop and diversify away from dependence on long-lived fossil fuel infrastructure (ADB, 2022a; Sokona et al., 2023).

Yet, between 2010 and 2020, 40% of all the gas discovered worldwide was in Africa, largely concentrated in Tanzania, Mozambique, Egypt, Senegal, and Mauritania (IEA, 2022a; UNU-INRA, 2019). Today, over 200 companies are actively pursuing fossil expansion in 48 out of the 54 African countries, exploring or developing new fossil fuel reserves or developing new fossil infrastructure such as liquefied natural gas (LNG) terminals and pipelines or gas- and coal-fired power plants in Africa (Schücking, 2022).

Moreover, in the wake of the war in Ukraine, European governments have looked to Africa and its fossil fuel resources as they seek alternative ways to meet their energy needs, even as they doubled down on their own clean energy transitions (Kemfert et al., 2022; Mulugetta et al., 2022; Sokona et al., 2023). While countries in North Africa are well-placed to benefit in the short-term given their existing export infrastructure, new oil and gas producers must carefully consider the risk of asset-stranding in the long run.

Developing fossil gas infrastructure, if managed by strong multi-stakeholder institutions, has the potential to yield some short- to medium-term economic

returns and societal benefits. However, despite the need to improve energy access across the continent, much of the gas produced on the continent could be destined for export (Sokona et al., 2023). In the case of Mozambique, expected economic benefits from gas production and exports have not materialized; its gas discovery a decade ago has instead been linked to increased domestic conflict, alleged corruption, and economic distortion (Gaventa, 2021).

Energy debates in countries that face critical decisions about development of their fossil fuel resources risk being driven by short-term considerations and transient geopolitical interests that might lock in long-term economic risks and state liabilities for rehabilitation and clean-up of abandoned coal mines and oil and gas wells. The near-term social, environmental, and public health harms of oil and gas development and associated water and air pollution are also significant, as documented in Nigeria and Mozambique (Gaventa, 2021; Obi et al., 2021; Raimi et al., 2022).

Many African economies have yet to craft economic diversification strategies to facilitate structural transformation and break away from primary commodity dependence. In the absence of such strategies, oil and gas extraction will be based on economic rents, creating structural dependence, tied to the fluctuations of the world market and inscribed in global value relations (Greco, 2020).

This comes with a number of inherent risks, including lower prices and revenue if and as countries transition away from oil and gas, and higher exposure to significant asset-stranding by newer producers (Geuskens & Butijn, 2022; Leke et al., 2022). African oil and gas assets are, on average, 15–20% more costly to develop and operate and 70–80% more carbon-intensive than global oil and gas assets, due to heavy crudes and the need for high-cost extraction technologies (Leke et al., 2022). Higher production costs thus could make many African producers less competitive in global markets and their assets more likely become stranded sooner.

Box 3.1 Challenges for oil and gas resource holders in Africa: achieving energy access and development in a carbon-constrained world (cont.)

In addition, many non-African countries are implementing carbon pricing mechanisms, including border carbon prices, that could have negative impacts on African countries dependent on oil and gas exports, giving further reason to invest early in clean energy systems to avoid long-term trade-related barriers (Leke et al., 2022).

In summary, the pursuit of oil and gas resources poses considerable risks for African countries and

is misaligned with efforts needed to meet the Paris Agreement's long-term temperature goal. African countries, like many others, face the need to ensure energy access and prosperity, while leapfrogging or diversifying away from fossil fuels to create cleaner and fairer energy systems (Sokona et al., 2023). The success of such diversification efforts will depend on access to technology, means of implementation, debt relief, and finance at a fair price (Sokona et al., 2023).



Box 3.2 Just Energy Transition Partnerships (JETPs)

JETPs are long-term multilateral partnerships between wealthier and emerging economies that launched in 2021 and have become a focus of international climate finance policy. The partnerships use diplomatic and political engagement to support emerging countries in achieving low-carbon development objectives, including the accelerated retirement of coal-fired power stations, and providing tools and funds to catalyse the public and private finance needed for a clean energy transition. As of March 2023, donor countries include Canada, Denmark, France, Germany, Italy, Japan, Norway, the European Union (EU), the UK, and the US, with additional private sector and finance institution commitments through the Glasgow Financial Alliance for Net Zero (Kusuma, 2023).

Two of the four recipient countries — South Africa and Indonesia — are major coal users and producers. A third, Viet Nam, is also a major coal user, while the fourth JETP in Senegal, an emerging oil and gas producer, is focused on support for renewable energy. The goal of the JETP process is to support countries' self-defined development pathways as they move away from high-emitting fossil fuel production and consumption, while mitigating the impacts of reduced production by supporting a just transition for affected groups (Kramer, 2022).

South Africa's JETP emerged first, with the announcement at COP26 of an initial USD 8.5 billion of additional, concessional and market rate finance from donor countries (Burton, 2022). In 2022, South Africa produced an investment plan which estimated the needs for mitigation (in electricity, coal, trans-

port, and industry) and just transition activities at USD 98 billion from 2023 to 2027, with investment beyond the initial USD 8.5 billion to be raised from the private sector (Presidency of Republic of South Africa, 2022).

Since then, JETPs have been agreed for Indonesia with an initial USD 20 billion, Viet Nam with an initial USD 15.5 billion, and Senegal with an initial EUR 2.5 billion (USD 2.6 billion) in commitments from G7 countries (European Commission, 2022, 2023; US Department of the Treasury, 2023).

While the scope of the JETPs varies between countries, most have focused on reducing emissions from the power sector by accelerating coal retirements, ramping up renewable energy deployment, and upgrading grid infrastructure to enable high renewables penetration. The 'J' in JETP is a result of South Africa being the first JETP announced, reflecting the prominence of just transition in the country's mainstream political discourse (Connolly, 2022).

The success of JETPs will depend on four developments: 1) maintenance of high-level political buy-in from both focus countries and donors (Burton, 2022); 2) provision of genuinely concessional public international finance; 3) better involvement of civil society and labour voices in consultations to increase transparency and ensure pathways reflect the interests of workers and communities, particularly those affected by the transition (Wemanya et al., 2022); and 4) recognition of context-specific development and diversification needs of different countries.

China

Announced climate ambitions

China's updated NDC, submitted in October 2021, "aims to have CO₂ emissions peak before 2030 and achieve carbon neutrality before 2060" (Government of China, 2021, p. 2).

Government views on domestic fossil fuel production

In recent years, the "clean and efficient" development of fossil fuels and bolstering China's energy security have emerged as central themes in government discourse for achieving the "dual-carbon" goals (i.e. peak emissions and carbon neutrality) (Li, 2023; Xi, 2022; NDRC, 2022b; NEA, 2023). For example, at the 20th National Congress of the Chinese Communist Party in October 2022, the President of China stated: "We will advance initiatives to reach peak carbon emissions in a well-planned and phased way in line with the principle of building the new before discarding the old ... Coal will be used in a cleaner and more efficient way, and greater efforts will be made to explore and develop petroleum and natural gas, discover more untapped reserves, and increase production" (Xi, 2022, pp. 44–45). Narratives around ensuring energy security through self-sufficiency, along with maximizing domestic coal production and expanding domestic oil and gas production to achieve this goal, appear in many government decrees and publications (NDRC & NEA, 2022; NEA, 2022).

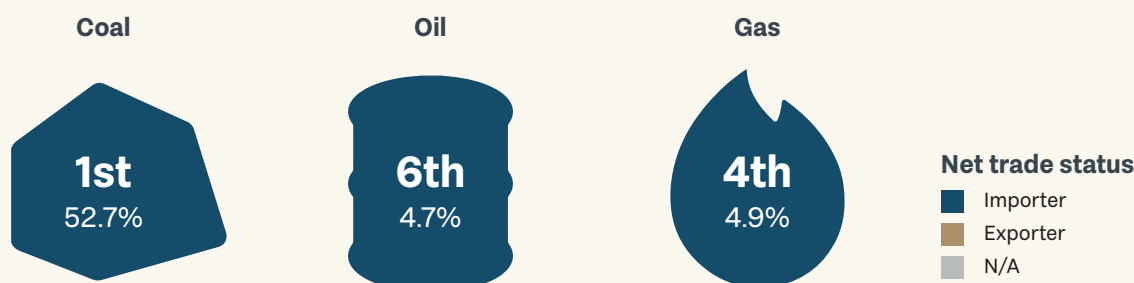
The "green and low-carbon transition" strategy laid out by the National Energy Administration in 2023 similarly aspires to "improve the ability to guarantee the supply of clean coal and oil and gas", including through CCUS, alongside plans to develop renewable energy (NEA, 2023). (The world leader in renewable power, China has doubled its installed wind and solar capacity since 2017 and is set to meet its 2030 targets

five years ahead of schedule (Mei et al., 2023)). In recent corporate reports, the fully state-owned China National Petroleum Corporation (CNPC) labels gas as a "clean" fuel, and sees it "as a critical contributor in the future energy system" (CNPC, 2021, p. 20, 2022, pp. 14–15).

Plans and projections for domestic fossil fuel production

China's fossil fuel production is dominated by several large SOEs (G20 Peer-review Team, 2016). Since no official government projections of fossil fuel production are publicly available for China, this report relies on outlooks provided by its SOEs, whose energy scenarios are now all aligned with China's 2060 carbon-neutrality goal. As shown in Figure 3.2, CNPC projects that national gas production will increase by 56% between 2020 and 2030, and by 13% between 2030 and 2050; oil production is expected to remain flat between 2020 and 2030, before declining by 10% between 2030 and 2050 (CNPC ETRI, 2022). Currently, around 7% of China's coal consumption is met by imports; this figure is expected to reach zero by 2030 and remain so through 2060, according to Sinopec, a fully state-owned petroleum and chemical company (Sinopec EDRI, 2022). Based on coal import projections by Sinopec and different consumption projections by CNPC and Sinopec, coal production is estimated to reach around 3.7–3.9 billion tonnes in the 2025–2030 period before declining (CNPC ETRI, 2022; Sinopec EDRI, 2022). However, the China Coal Industry Association has set a 2025 coal production target of 4.1 billion tonnes (CCIA, 2021), and China's domestic coal and gas production reached record highs in 2022 of around 4.5 billion tonnes and 220 billion cubic meters, respectively (National Bureau of Statistics of China, 2023).

Rank of country in, and share of, global production, and net trade status



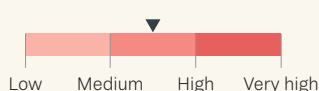
Fossil fuel transition capacity and dependence indicators

Income level
Upper-middle income

Coal direct employment

3.9 coal miners per 1,000 workers

Coal economic dependence

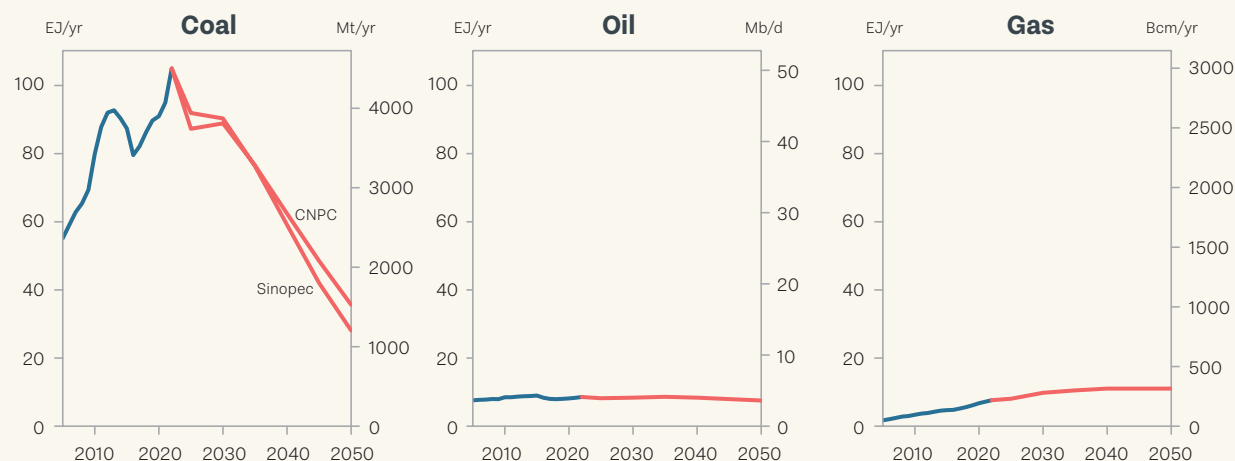


Share of GDP from oil & gas production

3%

Figure 3.2

Historical (2005–2022) and projected coal, oil, and gas production for China. Sources: Coal production projections are based on consumption and import projections from the Sustainable Transition Scenario (STS) in CNPC's 2060 World and China Energy Outlook (2022 Edition) (CNPC ETRI, 2022) and the Coordinated Development Scenario from Sinopec's 2060 China Energy Outlook (Sinopec EDRI, 2022). Oil and gas production projections are from the STS in CNPC's 2060 World and China Energy Outlook. Historical data are from China's National Bureau of Statistics (2023).



Government support for domestic fossil fuel production

■ In 2021, China's central, provincial, and local governments provided — in the form of direct budgetary transfers and tax expenditures — CNY 9.1 billion (USD 1.4 billion) for coal production and CNY 8.1 billion (USD 1.3 billion) for oil and gas production (OECD, 2023b).

■ As described above, the Government of China is promoting the concept of “clean” fossil fuel production and use. In 2021–2022, China's central bank issued state-backed loans totalling around CNY 300 billion (USD 46 billion) to support the “clean and efficient use of coal” and enhance coal production and stockpiling (People's Bank of China, 2022).

■ In February 2022, the National Development and Reform Commission (NDRC) approved three new coal mine projects that will together require CNY 24.1 billion (USD 3.6 billion) in investments (Bloomberg News, 2022).

Government support for international fossil fuel production

The majority state-owned Bank of China pledged to end financing for new coal mines and coal-fired power plants overseas in late 2021, following an announcement by the President of China at the UN General Assembly in September 2021 that China will stop building coal-fired power plants overseas (Xie, 2021).

China does not release official data on its overseas development finance. According to an independent assessment, the state-owned Chinese Development Bank (CDB) and Chinese Export-Import Bank (CHEXIM) — the two main financial institutions funding overseas projects — provided no new energy finance commitments to foreign governments in 2021, the first time this happened since 2000

(Global Development Policy Center, 2022). Nevertheless, CDB and CHEXIM have provided more energy sector loans to public entities than any other lender in the world, providing at least USD 235 billion to international fossil fuel projects in 2000–2020, including USD 61.3 billion for coal, oil, and gas exploration and extraction (Global Development Policy Center, 2022). About 35% of this amount was provided through China's Belt and Road Initiative. CNPC is also involved in the operation and management of 52 oil and gas projects in 20 countries through this initiative (CNPC, 2021).

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

No specific policies were identified. Many recent government discourses on energy strategies have reiterated themes centred on achieving the “dual-carbon” goals in a “scientific and orderly manner” (e.g. NDRC & NEA, 2022; Xi, 2022), with emphasis mainly placed on the carbon-peaking goal. For example, the State Council has introduced an “Action Plan to Achieve Carbon Peak Before 2030”, but no equivalent plan exists for the 2060 carbon-neutrality goal (State Council, 2021).

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

No specific policies were identified. The NDRC and NEA have highlighted the need to “study and improve support policies for the withdrawal and transformation development of coal enterprises, as well as placement of employees” (NDRC & NEA, 2022).

United States of America (US)

Announced climate ambitions

In early 2021, the US updated the GHG emissions reduction target in its NDC to 50–52% below 2005 levels by 2030 and announced a goal of net-zero emissions by 2050 (The White House, 2021b, 2021c).

Government views on domestic fossil fuel production

The US continues to be the top oil and gas producer in the world, and is fourth in coal production (on an energy basis) (IEA, 2023a). Soon after taking office, the current US administration revoked the permit for the Keystone XL oil pipeline, citing concerns that it would undermine the country's leadership role in global climate action (The White House, 2021a), and paused the leasing of federal lands and offshore waters for oil and gas extraction until a comprehensive review of the leasing programme was completed (US DOI, 2021a, 2021b). Following a legal challenge by 13 states in 2021, a federal judge ordered the federal government to resume oil and gas leasing on federal lands and offshore waters until a final ruling is made, resulting in a significant increase in drilling permits issued (US BLM, 2023b; US DOI, 2021c). In light of increasing energy prices and concerns over energy security due to the war in Ukraine, the current US administration encouraged oil and gas companies to boost investment and ramp up domestic production (The White House, 2022a, 2022b).

Energy Secretary Jennifer Granholm has reiterated the country's need for fossil fuels through 2050, and for fossil fuel emissions to be "abated" with carbon management technologies (US DOE, 2023b). The recently enacted Inflation Reduction Act (IRA) is considered by the White House as "the most significant action Congress has taken on clean energy and climate change in the nation's history" (The White House, 2023a). While the IRA places a USD 900 per

tonne fee on methane emissions from oil and gas facilities that exceed a specified emissions threshold, it also includes concessions to the oil and gas industry as noted below (117th Congress, 2022).

Plans and projections for domestic fossil fuel production

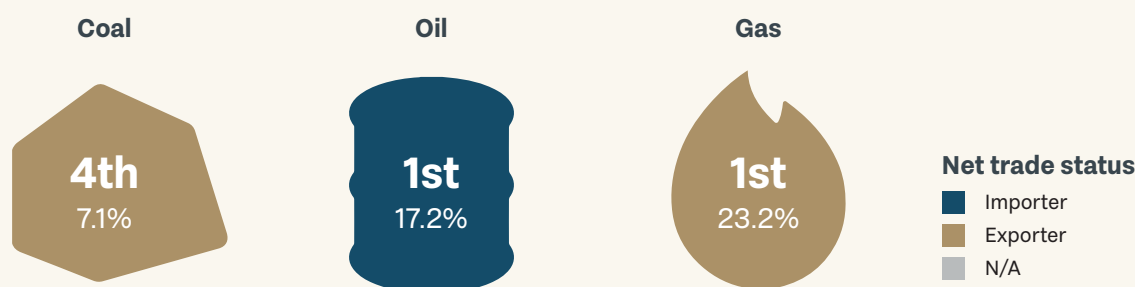
The US Energy Information Administration (EIA) forecasts that oil production will reach and remain at record high levels of 19–21 Mb/d from 2024 to 2050, while gas production is projected to continually increase, reaching 1.2 trillion cubic meters in 2050, as illustrated in Figure 3.3 (US EIA, 2023a). The additional oil and gas volumes are largely destined for exports. Conversely, coal production is projected to drop by 43% between 2021 and 2030, followed by a more gradual long-term decline.

Government support for domestic fossil fuel production

■ In July 2022, the US became the world's leading exporter of LNG, and further major expansion is planned, including a doubling of liquefaction capacity by 2027 (BloombergNEF, 2023; US EIA, 2022). As of March 2023, the US Department of Energy had authorized 18 large-scale LNG export projects totalling 450 billion cubic meters per year of capacity, with nearly half of that capacity awaiting final investment decisions (US DOE, 2022a, 2023a).

■ The IRA mandates the Department of Interior (US DOI) to conduct four oil and gas lease sales in the Gulf of Mexico Outer Continental Shelf by the end of 2023. It also makes wind and solar development on federal lands contingent on further oil and gas lease sales over the next decade (117th Congress, 2022).

Rank of country in, and share of, global production, and net trade status



Fossil fuel transition capacity and dependence indicators

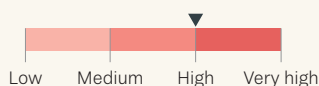
Income level

High income

Coal direct employment

0.3 coal miners per 1,000 workers

Coal economic dependence

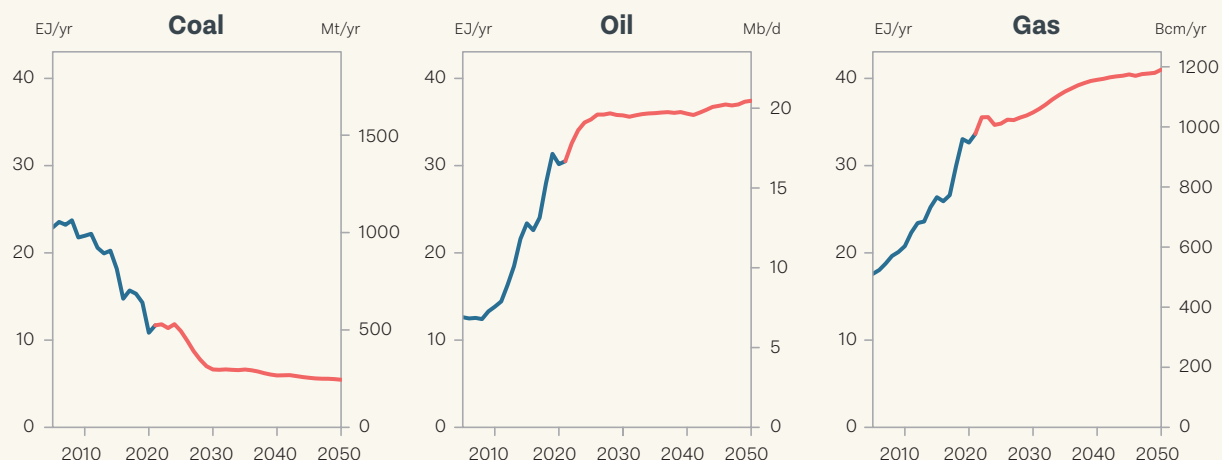


Share of GDP from oil & gas production

8%

Figure 3.3

Historical (2005–2021) and projected coal, oil, and gas production for the US. Sources: Reference scenario from the EIA Annual Energy Outlook 2023 (US EIA, 2023a).



■ In March 2023, the federal government approved the largest single oil project on federal lands, the ConocoPhillips Willow project in Alaska, which is projected to produce up to 180,000 barrels of oil a day as early as the late 2020s (US BLM, 2023c; US DOI, 2023).

■ Federal and state governments continue to provide over 60 subsidies to coal, oil, and gas producers, with a total worth of nearly USD 4 billion in 2021 (OECD, 2023b). In its 2023 budget, the US government proposed the elimination of tax subsidies for major oil and gas companies (The White House, 2023b), though the proposal has yet to be passed by the US Congress.

■ Several exemptions from federal environmental regulations remain in place for fossil fuel producers, including for hazardous waste clean-up requirements (Achakulwisut et al., 2021; Brady & Crannell, 2012; Congressional Research Service, 2020; Goldman et al., 2013; Simms, 2017). The US Congress recently reduced the scope and powers of the National Environmental Policy Act, which serves as the main environmental review process for many large fossil fuel projects (118th Congress, 2023).

Government support for international fossil fuel production

In 2021, the US government spent over USD 90 million on fossil fuel production abroad via the US Export-Import Bank (EXIM) and a further USD 25 million in 2022 (EXIM, 2023a; OCI, 2023). Additionally, up to USD 1.5 billion was allocated by the US International Development Finance Corporation in 2021 in political risk insurance for a new natural gas liquefaction facility in Mozambique (DFC, 2021; OCI, 2023). During COP26, the US and 39 other countries signed onto the Glasgow Statement, pledging to halt public financing for unabated fossil fuel energy projects abroad by the end of 2022 and spend on clean energy instead (UK Government, 2021a). EXIM has since approved USD 99.7 million for a refinery expansion in Indonesia (EXIM, 2023b).

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

The current US administration has proposed restricting future oil and gas leasing on 5.3 million hectares in the Alaskan National Petroleum Reserve and designated 1.1 million hectares of the Arctic Ocean off limits for future oil and gas leasing, in perpetuity (The White House, 2023c; US DOI, 2023). The State of California, the seventh-largest oil-producing state (US EIA, 2023b), is an associate member of BOGA, which aims to facilitate a managed phase-out of oil and gas production (BOGA, n.d.-a).

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

Domestically, USD 22 billion has been allocated by the US government towards communities impacted by the closure of coal mines or power plants. Projects in these “energy communities” include, for example, redeveloping power plant sites and pilot testing the extraction of critical minerals from abandoned coal mine waste streams (The White House, 2023d).

To support coal miners affected by black lung disease, the IRA set higher excise tax rates on coal producers to fund the Black Lung Disability Trust Fund, which ensures affected miners and their dependents receive health, disability, and survivor’s benefits (Environmental and Energy Law Program, 2022; Szymendera et al., 2023). US states including Colorado, New York, and New Mexico have created state-level just transition plans to support affected workers in the oil and gas sector (Aklin & Urpelainen, 2022).

Russian Federation

Announced climate ambitions

The Russian Federation's NDC aims to reduce net GHG emissions to 30% below 1990 levels by 2030 (Government of the Russian Federation, 2022a), a goal unchanged since 2015. The Russian Federation has also announced its intention to achieve carbon neutrality (a balance between emissions and sequestration) by 2060 (Government of the Russian Federation, 2022b; President of the Russian Federation, 2021).

Government views on domestic fossil fuel production

The Government of the Russian Federation adopted its existing energy strategy to 2035 in June 2020 (Government of the Russian Federation, 2020b), prior to the announcement of its net-zero 2060 goal, the war in Ukraine, associated sanctions, and other geopolitical developments. As of August 2023, a new energy strategy to 2050 is under development (Ministry of Energy, 2023a). The President of the Russian Federation indicated that the new strategy may include a reorientation of fossil fuel exports towards Asia-Pacific markets and accelerated monetization of oil reserves (President of the Russian Federation, 2022).

The Government of the Russian Federation has highlighted the significance of boosting coal exports from the Russian Federation to the Asia-Pacific and Atlantic regions, reducing dependence on imported mining technologies, and developing a bulk carrier fleet (Government of the Russian Federation, 2022c). In March 2023, the President of the Russian Federation noted energy cooperation with China was expanding and that Russian gas exports to China will reach at least 98 billion cubic meters by 2030 (not including another 100 million tonnes of liquefied natural gas). They also stated that

agreement had been reached on most of the parameters for a new pipeline across Mongolia with the capacity to export 50 billion cubic meters of Russian gas to China (President of the Russian Federation, 2023).

Plans and projections for domestic fossil fuel production

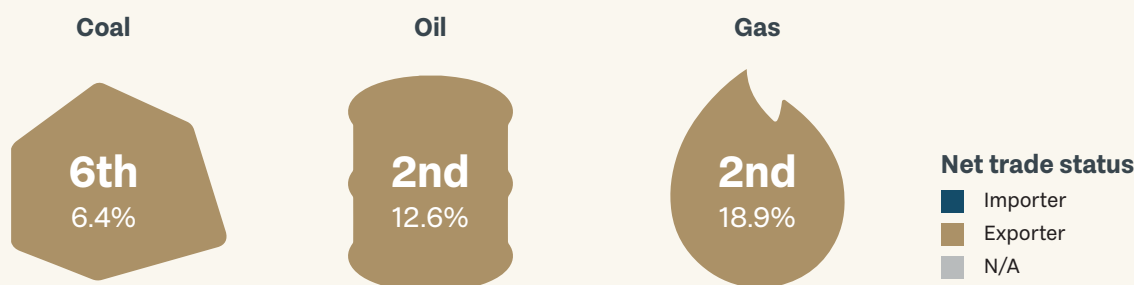
The Government of the Russian Federation projects fossil fuel production for "low" and "high" scenarios. As illustrated in Figure 3.4, the most recent plans, adopted in 2020 and 2021, foresee increases in production by 2035 relative to 2021 levels of 11% (low) and 53% (high) for coal, and 6% (low) and 32% (high) for gas (Alifirova, 2021; Government of the Russian Federation, 2020a, 2020b). In contrast, the potential growth in oil production is more limited, ranging from a decline of 12% (low) to an increase of 6% (high) by 2035 relative to 2022 levels (Alifirova, 2021; Central Dispatch Department of the Fuel and Energy Complex, 2021), due to the depletion of deposits and the imposition of high taxes (Kozlov, 2021).

Government support for domestic fossil fuel production

■ Tax breaks and budget expenditures for fossil fuel production totalled RUB 884 billion (USD 12 billion) in 2020, with most support associated with exemptions from or reductions of extraction taxes for oil and gas (OECD, 2023b).

■ As part of the reorientation of fossil fuel exports from Europe to Asia, the Government of the Russian Federation incentivizes the creation of corresponding pipeline, railway, seaport, LNG terminal, and power grid infrastructure, as well as the construction or purchase of oil tankers and bulk carriers (Xu & Nazarov, 2022). For example, state-owned

Rank of country in, and share of, global production, and net trade status



Fossil fuel transition capacity and dependence indicators

Income level
Upper-middle income

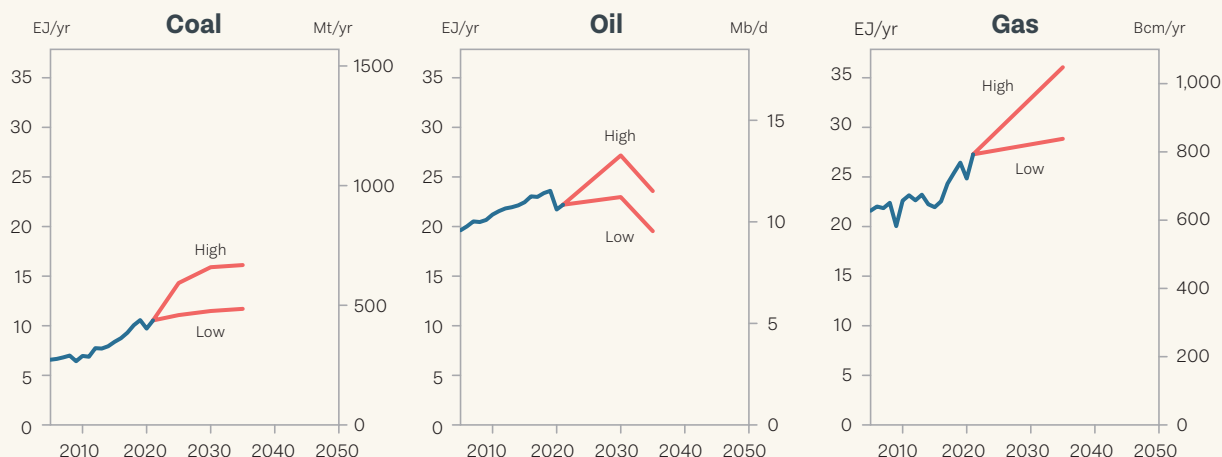
Coal direct employment
2.0 coal miners per 1,000 workers

Coal economic dependence
Low Medium High Very high

Share of GDP from oil & gas production
19%

Figure 3.4

Historical (2005–2021) and projected coal, oil, and gas production for the Russian Federation. Sources: Coal projections are from the Energy Strategy and the Development of the Coal Industry until 2035 (Government of the Russian Federation, 2020b, 2020a); oil and gas projections are from General Scheme for the Development of the Oil and Gas Industries until 2035 (Alifirova, 2021; Central Dispatch Department of the Fuel and Energy Complex, 2021). All projections contain two scenarios, “High” and “Low”. Historical data are from the IEA (2023a).



railway and grid companies are investing RUB 2 trillion (USD 27 billion) in a project that will expand coal transportation and exports through the eastern part of the Russian Federation (Ministry of Energy, 2023a; TASS, 2022a). Additionally, a development plan for the Northern Sea Route has been approved, with a goal to transport up to 30 million tonnes of cargo per year by 2035, mainly consisting of oil, LNG, gas condensate, and coal (TASS, 2022b).

■ Oil and gas companies continue to receive government preferences for the mineral extraction tax due to the implementation of new fossil fuel production projects, including in the Arctic, and are claiming new tax breaks due to the increased costs (Dyatel, 2023).

Government support for international fossil fuel production

The Government of the Russian Federation and state-owned companies are involved in international fossil fuel production projects, including Gazprom investments in gas development in Bolivia, and oil and gas sector investments in Uzbekistan backed by the Russian Development Bank and Export Insurance Agency (OCI, 2023). Sanctions have affected international activity (Edovina, 2022); in 2020, Russian state-controlled company Rosneft sold all of its assets in Venezuela, including five oil-producing companies, to a company wholly owned by the Government of the Russian Federation due to US sanctions on Venezuela (Tétrault-Farber & Astakhova, 2020). Russian state-owned company Zarubezhneft is developing oil and gas fields in Viet Nam (Interfax, 2022) and Indonesia (Evans, 2022).

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

There is no public discussion indicating that the Government of the Russian Federation agencies or SOEs have considered the need or are planning to wind down fossil fuel production or consumption.

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

No specific just transition policies or discourses were identified. However, there are initiatives to diversify the economy in some fossil-fuel-dependent regions. For example, in November 2022, the Government of the Russian Federation approved the creation of a special economic zone in Kuzbass, the country's main coal-mining region, to incentivize the development of other industries, such as mineral fertilizers, lime, medical furniture, and food products (Government of the Russian Federation, 2022d).

Saudi Arabia

Announced climate ambitions

Saudi Arabia updated its NDC in late 2021 with the aim to reduce, avoid and remove GHG emissions of 278 million tonnes of CO₂ equivalent per year (MtCO₂eq/yr) by 2030, up from 130 MtCO₂eq/yr as pledged in its first NDC (Kingdom of Saudi Arabia, 2021), though the baseline is not specified. Together with its NDC update, Saudi Arabia announced a 2060 net-zero target (Saudi & Middle East Green Initiatives, 2021).

Government views on domestic fossil fuel production

Aramco, a state-owned enterprise that holds 17% of global proven petroleum reserves, administers all oil and gas exploration and extraction in Saudi Arabia. Aramco has announced a 2050 net-zero GHG target across owned and operated assets though only for its operational emissions (Aramco, 2021c). Aramco has indicated its intention to continue being a major producer, owing to its position as “one of the lowest-cost lowest-carbon producers globally” and its expectations that “the world will likely continue to need oil and gas for the foreseeable future” (Aramco, 2023a).

Plans and projections for domestic fossil fuel production

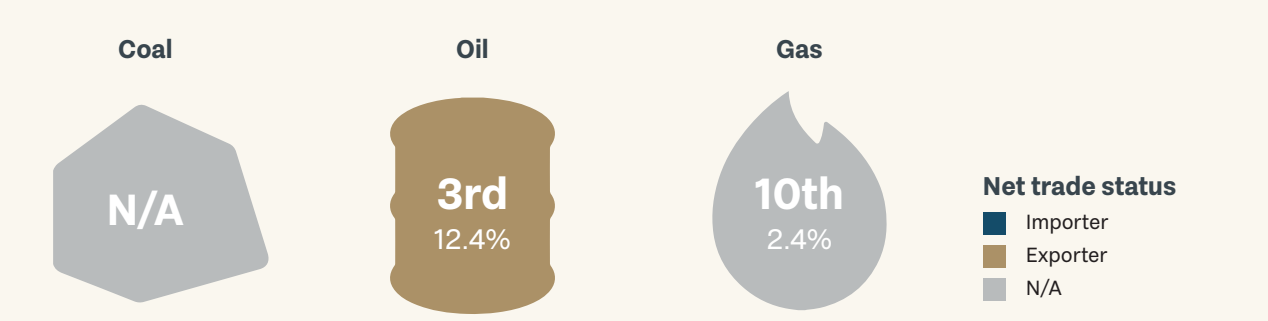
In 2022, Aramco’s average fossil fuel production was 13.6 million barrels of oil equivalent per day, including 11.5 Mb/d of liquids (Aramco, 2023a). In early 2023, Aramco indicated it will continue its investments in future growth projects, including the expansion of its maximum sustainable capacity from 12 Mb/d in 2022 to 13 Mb/d by 2027 as well as growing its gas production capacity, to meet future demand (Aramco, 2023a).

There are few publicly available government documents that reveal planning assumptions or government intentions for future domestic oil and gas production. An exception is Aramco’s updated Base Prospectus (Aramco, 2021a). As illustrated in Figure 3.5, it forecasts that Saudi Arabia’s domestic oil production will increase at an annual rate of 1% from 2015 to 2050 under a scenario where global oil demand levels off by 2037, and by 0.7% over the same period under a more rapid transition scenario where demand declines after 2019 (Aramco, 2021a, p. 159). This represents total growth of 47% or 26%, respectively, between 2015 and 2050. The prospectus also projects that gas production will increase by 40% between 2019 and 2030, primarily driven by domestic demand for power generation, and the refining and industrial sectors (Aramco, 2021a, p. 163).

Government support for domestic fossil fuel production

- Aramco’s capital expenditure in 2022 was USD 37.6 billion, an increase of 18% from 2021 (Aramco, 2023b). Aramco expects its capital expenditure to grow in 2023 to USD 45–55 billion, including external investments, and again through the middle of the decade (Aramco, 2023a, p. 42). Aramco has forecast that oil and gas will “remain essential for the foreseeable future” and warned that underinvestment could lead to higher energy prices. “To leverage our unique advantages at scale and be part of the global solution, Aramco has embarked on the largest capital spending program in its history,” the company noted (Aramco, 2023a).
- No other information is publicly available on tax expenditures other measures that support fossil fuel production in Saudi Arabia.

Rank of country in, and share of, global production, and net trade status

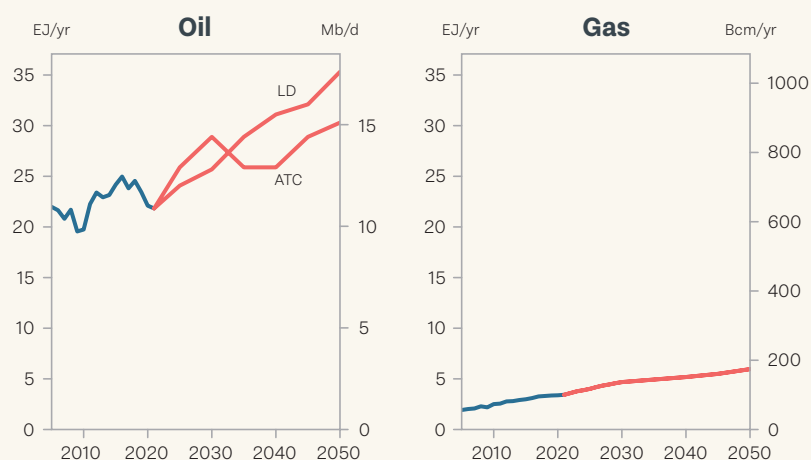


Fossil fuel transition capacity and dependence indicators

Income level	Coal direct employment	Coal economic dependence	Share of GDP from oil & gas production
High income	N/A	N/A	50%

Figure 3.5

Historical (2005–2021) and projected oil and gas production for Saudi Arabia. Sources: Oil and gas projections are from Saudi Aramco's Base Prospectus 2021 (Aramco, 2021a). For oil, two scenarios — “levelling of demand” (LD) and “accelerated transition case” (ATC) — are provided. Historical data are from the IEA (2023a).



Government support for international fossil fuel production

While Aramco has expanded its international presence with 14 subsidiary offices and several overseas refining and chemical joint ventures, it is not involved in fossil fuel production overseas (Aramco, 2021b).

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

No government policies or discourses to support a managed wind-down of fossil fuel production were identified. Saudi Arabia has a long history of engaging in international climate negotiations around issues related to oil and the impact of climate change mitigation on economies that are highly dependent on fossil fuel revenues (Depledge, 2008; IEA, 2021). Saudi officials have advocated for managing GHG emissions through measures including cleaner production processes, energy efficiency, expanding renewables, and CCUS (Krane, 2022).

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

While no direct policies or discourses regarding a just transition from fossil fuels were identified, the Government of Saudi Arabia is conscious that climate change mitigation measures might adversely impact the economy, should demand for oil and gas export products fall in a carbon-constrained future (Aramco, 2021a, p. 117). In 2022, Aramco established a USD 1.5 billion Sustainability Fund “to support a stable and inclusive energy transition” (Aramco, 2023b), though none of the investment categories target a transition away from fossil fuel production (Aramco Ventures, 2022).

Australia

Announced climate ambitions

In June 2022, Australia updated its NDC, raising its emission reduction target to 43% below 2005 levels by 2030, up from the prior target of 26–28%. New legislation codifies Australia's emissions targets, including net-zero emissions by 2050, requires the government to account for progress, and mandates the independent Climate Change Authority to advise on strengthened targets for future NDC updates (Parliament of Australia, 2022).

Government views on domestic fossil fuel production

Australia is one of the world's top two LNG and coal exporters, and its coal and gas industries have strong influence in political debate, diplomacy, economic strategy, and policy development, both nationally and in fossil-fuel-exporting states (Disavino, 2021; Hamilton et al., 2023; IEA, 2023a). In March 2023, the Minister for Resources noted to Parliament that "Australia's coal and gas resources are essential for energy security, stability and reliability both domestically and across the Asia-Pacific and will be needed for decades" (King, 2023). Ministers have rejected calls to ban new fossil fuel projects (Thompson, 2023).

A government list of "major projects" showed 69 coal projects and 49 new oil and gas projects in the pipeline (Department of Industry, Science and Resources, 2022a). These together represent nearly 5 GtCO₂eq of potential emissions, though not all are expected to materialize, as some of the projects are at announcement or feasibility stage (Campbell et al., 2023).

A small number of projects have been cancelled by government decisions to rescind licenses or reject approvals, and through legal challenges under environmental laws. Some state governments have imposed regional bans on some forms of production. For example, the state of Victoria has banned hydraulic fracturing (Parliament of Victoria, 2022), though still allows conventional gas production.

Fossil fuel production is a major source of Australia's domestic emissions, accounting for 19% of the total in 2021 (DCCEEW, 2023a), and half of the emissions covered by the Safeguard Mechanism, a baseline-and-credit scheme that covers large industrial facilities and ensures that absolute aggregate emissions covered by the scheme fall over time. Covered facilities, including coal mines and gas projects, will need to reduce emissions or acquire and surrender offsets; new facilities, including gas projects, face more stringent emission constraints (DCCEEW, 2023b). The impact of these changes on fossil fuel production remains unclear, though reactions by Australia's gas importers suggest an expectation of material effects on future gas production (Morton, 2023).

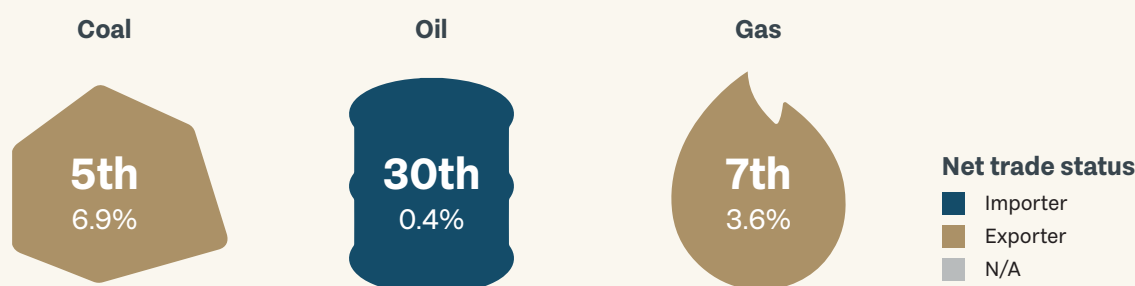
Plans and projections for domestic fossil fuel production

Recent energy trade projections by the government see coal production increasing slightly to 2025, then remaining constant to 2028 (Figure 3.6), with the overall increase shared between metallurgical and thermal coal. Production of gas is projected to slightly decline to 2025, then remain constant to 2028, with the export share constant around 70% (Department of Industry, Science and Resources, 2023). The government's emission projections to 2035 assume a modest decline in coal mining, due in part to reduced domestic consumption, and a small increase in LNG production and exports (DCCEEW, 2022, pp. 45, 47).

Government support for domestic fossil fuel production

■ Fiscal support for fossil fuel production includes the Fuel Tax Credit Scheme, of which coal mining is among the largest beneficiaries (Australian Taxation Office, 2021); tax incentives under the Petroleum Resource Rent Tax (Treasury, 2023b); and direct capital expenditure for infrastructure (The Australia Institute, 2022).

Rank of country in, and share of, global production, and net trade status



Fossil fuel transition capacity and dependence indicators

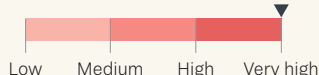
Income level

High income

Coal direct employment

3.8 coal miners per 1,000 workers

Coal economic dependence

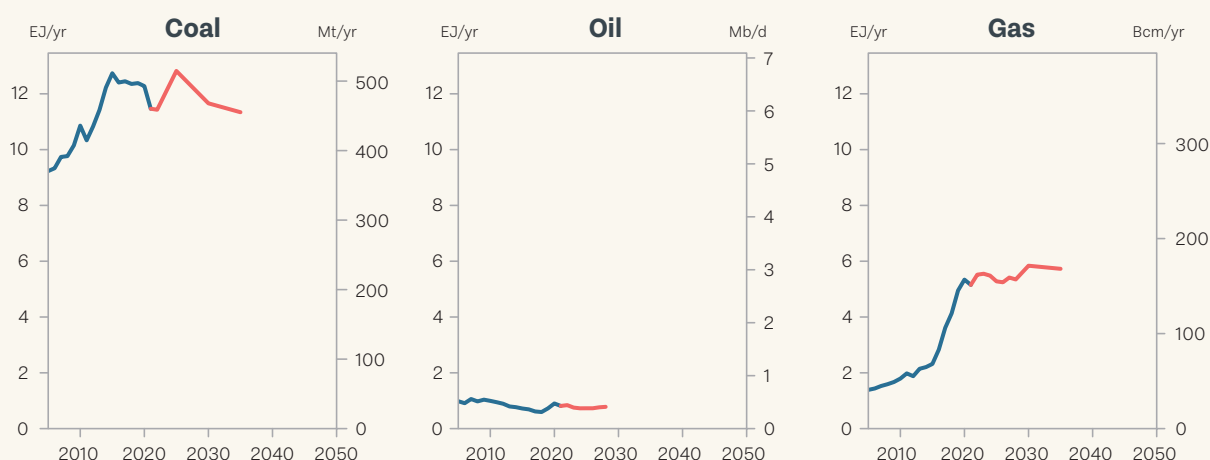


Share of GDP from oil & gas production

3%

Figure 3.6

Historical (2005–2021) and projected coal, oil, and gas production for Australia. Sources: Historical data and 2022–2028 projections for oil and gas are from the Resources and Energy Quarterly, March 2023 (Department of Industry, Science and Resources, 2023), and 2030 and 2035 gas projections are estimated from the LNG production projections provided in Australia's emissions projections 2022 (DCCEEW, 2022); 2025, 2030, and 2035 coal projections are taken from this document.



■ Australia's fiscal regime for oil and gas production have allowed many operators of major projects to pay little or nothing in royalties or resource rent taxes (Bruce, 2019; Butler, 2021; Campbell, 2020). Despite being highly profitable, to date no LNG project has paid Petroleum Resource Rent Tax (Commonwealth of Australia, 2023).

■ Changes to the Petroleum Resource Rent Tax announced in May 2023 will increase taxation of the gas industry somewhat, but fall short of earlier proposals for reform (Janda et al., 2023).

■ The new government has removed some of its predecessor's subsidies for gas exploration and infrastructure. The government is continuing with plans to provide AUD 1.5 billion (USD 1 billion) for a new port in Darwin Harbour that could support the development of shale gas fracking in the Beetaloo Basin (Gibson, 2022). Infrastructure Australia is currently considering proposals for the government to fund gas pipelines and supporting infrastructure in the Beetaloo Basin (Infrastructure Australia, 2022), and large gas extraction projects are planned there (Reuters, 2023d).

■ Financing for coal and gas has been banned through some government vehicles, including through the Powering Our Regions Fund (Bowen, 2023) and the Industry Research and Development Act (House of Representatives, 2023). Coal and gas financing is still allowed through other agencies, including Export Finance Australia and the Northern Australia Infrastructure Fund.

■ The government owns and expands the rail network that transports thermal coal to the world's largest coal port at Newcastle (ARTC, 2022).

Government support for international fossil fuel production

Export Finance Australia has funded fossil fuel projects overseas and exports from Australia with more than AUD 1.6 billion (USD 1.2 billion) between June 2009 and June 2020 (Rui & Strachan, 2021). As of August 2023, the government

has not committed to end overseas government financing of fossil fuel projects.

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

There is no national policy framework aiming to restrict fossil fuel exploration, production, or infrastructure development. The Treasurer has directed the Treasury to conduct analysis of climate and transition impacts on Australia's national economy and budget (Wright & Foley, 2022). The Treasury is also exploring standardized requirements for financial disclosures of climate risks (Treasury, 2023a).

Independent Australian regulators have begun scrutinizing carbon risk management and greenwashing, including with regards to fossil fuel companies. Actions to date have focused on guidance statements and encouraging voluntary action (APRA, 2021; Hughes, 2023).

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

The government has made budget commitments that it frames as enabling regional economic transition, including a Powering the Regions Fund with AUD 1.9 billion (USD 1.3 billion) in grants, a National Reconstruction Fund with AUD 15 billion (USD 10 billion), and a Rewiring the Nation programme with funds of AUD 20 billion (14 USD billion) (Bowen & McAllister, 2022; Department of Industry, Science and Resources, 2022b).

A Net Zero Authority is to be established by legislation, building on an agency within the Department of the Prime Minister and Cabinet. The Authority is to support workers in coal-mining and emissions-intensive sectors, support regions and communities to take advantage of clean energy industries, and help mobilize private investment (Department of the Prime Minister and Cabinet, 2023).

Indonesia

Announced climate ambitions

In its enhanced NDC, Indonesia pledged to reduce emissions by 31.89% by 2030, or by 43.2% with international assistance, slightly higher than the previous targets of 29% and 41%, respectively (Government of Indonesia, 2022). Indonesia has also developed a long-term strategy (LTS) to achieve “the peaking of national GHG emissions in 2030” and “rapidly progress towards net-zero emission in 2060 or sooner” (Government of Indonesia, 2021).

Government views on domestic fossil fuel production

Indonesia was the world’s third-largest producer and largest exporter of coal in 2021 (IEA, 2023a). Coal and gas account for nearly 20% of the country’s net goods exports, and coal royalties accounted for around 3% of government revenues in 2021 (IEA, 2022b). In 2022, Indonesia exported over 70% of its produced coal, despite a coal export ban announced at the start of the year (Reuters, 2023b). Under Presidential Regulation 112, issued in September 2022, Indonesia plans to phase out unabated coal power generation by 2050 (President of the Republic of Indonesia, 2022). However, this does not necessarily signify a reduction in coal production, as government strategy documents foresee strong government support for the expansion of downstream industries to transform low-grade coal into products for non-energy uses such as dimethyl ether (DME) and methanol (MEMR, 2021, 2022a).

The need to achieve energy independence and energy security, as well as to balance emission reduction against economic development, dominate government discourses and policies on energy (Government of Indonesia, 2021; National Energy Council, 2022). Even under a Paris-aligned scenario described in its LTS, Indonesia sees coal supply and use remaining “significant, especially in power sub-sector which will be

equipped with carbon capture and storage (CCS) systems” (Government of Indonesia, 2021, p. 61). A draft law aims to promote the development of “new energy” sources, including fossil fuels produced using new technologies, such as liquefied and gasified coal and coal methane gas (CNN Indonesia, 2023; Sambodo, 2023).

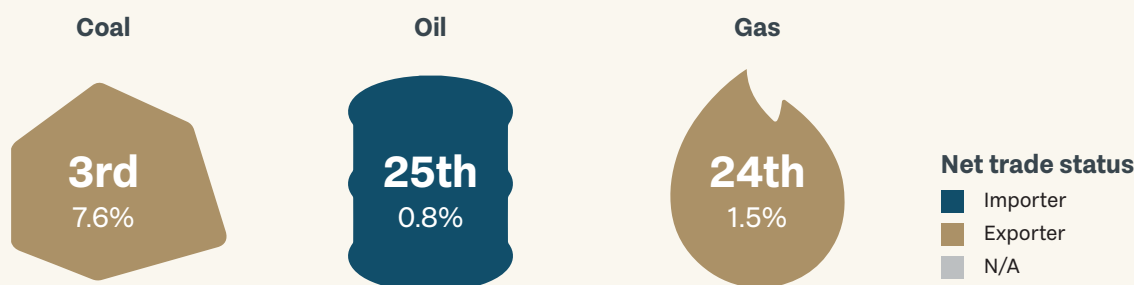
Indonesia is currently exploring goals to reach peak total emissions by 2030 and net-zero emissions by 2050 in its power sector, while ensuring a just and affordable energy transition through international support, including the JETP initiative (see Box 3.2) and the Asian Development Bank’s Energy Transition Mechanism (ADB, 2022b). Although both of these mechanisms include funding for the early retirement of coal-fired power plants, Indonesia is still building new coal plants (Simon, 2023). Nothing specific to domestic fossil fuel production is mentioned within these initiatives.

Plans and projections for domestic fossil fuel production

According to Indonesia’s 2021 Energy Outlook,²³ coal production is expected to grow by around 18% between 2021 and 2030, before plateauing at around 680 million tonnes out to 2050, under a “business-as-usual” scenario (see Figure 3.7) (PPIPE & BPPT, 2021). Gas production is projected to peak in 2028 at almost 3.5 trillion cubic feet and subsequently decline due to resource depletion. Oil production is also projected to decline starting around 2028 due to resource depletion.

The government has also developed coal production scenarios consistent with its climate ambitions, though has not yet incorporated such scenarios into its national energy outlooks. In its LTS, a “Current Policy Scenario” and a “Low Carbon Scenario Compatible with Paris Agreement target” see coal production peaking around 2025 and declining thereafter out to 2050 at annual rates around 1% and 3%, respectively

Rank of country in, and share of, global production, and net trade status



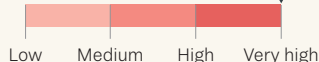
Fossil fuel transition capacity and dependence indicators

Income level
Lower-middle income

Coal direct employment

1.8 coal miners per 1,000 workers

Coal economic dependence

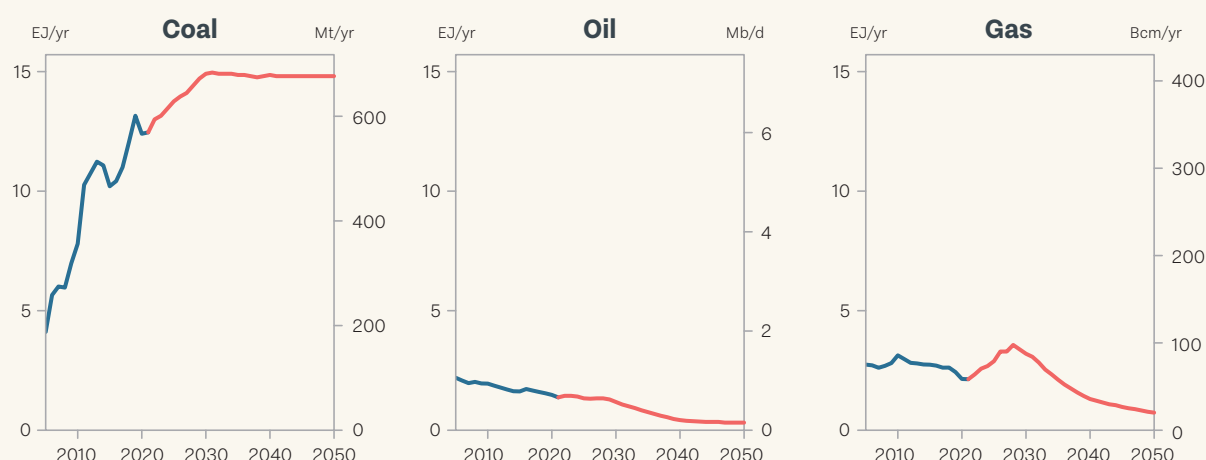


Share of GDP from oil & gas production

12%

Figure 3.7

Historical (2005–2021) and projected coal, oil, and gas production for Indonesia. Sources: Projections are from the business-as-usual scenario of the Indonesia Energy Outlook 2021 by the government's Research Center for Industrial Processing and Energy (PPIPE) and Agency for the Assessment and Application of Technology (BPPT) (PPIPE & BPPT, 2021). Historical data are from the IEA (2023a).



(Government of Indonesia, 2021). The government also asked the Ministry of Energy and Mineral Resources (MEMR) and the IEA to develop a “detailed scenario and policy analysis of what [its net-zero] target means for Indonesia’s energy sector” (IEA, 2022b). However, the resulting roadmap does not detail pathways for domestic fossil fuel production beyond mentioning that “the government aims to provide continued support to maintain current levels of coal production” (IEA, 2022b, p. 45).

Government support for domestic fossil fuel production

- The government provided budgetary transfers and tax expenditures totalling IDR 51.4 trillion (USD 3.6 billion) for coal and IDR 3.6 trillion (USD 250 million) for oil and gas production in 2021 (OECD, 2023b).
- The government is heavily subsidizing the development of downstream industries to transform low-grade coal into products such as DME and methanol (IEA, 2022b; MEMR, 2022b; Peh, 2023). The government is also preparing regulatory measures to boost coal gasification, including cutting royalties on coal produced for this purpose, tax exemptions on midstream processes, and setting a benchmark price for coal derivatives (MEMR, 2022b).
- In 2023, the Indonesian Parliament approved a Job Creation Regulation with the same features and legal power as the annulled 2020 Job Creation Act, including the loosening of environmental safeguards for coal-mining permits and royalty fee exemptions for companies developing coal derivatives (Shafira, 2023).
- In 2023, the MEMR announced new legislation aimed at boosting the development of CCS and CCUS in the oil and gas sector, in order to reduce emissions from production

activities and potentially also for enhanced oil recovery (Sidemen, 2022).

Government support for international fossil fuel production

No support was identified.

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

No such policies specific to production were identified. Indonesia’s LTS noted that “Substitution of fossil energy by renewable energy will cause fossil energy resources [to be] left unexploited... and become stranded assets with some economic implications to the country... The loss would be much bigger if Indonesia’s mitigation strategy were in the form of extreme coal elimination (phase out)” (Government of Indonesia, 2021, pp. 66–67). At COP26, Indonesia signed on to Clause 2 (phase-out of unabated coal power by 2030/2040) but not Clause 3 (no new coal-fired power plants) of the Coal Exit Pledge; coal production itself is not addressed (CAT, 2022).

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

Although no policies or discourses specific to fossil fuel production were identified, Indonesia has recently started work on just energy transitions with international support, as described above. The concept was previously noted in its LTS as a need for “preparation of migration to green jobs” (Government of Indonesia, 2021), and the Indonesian G20 Presidency also pushed for the concept of an inclusive and just energy transition in the G20 Bali Leaders’ Declaration (G20, 2022).

²³ This report uses the latest outlook published by the government’s Research Center for Industrial Processing and Energy (PPIPE) and Agency for the Assessment and Application of Technology (BPPT) (PPIPE & BPPT, 2021), as a more recent outlook published by the National Energy Council does not provide projections for fossil fuel production (National Energy Council, 2022).

India

Announced climate ambitions

India's updated NDC, submitted in August 2022, pledges a reduction in "the emissions intensity of its GDP" of 45% by 2030, compared to 2005 levels, and an increase in the share of non-fossil power capacity to 50% by 2030 (Government of India, 2022). The document also states that this updated NDC "is a step forward towards our long term goal of reaching net-zero by 2070".

Government views on domestic fossil fuel production

India's LT-LEDS, released during COP27, commits it to a low-carbon transition "at a pace and scale that is nationally determined, without compromising development futures", and that "should not impact energy security, energy access and employment" (MOEFCC, 2022).

The Ministry of Home Affairs has noted that increasing coal production to make India self-reliant is a priority for the government (PIB India, 2022). It called on mining companies to scale up production and stressed that the government views the coal industry as being integral in generating income for states and creating multiple employment avenues. In 2022, the Ministry of Finance extended support for coal gasification and incentives for commercial mining, and the Ministry of Coal launched the country's largest-ever auction of coal-mining blocks (Ministry of Coal, 2022b). The government also plans to increase domestic oil and gas exploration and production to support growing domestic demand (Mohanty & Ratnajyoti, 2022; Ugal, 2023). The government has forecast that demand for gas will grow by over 500% as it seeks to raise the share of gas in the country's energy mix from 6%

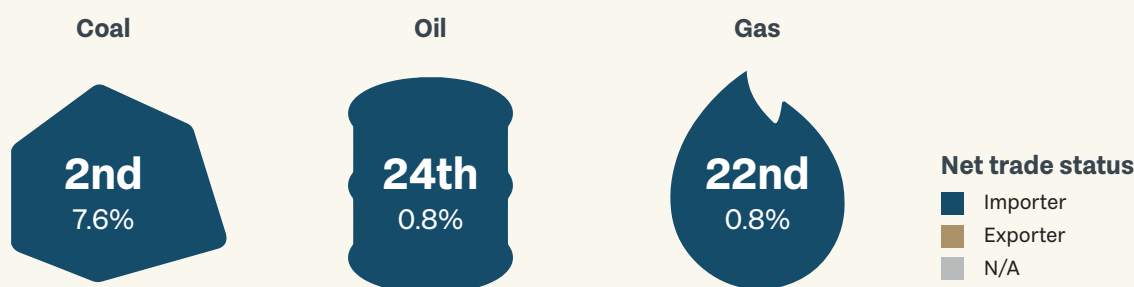
to 15% by 2030 (Mohanty et al., 2023). The Union Petroleum and Urban Affairs Minister has stated that the country aims to meet 25% of its crude oil demand from domestic production by 2030 (IANS, 2022).

Despite the Government of India's pursuit of clean energy, including the earmarking of USD 4.3 billion for green energy production in the national budget (Padma, 2023), it remains committed to fossil fuels, in particular coal, to meet rapidly growing energy needs (Pasricha, 2022; PIB India, 2022; Schmall & Krauss, 2022).

Plans and projections for domestic fossil fuel production

In March 2022, the Ministry of Coal announced plans to increase India's overall coal production to 1 billion tonnes in fiscal year 2023–2024, and production by state-owned Coal India Limited (CIL) alone to 1 billion tonnes the following year (PIB India, 2023c). CIL currently accounts for 85% of domestic coal production in India (CIL, 2021). In the longer term, the Ministry projects domestic coal production of 1.5 billion tonnes in 2030, more than double the 2021 level, as shown in Figure 3.8 (Ministry of Coal, 2022a). The ministry has also noted that India aims to become a net thermal coal exporter by 2024–2025 (The Economic Times, 2022); currently India meets about one-fifth of its coal demand with imports, exposing the country to price volatility on the international market and loss of foreign exchange reserves (Singh, 2023). As noted above, recent government statements indicate that India plans to ramp up domestic oil and gas production. However, official projections are not available.

Rank of country in, and share of, global production, and net trade status



Fossil fuel transition capacity and dependence indicators

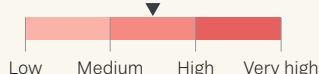
Income level

Lower-middle income

Coal direct employment

0.9 coal miners per 1,000 workers

Coal economic dependence

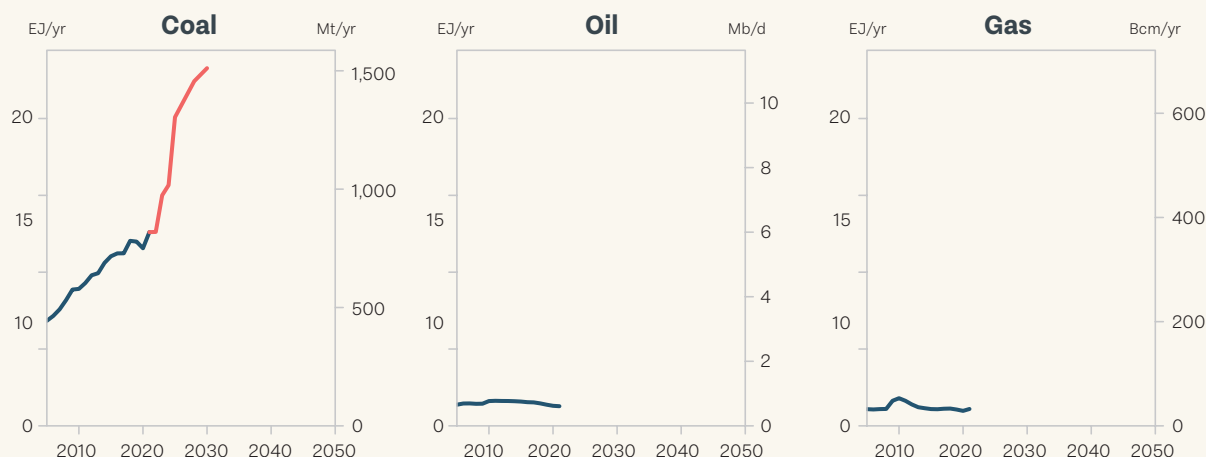


Share of GDP from oil & gas production

2%

Figure 3.8

Historical (2005–2021) coal, oil, gas and projected coal production for India. Sources: Coal projections are from India's Ministry of Coal (2022a). Oil and gas projections are not available. Historical data are from the IEA (2023a).



Government support for domestic fossil fuel production

■ Producer subsidies through direct budgetary transfers and tax breaks were valued at INR 5.7 billion (USD 77 million) in 2021 (OECD, 2023b).

■ The government has set up rolling electronic auctions of mining blocks to increase domestic coal production (PIB India & Ministry of Coal, 2022). In 2021, the government streamlined the process for providing clearances and approvals for coal mines (PIB India, 2023a).

■ The government is encouraging foreign direct investment in the oil and gas sector (Chakraborty, 2023). For example, it has opened up an additional 1 million square kilometers of its exclusive economic zone (EEZ) for oil and gas exploration and production (PIB India, 2023b).

Government support for international fossil fuel production

ONGC Videsh Ltd (OVL), a subsidiary of India's national oil company, has stakes in 33 oil and gas projects in 15 countries (ONGC Videsh, 2023). OVL expects to increase investments in its overseas assets from INR 30 billion (USD 410 million) in 2023 to INR 50 billion (USD 680 million) by 2024.

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

While India has made significant investments and set ambitious targets for renewable energy (Biorol & Kant, 2023; REN21, 2023), no government policies or discourses to support a managed wind-down of fossil fuel production were identified.

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

Some commentators hold that the idea of a just transition is relatively new in India and is gaining traction (Pai & Ranjan, 2023). In late 2022, an inter-ministerial committee produced a report on enabling a just transition from coal, proposing a funding, action, and implementation framework to help coal-producing regions handle mine closures and manage the transition (NITI Aayog, 2022). In May 2023, the Ministry of Coal organized a seminar on just transitions as a side event at the 3rd Energy Transitions Working Group of the G20 Presidency of India (Ministry of Coal, 2023). Jharkhand (the Indian state with the largest coal production and reserves) has created a task force to assess the dependency of local communities on a coal-based economy and produce a road-map towards a just transition away from coal (Kumar, 2023; Pai & Ranjan, 2023).

There have also been discussions about the possibility of a JETP between India and funding countries (Nandi, 2022) (see Box 3.2).

Canada

Announced climate ambitions

Canada updated its NDC in 2021, committing the country to reduce emissions to 40–45% below 2005 levels by 2030 and to reach net-zero by 2050 (ECCC, 2021). The Net-Zero Emissions Accountability Act enshrines the 2050 net-zero commitment in law (Government of Canada, 2021). In 2022, the government released the first national Emissions Reductions Plan under the law, outlining measures the government will take to achieve its targets (Government of Canada, 2022c).

Government views on domestic fossil fuel production

The federal government continues to view fossil fuels as an important contributor to Canada's economy (Office of the Prime Minister of Canada, 2021b), and has noted that under its Emission Reductions Plan, oil production could still grow by up to 1 Mb/d (The Canadian Press, 2022). The federal and provincial governments have recently approved new oil and gas developments, such as the Bay Du Nord offshore oil project in 2022 (Impact Assessment Agency of Canada, 2022) and the Cedar LNG export terminal in 2023 (Impact Assessment Agency of Canada, 2023). The federal government stipulated that these projects must have a plan to bring GHG emissions associated with production to net zero by 2050 (Impact Assessment Agency of Canada, 2022, 2023).

The federal government has committed to implementing a cap on emissions from the oil and gas sector, a measure projected to reduce the sector's emissions to 31% below 2005 levels by 2030 (Government of Canada, 2022d). Alongside the emissions cap, the government has introduced a number of other incentives and regulations to reduce emissions from production, such as an investment tax credit for CCUS (Department of Finance Canada, 2021, 2022b), draft guidance for "best-in-class" GHG emissions performance by oil and gas

projects (Government of Canada, 2022b), and a target to reduce methane emissions in the sector 75% below 2012 levels by 2030 (ECCC, 2022).

Plans and projections for domestic fossil fuel production

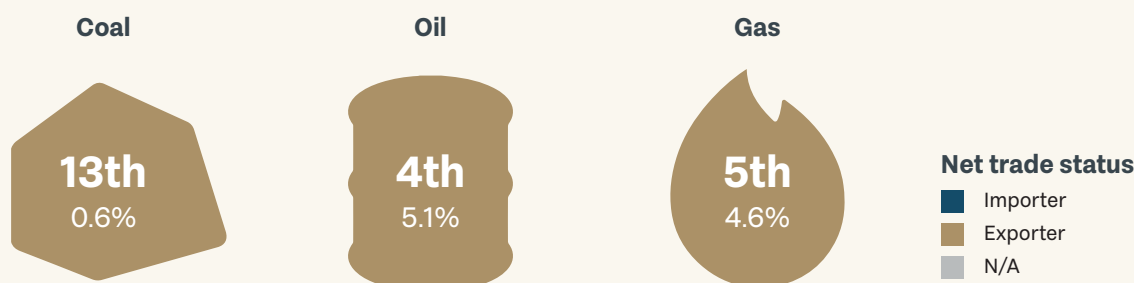
A 2023 energy outlook published by the Canada Energy Regulator (CER) presents three scenarios out to 2050 (Canada Energy Regulator, 2023). Under the "current measures" scenario, which assumes no further action to reduce emissions, Canada's oil production (crude oil plus natural gas liquids) increases by 25% over 2022 levels by 2035 and remains roughly constant through 2050; and gas production rises steadily through 2050, to 24% above 2022 levels (Figure 3.9). In contrast, under the "global net-zero" scenario, with lower global oil and gas prices and demand, Canada's oil production peaks in 2026 and declines to 73% below 2022 levels by 2050, while gas production peaks in 2023 before dropping 68% below 2022 levels by 2050. In the "Canada net-zero" scenario, the rest of the world moves more slowly to decarbonize, and Canada's oil and gas production fall 23% and 37% respectively by 2050, compared to 2022 levels. Following its 2021 report, the CER no longer provides projections for coal production.

Government support for domestic fossil fuel production

■ National and sub-national fossil fuel production subsidies totalled CAD 2 billion (USD 1.6 billion) in 2021 with over half going towards deep drilling credits in British Columbia for gas wells (OECD, 2023b).

■ Between 2018 and 2021, the government also provided CAD 21.7 billion (USD 16.6 billion) in public finance (i.e. loans,

Rank of country in, and share of, global production, and net trade status



Fossil fuel transition capacity and dependence indicators

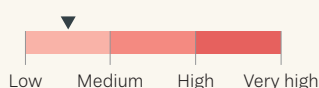
Income level

High income

Coal direct employment

0.4 coal miners per 1,000 workers

Coal economic dependence

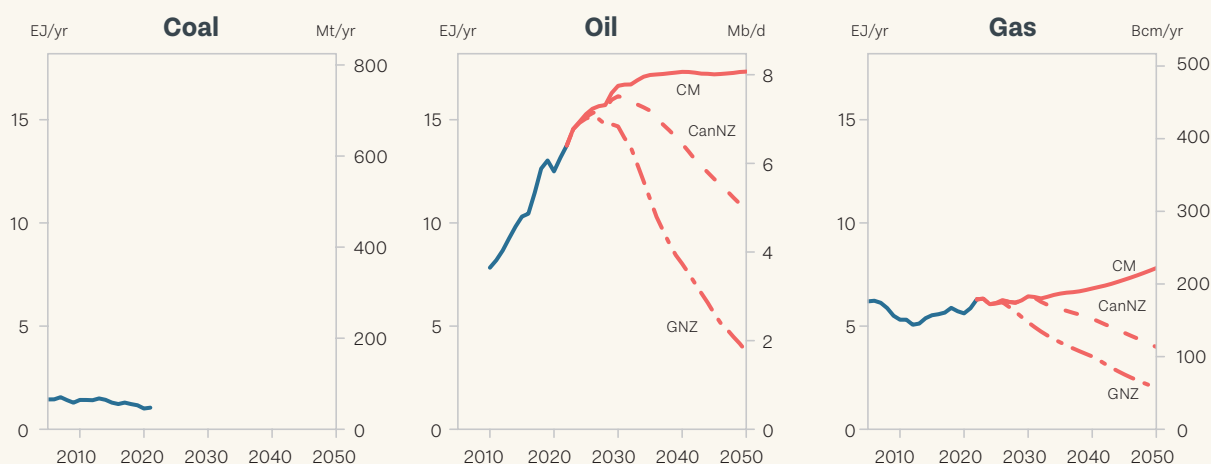


Share of GDP from oil & gas production

10%

Figure 3.9

Historical (2005–2022) and projected coal, oil, and gas production for Canada. Sources: Historical data and projections for oil and gas production are from the “current measures” (CM), “global net-zero” (GNZ), and “Canada net-zero” (CanNZ) scenarios presented in Canada’s Energy Future 2023 report (Canada Energy Regulator, 2023). Coal projections are not provided in the report.



grants, and guarantees) for domestic fossil fuel development including pipelines (EDC, 2018, 2019, 2020, 2021; OCI, 2023).

■ The federal government has committed to phasing out inefficient fossil fuel subsidies in 2023, and in July published guidelines to determine which subsidies will be removed (ECCC, 2023a). The government has also committed to phasing out public financing for fossil fuels, including by federal corporations, and has partially eliminated flow-through shares for coal, oil, and gas projects (Government of Canada, 2022a; Office of the Prime Minister of Canada, 2021a).

■ In 2022, the federal government provided a CAD 10 billion (USD 7.6 billion) loan guarantee for the Trans Mountain Expansion Project, a crude oil pipeline intended to open up additional global markets for Alberta crude oil (Department of Finance Canada, 2022a; Natural Resources Canada, 2020).

Government support for international fossil fuel production

Canada has historically been one of the largest international public financiers of fossil fuels, primarily through Export Development Canada, providing at least USD 2.6 billion from 2018 to 2021 for fossil fuel production and related transportation projects (EDC, 2018, 2019, 2020, 2021; OCI, 2023). At COP26, the federal government signed the Glasgow Statement committing to end international public financing for unabated fossil fuel projects by the end of 2022 and redirect investments into clean energy (UK Government, 2021a). Canada’s related policy guidelines include exemptions (e.g. for gas power generation) along with conditions, including that any exempted project is aligned with a 1.5°C pathway (Natural Resources Canada, 2022).

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

The province of Quebec is a core member of BOGA, which advocates for a managed phase-out of oil and gas production (BOGA, n.d.-a). The Federal Minister of Environment and Climate Change has called for countries to commit to the phase-out of “unabated” fossil fuels at COP28 (ECCC, 2023b).

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

The federal government is investing CAD 150 million (USD 120 million) in 2019–2025 towards infrastructure projects in communities affected by the coal power transition (Government of Canada, 2023a). In early 2023, the federal government released an action plan that allocates CAD 960 million (USD 740 million) towards a programme including training and re-skilling for jobs emerging from the decarbonization of oil and gas production and the growth of alternative energy sources. The plan also includes the creation of a Sustainable Jobs Secretariat for implementation, a Sustainable Jobs Training Centre, and a Partnership Council composed of diverse representatives, with CAD 250 million (USD 200 million) committed to the former two bodies so far (Government of Canada, 2023a). The government has tabled draft legislation that aims to enshrine just transition governance bodies and processes in law (Government of Canada, 2023b).

United Arab Emirates (UAE)

Announced climate ambitions

In July 2023, the UAE updated its NDC to set an absolute GHG emissions reduction target of 19% below 2019 levels by 2030, replacing its previous commitment to reduce emissions to 31% below a business-as-usual level for the year 2030 (Government of the United Arab Emirates, 2023a). In the run-up to COP26 in 2021, the UAE announced its intention to achieve net-zero emissions by 2050, a target that is reiterated in its updated NDC (Ibrahim & Hussein, 2021). At COP27 in 2022, UAE announced its net-zero roadmap, which includes a target of reducing emissions from 2019 levels by 60% by 2040 (UAE Ministry of Climate Change and Environment, 2022).

Government views on domestic fossil fuel production

While the government strives to diversify its economy and rely less on oil, with a focus on green and low-carbon development, it acknowledges that oil and gas will continue to play a key role in its socioeconomic development (Government of the United Arab Emirates, 2022, 2023b).

The war in Ukraine has reinforced UAE's approach of boosting domestic oil and gas production while promoting domestic development of renewables, nuclear power, and energy efficiency resources (Ministry of Energy & Infrastructure, 2023; Sim, 2023).

The state-owned Abu Dhabi National Oil Company (ADNOC) set targets of reaching zero methane emissions by 2030 and net-zero emissions by 2045, though only for its operational emissions (ADNOC, 2023a).

Plans and projections for domestic fossil fuel production

ADNOC aims to boost oil production capacity to 5 Mb/d by 2027 from the current 4 Mb/d as part of a USD 150 billion investment plan (Fogarty, 2023; ADNOC, 2022). The company also plans to increase LNG production capacity from the current 6 million tonnes (Mt) (equivalent to 8.2 Bcm) per year to 15.6 Mt (21.2 Bcm) by 2028, and is building a major LNG facility capable of exporting 9.6 Mt (13.1 Bcm) per year, to feed growing demand in Asia and Europe, and to reach national self-sufficiency by 2030 (ADNOC, 2022; Di Paola & Ratcliffe, 2022).

Government support for domestic fossil fuel production

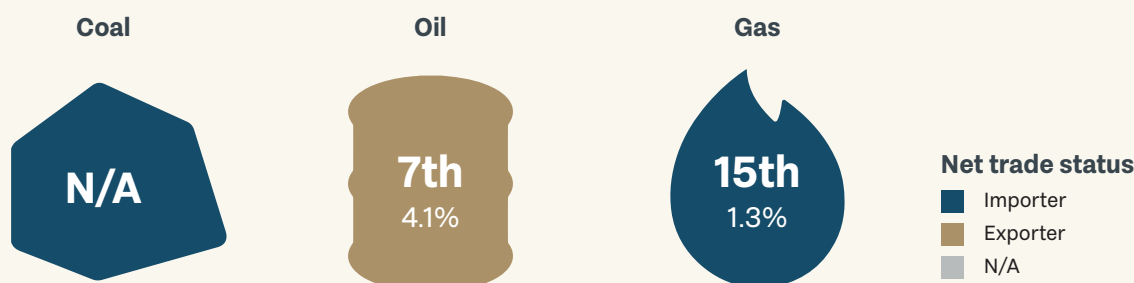
■ As noted above, ADNOC and the UAE have made significant investments in the energy sector and expect to continue doing so, with ADNOC announcing in late 2022 its five-year USD 150 billion investment programme (ADNOC, 2022).

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

Government support for international fossil fuel production

Abu Dhabi's sovereign wealth fund, Mubadala, invests in oil and gas fields abroad, including the USD 1 billion purchase of a 22% stake in Israel's Tamar gas field in 2019 (Glover, 2021).

Rank of country in, and share of, global production, and net trade status

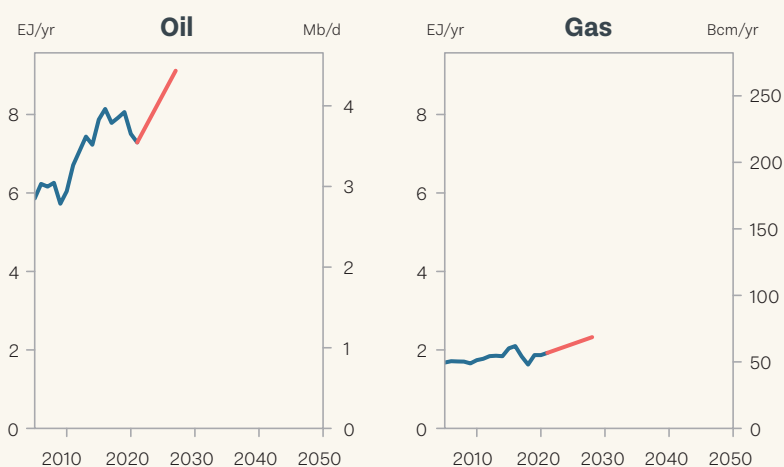


Fossil fuel transition capacity and dependence indicators

Income level	Coal direct employment	Coal economic dependence	Share of GDP from oil & gas production
High income	N/A	N/A	27%

Figure 3.10

Historical (2005–2021) and projected oil and gas production for the UAE (no coal is produced). Sources: 2027 oil production is estimated by assuming that it will scale with the target increase in oil production capacity; 2028 gas production is estimated from the target increase in LNG production (ADNOC, 2022; Di Paola & Ratcliffe, 2022). Historical data are from the IEA (2023a).



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

While the UAE has made significant investments and set ambitious targets for clean energy (Silverstein, 2023), it has no concrete policies intended to support a managed wind-down of fossil fuel production.

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

As integral elements of the UAE's National Climate Change Plan 2017–2050, the government has various human capacity programmes that support sustainability, green growth, and climate goals, though none are specifically oriented to transitioning away from fossil fuels (Al-Sarihi & Mason, 2020).

Qatar

Announced climate ambitions

Qatar submitted a revised NDC in 2021, pledging a 25% reduction in GHG emissions by 2030 relative to a business-as-usual baseline (Ministry of Municipality and Environment, 2021). Qatar has not announced a net-zero strategy.

Government views on domestic fossil fuel production

Qatar holds the third-largest proven reserves of fossil gas, after the Russian Federation and Iran (OPEC, 2022), and in 2022 had the world's second-largest LNG export capacity, after Australia and just ahead of the US (Statista, 2022). In 2005, the Government of Qatar placed a moratorium on new gas projects in the North Field, the world's largest gas field, to allow for technical assessment and in 2017 laid out plans to resume development and significantly expand gas production and exports (Munro, 2017).

The Government of Qatar views LNG exports as the mainstay of its economy and a key element of its international relationships. Earnings from the fossil fuel sector amounted to 80.5% of total government revenues in 2021 (EIA, 2023b, p. 1; IMF, 2022, pp. 28–29). The CEO of QatarGas has stated that “while some see natural gas as a transition fuel, we believe it is a ‘destination fuel!’” (QatarGas, 2023)

Qatar's oil production has fallen from a 2008 peak of 852,000 barrels per day to 616,000 barrels per day in 2022 (EIA, 2023b). Qatar's withdrawal from OPEC in January 2019 signalled an intent to focus on its standing as a global gas giant rather than a relatively small regional oil producer (Wright, 2019, p. 11).

State-owned QatarEnergy has committed to reducing the GHG intensity of its operations and eliminate routine flaring by 2030 (QatarEnergy, 2022a).

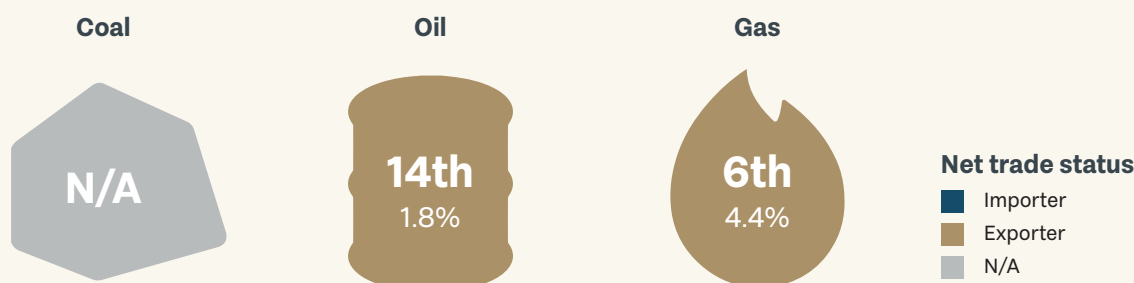
Plans and projections for domestic fossil fuel production

QatarEnergy, which controls all oil and gas operations in the country, is implementing a decade-long expansion of its gas production that will raise liquefaction capacity from 77 Mt/yr in 2021 to 110 Mt/yr by 2025 and 126 Mt/yr by 2027 (ITA, 2021; QatarEnergy, 2022b). Six new LNG trains will be developed at a cost of USD 30 billion (ITA, 2021). This increased capacity will cater to projected demand growth from Europe as well as existing supply agreements in Asia, which took on added geopolitical significance after the outbreak of war in Ukraine in February 2022 (EIA, 2023b). In late 2022, QatarEnergy signed long-term deals with Germany and China to supply them with LNG (15 years for Germany and 27 years for China). Since then, QatarEnergy has made deals with China and Bangladesh (Al Jazeera, 2023; Mills, 2023), with more expected as the production ramp-up nears completion (QatarEnergy, 2022c; Al Jazeera, 2022). Energy officials anticipate that the new supply agreements will lock in international demand for Qatari LNG into mid-century (Dargin, 2022).

Government support for domestic fossil fuel production

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

Rank of country in, and share of, global production, and net trade status

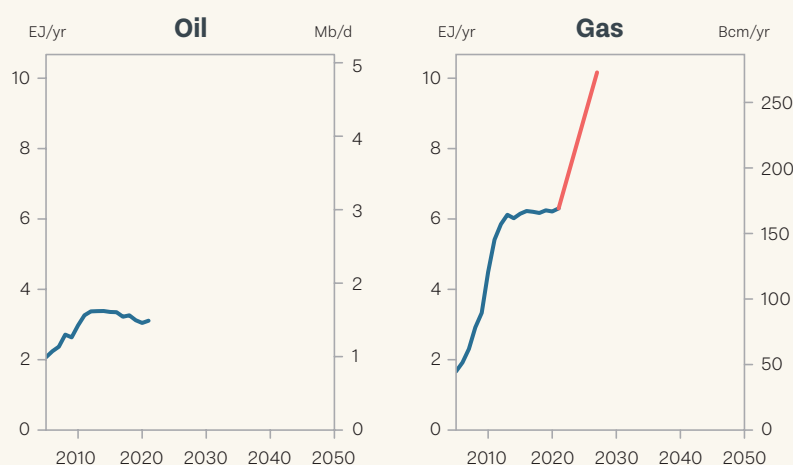


Fossil fuel transition capacity and dependence indicators

Income level	Coal direct employment	Coal economic dependence	Share of GDP from oil & gas production
High income	N/A	N/A	40%

Figure 3.11

Historical (2005–2021) oil and gas and projected gas production for Qatar (no coal is produced, and oil projections are not available). Sources: 2027 gas production is estimated from the target increase in LNG production capacity (QatarEnergy, 2022b). Historical data are from the IEA (2023a).



Government support for international fossil fuel production

Since 2017, QatarEnergy has rapidly expanded and diversified its international portfolio of upstream assets and has acquired stakes in exploration blocks in Argentina, Brazil, Cyprus, Lebanon, Mexico, Mozambique, and Oman, in partnership with major international oil and gas companies (Ulrichsen, 2020).

No other information is publicly available on tax expenditures or other measures to support fossil fuel production outside Qatar.

Policies and discourses on 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

Environmental development is listed as one of the four pillars of Qatar National Vision 2030, alongside human, social, and economic development (GCO, 2008). However, Qatar has not articulated any policy toward a just and equitable transition away from fossil fuels.

South Africa

Announced climate ambitions

In 2021, South Africa submitted an updated NDC, in which the country tightened its 2030 emissions target from 614 MtCO₂eq to a new target range of 350–420 MtCO₂eq (Government of South Africa, 2021); the country's 2020 emissions were 474 MtCO₂eq (DFFE, 2022).

In its 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). The Just Transition Framework, released by the Presidential Climate Commission in June 2022, also refers to reaching “net-zero greenhouse gas emissions by 2050” (Presidential Climate Commission, 2022).

Government views on domestic fossil fuel production

The Government of South Africa recognizes the socioeconomic risks of a coal phase-down for workers and communities (Presidency of Republic of South Africa, 2022). Coal is also still viewed by some ministries as central to energy security, stable and relatively well-paying jobs, and reliable “baseload” power (Mantashe, 2022). The coal industry advocates for CCS in support of ongoing coal extraction and use (Creamer, 2022; Peyper, 2023).

Offshore oil and gas production has been promoted by the Ministry of Mineral Resources and Energy and related SOEs as a major source of future economic growth (Burton et al., 2022; Comrie, 2022; DMRE, 2021). The government is also encouraging shale gas exploration in the Karoo region (Roelf, 2023).

Plans and projections for domestic fossil fuel production

To date, the government has not published national projections or targets for coal, oil, or gas production. Civil society legal action has compelled the government to announce a commitment to produce an Integrated Energy Plan by early 2024 (Omarjee, 2023).

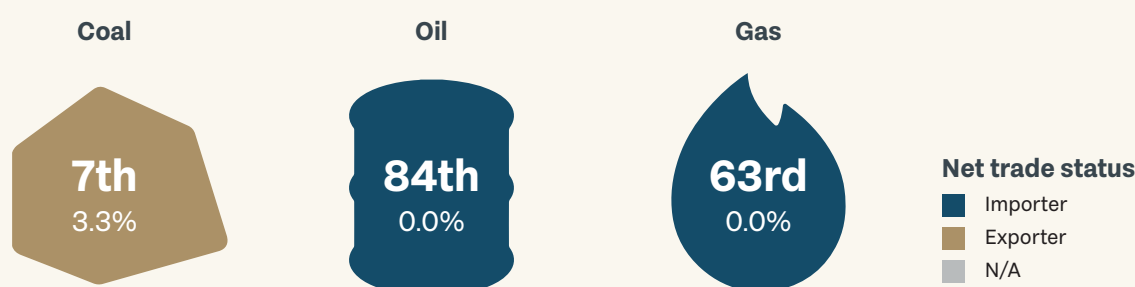
South Africa has over 70 active coal mines, the majority of which are privately owned. Falling exports due to rail logistics barriers and other factors led to a decline in annual coal production in 2022 to around 234 Mt from historical production levels of around 250 Mt (Minerals Council South Africa, 2023, 2021; Reuters, 2023a).

The South African Minerals Council has noted that “global sentiments against coal use have negatively affected long-term investment in the industry” (Minerals Council South Africa, 2023). However, as of May 2023, according to Global Energy Monitor, there are 36 proposed or planned projects in South Africa at different stages of development, of which half are new mines (Global Energy Monitor, 2023). If all are completed, they would account for at least 117 Mt per year of additional production capacity (Global Energy Monitor, 2023).

Government support for domestic fossil fuel production

■ The coal sector has historically received significant direct and indirect support via regulatory measures, SOEs, and subsidies to large users such as Eskom (a state-owned electricity utility) and Sasol (a coal-to-chemicals producer) (Bridle et al., 2022).

Rank of country in, and share of, global production, and net trade status



Fossil fuel transition capacity and dependence indicators

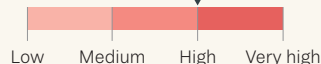
Income level

Upper-middle income

Coal direct employment

3.3 coal miners per 1,000 workers

Coal economic dependence

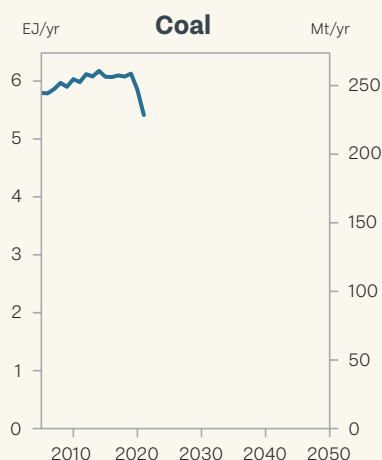


Share of GDP from oil & gas production

No data

Figure 3.12

Historical (2005–2021) coal production for South Africa based on data from the IEA (2023a). Government projections are not available. Oil and gas production are small (<0.5 EJ/yr) and not shown.



■ While indirect support remains substantial, direct subsidies for coal mining are now smaller than in the past (Burton et al., 2018; Pant et al., 2020). In 2021, the government provided direct budgetary transfers worth an estimated ZAR 760 million (USD 51 million) to projects that supply water to power stations and to coal mines (OECD, 2023b).

■ State-owned development finance institutions, the Development Bank of Southern Africa (DBSA), and the Industrial Development Corporation of South Africa (IDC) have supported coal production through their investment holdings as recently as 2019 (Halim & Omar, 2020), but no recent mining investments were identified.

Government support for international fossil fuel production

South Africa has supported gas liquefaction in Mozambique through investments by DBSA and IDC (USD 270 million in 2020) and export guarantees through Export Credit Insurance Company (USD 800 million) (OCI, 2023).

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

No policies or discourses to support a managed wind-down of fossil fuel production were identified.

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

South Africa has a rich and well-developed discourse on just transitions, accompanied by several policy and investment initiatives. The Department of Mineral Resources and Energy in late 2021 released a Framework for the Just Energy Transi-

tion in the Minerals and Energy sectors, noting that managing the risks of asset closures for coal regions is a priority (DMRE, 2021).

Coal has been the most successful mining sub-sector in terms of economic transformation of ownership in post-apartheid South Africa (Burton et al., 2022). Its political salience and high contribution to emissions has meant substantial focus on coal as a major sector in just transition policy. Eskom, the monopoly utility that accounts for around 40% of national coal use, created a Just Energy Transition Office in 2020 to manage the transition to net-zero carbon emissions by 2050 while creating sustainable jobs in the power sector, and has started to close some of its oldest units (Eskom, 2023). Sasol, the second-largest user of coal, has created a Just Energy Transition office (Sasol, 2023). Coal mining is explicitly recognized as a priority area in the National Just Transition Framework, released in August 2022, given the extensive potential impacts on livelihoods of an unplanned and unjust transition (Presidential Climate Commission, 2022).

At COP26, South Africa, alongside a group of international partners comprising the European Union, France, Germany, the UK, and the US, announced the first-of-its-kind JETP, with initial financial support of USD 8.5 billion (see Box 3.2). In 2022, South Africa developed the Just Energy Transition Investment Plan that outlines total investment of USD 98 billion from 2023 to 2027, focusing largely on clean energy, but also including support for coal mine closure planning, mine closure, rehabilitation, and land repurposing, coal worker transition support, and community revitalization (Presidency of Republic of South Africa, 2022).

Norway

Announced climate ambitions

In 2021, Norway established by law a target of reducing total GHG emissions, relative to 1990 levels, by 50–55% by 2030, and by 90–95% by 2050 (MCE, 2021). The Government has since updated the 2030 target to “by at least 55%”; and has proposed to amend its Climate Act to reflect this change (Government of Norway, 2022; MCE, 2023).

Government views on domestic fossil fuel production

The government views the oil and gas industry as playing “a vital role in the Norwegian economy and the financing of the Norwegian welfare state”, especially in terms of providing employment, export value, and government revenues (NPD & MPE, 2023b). The industry is highly regulated, and a large share of the sector’s revenue is directly channelled into the government’s sovereign wealth fund (Lahn, 2019). Despite increasing political controversy, a broad political majority continues to support expanding Norway’s offshore exploration and production (Harrison & Bang, 2022). The war in Ukraine has foregrounded Norway’s role as a secure provider of gas for Europe, and the Government of Norway has therefore sought to secure EU support for increased oil and gas exploration and production (Melgård, 2022). Both government and industry justify their position by citing the sector’s relatively low production-related GHG emissions and future decarbonization plans (KonKraft, 2022; MPE, 2023, p. 59). Additionally, the majority state-owned company Equinor aims to achieve net-zero (including Scope 3 or full lifecycle) emissions by 2050 (Equinor, 2022).

Plans and projections for domestic fossil fuel production

As shown in Figure 3.13, Norway’s oil and gas production are projected to peak in 2026 and decline over the next decades,

by a combined 67% between 2026 and 2050, as resources in the large North Sea fields are depleted (Norwegian Ministry of Finance, 2021). However, the rate of decline is uncertain and depends heavily on possible new discoveries and thus on government policy for exploration (NPD, 2022). The Norwegian Petroleum Directorate (NPD) notes that official forecasts tend to underestimate resource growth (NPD, 2022, p. 58). To complement their official central forecast previously published in 2021, the NPD published a new scenario under “high resource growth with considerable and fast technology development” in 2022 (NPD, 2022, p. 58). In this scenario, decline is considerably slower, with 2050 production about 50% higher than in the central forecast (see Figure 3.13).

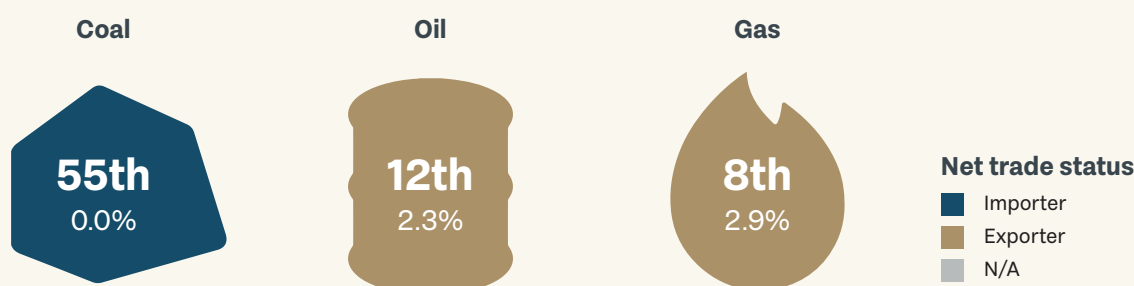
Government support for domestic fossil fuel production

■ The government’s oil and gas exploration policy plays a major role in influencing domestic production. While some specific offshore less-explored or frontier areas have been closed off to exploration for political and environmental reasons (Buli & Adomaitis, 2022; Lahn, 2019), licenses are still awarded annually in so-called “mature” areas, with 47 licenses awarded in 2022 (MPE, 2023, p. 56). The government also intends to substantially increase the areas designated as “mature”, especially in the Arctic (MPE, 2023).

■ Although Norway’s tax system ensures a 78% effective tax rate on oil and gas production profits, the government effectively acts as a co-investor that shoulders a large share of risk in all new investments (Lahn, 2019).

■ To support the industry during the fall in oil price in early 2020, the government introduced a special tax scheme in which all new developments approved by the end of 2023 will benefit from special provisions. A recent estimate suggests this temporary scheme may amount to a tax subsidy of around NOK 26 billion (USD 2.7 billion) (Rydje & Holter, 2022; cf. Norwegian Ministry of Finance, 2022).

Rank of country in, and share of, global production, and net trade status

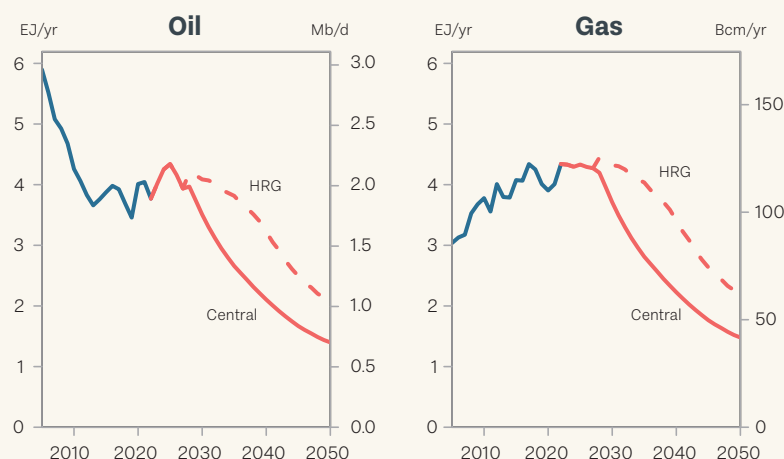


Fossil fuel transition capacity and dependence indicators

Income level	Coal direct employment	Coal economic dependence	Share of GDP from oil & gas production
High income	No data	No data	14%

Figure 3.13

Historical (2005–2022) and projected oil and gas production for Norway. Coal production is small (<0.5 EJ/yr) and not shown. Sources: Historical data and 2023–2027 projections are from the Norwegian Petroleum Directorate (2023a); 2028–2050 projections are from the Norwegian Ministry of Finance (2021). The 2028–2050 oil and gas projections are estimated from the source document's reported total, assuming the liquids-to-gas ratio remains constant at average 2022–2027 values. To complement their official central forecast, a new scenario under “high resource growth with considerable and fast technology development” (HRG) was also published in 2022.



■ The government provided further tax breaks and budget expenditures for oil and gas production (primarily for research, development, and demonstration) worth NOK 656 million (USD 76 million) in 2021, according to OECD estimates (OECD, 2023b).

Government support for international fossil fuel production

Norway has generally wound down its international support for fossil fuels after adopting the Paris Agreement: for example, by reorienting aid programmes from oil to renewable energy (Norwegian Ministry of Finance, 2021). In addition, the Norwegian sovereign wealth fund decided to exclude upstream oil and gas companies from its investment portfolio in 2019 (Norwegian Ministry of Finance, 2019). The government has stressed that this divestment should not be seen as a climate policy measure, but as a diversification strategy to make the Norwegian economy less exposed to oil price fluctuations (Norwegian Ministry of Finance, 2019). Equinor operates on a commercial basis and continues to invest in new oil and gas developments globally, including in recent controversial projects in Argentina (Vaca Muerta) and the UK (Rosebank) (Helgesen, 2020; Searancke, 2023).

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

Norway has no official strategy for winding down oil and gas production, and the government emphasizes that it wants to “develop, not dismantle” the industry (MPE, 2023). There have, however, been recent moves to incorporate climate concerns into the regulatory process for approving new oil and gas fields. As of 2022, companies are required to undertake a climate risk assessment for the economic viability of

the field, and, following a decision in the Norwegian Supreme Court, the Ministry of Petroleum and Energy (MPE) has begun to assess the expected GHG emissions of new fields, including from the eventual combustion of produced fuels (MPE, 2023). The MPE commissioned Rystad Energy, an independent consultancy, to develop a methodology for determining the net GHG effects of additional Norwegian oil production. The resulting methodology and assessment concluded that new oil and gas production by Norway would result in a net emissions reduction globally due to substitution effects (Rystad Energy, 2023). However, the methods and assumptions diverge from similar analyses by other researchers, who come to the opposite conclusion (Fæhn et al., 2017; Prest et al., 2023; Riekeles, 2023).

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

The need to prepare for an eventual transition away from oil and gas production is widely accepted, and government strategies generally emphasize the importance of diversifying current offshore activities into new areas such as offshore wind, CCS, and blue hydrogen production (e.g. MPE, 2023), in parallel with initiatives to reduce GHG emissions from oil and gas production (Jordhus-Lier et al., 2022, pp. 9–10). In 2022, the government established a tripartite²⁴ Just Transition Advisory Council in the context of achieving a “zero-emissions future” (MCE, 2022). However, in line with the government's commitment to encourage further oil and gas production, the council does not have a specific mandate related to fossil fuels (MCE, 2022), and there is generally a lack of specific policies to advance a just transition agenda (Jordhus-Lier et al., 2022, p. 7).

²⁴ Norway has a well-established tradition for tripartite cooperation between government, unions, and employers' associations, including for the petroleum sector (see, e.g., <https://www.ptil.no/en/tripartite-cooperation/responsibility/tripartite-collaboration-explained/>).

Brazil

Announced climate ambitions

Brazil updated its NDC in March 2022, maintaining the earlier target of reducing GHG emissions by 37% from 2005 levels by 2025, while increasing ambition to 50% below 2005 levels by 2030, and including the objective of climate neutrality by 2050 (Federative Republic of Brazil, 2022). Petrobras, a state-owned company that accounts for a majority of Brazil's oil and gas production, has also set a goal of net-zero operational emissions by 2050 (Petrobras, 2023).

Government views on domestic fossil fuel production

With significant reserves of crude oil in “pre-salt” offshore basins with upstream GHG emissions intensity less than half of the global average (Bello et al., 2023; Draeger et al., 2022), the government views oil production and exports as critical for the country's development (MME, 2023c). National laws and regulatory changes enacted in recent years, along with improving financial conditions, have played critical roles in attracting investment and driving the expansion of Brazil's oil and gas industry (Barboza Mariano et al., 2023). The current administration continues to count on economic and regional development from the exploration of new petroleum frontiers, extension of the production period of mature fields, and tax revenues from fossil fuel production (Petrobras, 2023; MME, 2023c).

Plans and projections for domestic fossil fuel production

As shown in Figure 3.14, Brazil's 10-Year Energy Expansion Plan 2032 and the longer-term National Energy Plan 2050 both indicate an expanded role for oil and gas, with the

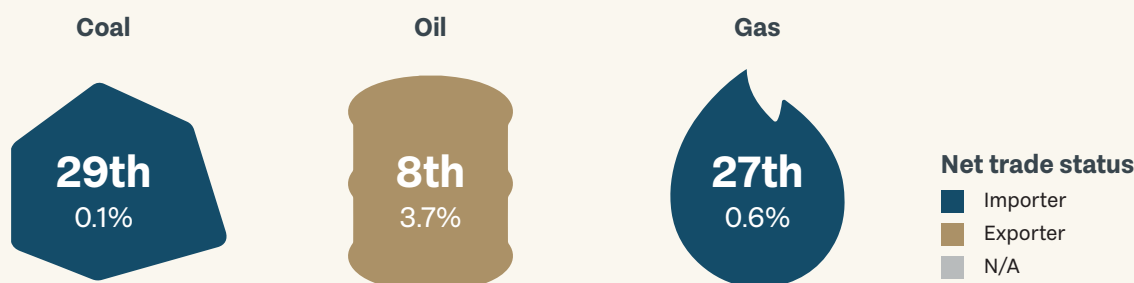
production of both types of fossil fuels set to increase in the coming decades (MME & EPE, 2020, 2023). (The small reduction between 2032 and 2033 in gas are due to a disconnect between the two plans, given their different release dates.) The 2032 Plan foresees production of oil and gas increasing by 63% and 124%, respectively, between 2022 and 2032. These projections were derived based on the Petrobras business plan (Petrobras, 2023), investment expectations generated by auctions announced by the Brazilian National Agency of Petroleum, Natural Gas and Biofuels (ANP) for the coming years, and the New Natural Gas Market programme announced by the Ministry of Mines and Energy (MME) in 2021 (Federative Republic of Brazil, 2021).

The current administration also recently announced its intention to launch a new initiative to guarantee investments in exploration and “transform Brazil into the fourth-largest oil producer in the world” (MME, 2023c).

Government support for domestic fossil fuel production

- Tax expenditures and direct budgetary transfers to incentivize oil and gas production totalled USD 8.6 billion in 2021, much of this from a tax exemption for the import and manufacture of equipment used for oil and gas exploration and production (“Repetro”) that was set to expire in 2020, but was renewed until 2040 (Inesc, 2022).
- The “Open Acreage” programme, a continuous offer of exploration blocks (MME, 2021b), was introduced in 2019 to attract private investments, expand exploration and production, and increase government revenues from the hydro-carbon sector (Barboza Mariano et al., 2022). As of 2022, permanent offering replaced regular bidding rounds for areas

Rank of country in, and share of, global production, and net trade status

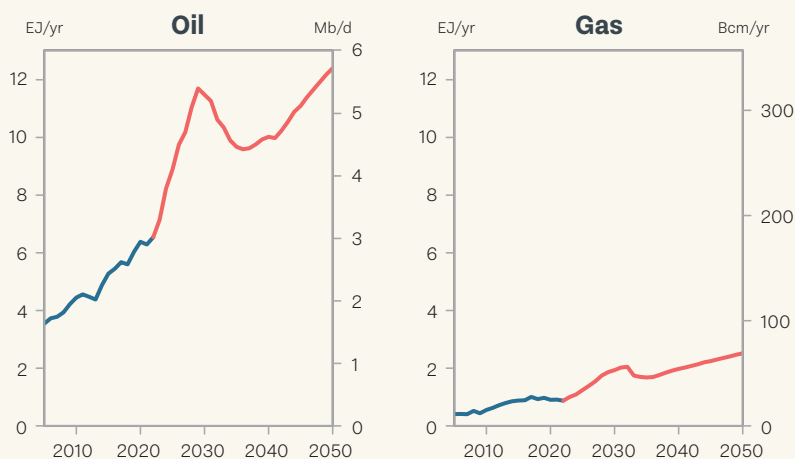


Fossil fuel transition capacity and dependence indicators

Income level Upper-middle income	Coal direct employment No data	Coal economic dependence No data	Share of GDP from oil & gas production 10%
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Figure 3.14

Historical (2005–2022) and projected oil and gas production for Brazil. Coal production is small (<0.5 EJ/yr) and not shown. Sources: 2023–2032 projections are from the 10-Year Energy Expansion Plan 2032 (MME & EPE, 2023); 2033–2050 projections are from the National Energy Plan 2050 (MME & EPE, 2020). Historical coal and oil data are from the Brazilian National Agency of Petroleum, Natural Gas and Biofuels (ANP, n.d.-b), and from the IEA (2023a) for gas. Brazil's gas production (as shown) does not include fractions that are re-injected, self-consumed, and flared, which accounts for around 50% of total production historically and is expected to account for 52% of total production in 2023–2027 on average (ANP, n.d.-a); this average is applied to subsequent years.



with exploratory risks, enabling an acceleration of activity in the pre-salt region that accounts for a majority of Brazil's oil production (Diário Oficial da União, 2021).

■ In 2021, the prior administration launched the New Natural Gas Market Program to spur the production, transport, and use of gas, with expected investments of about USD 10 billion, largely in pipelines to connect users with offshore fields, where gas is currently reinjected to enhance oil recovery (Barboza Mariano et al., 2023).

Government support for international fossil fuel production

No support was identified.

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

State-controlled Petrobras stated that the company must prepare for an inevitable energy transition and will lead Brazil's shift to renewable energy, while keeping its oil and gas expansion on track (Frontini & Nogueira, 2023). Petrobras recently set up a new division responsible for energy transition and sustainability, which has raised expectations of a major pivot towards renewables (Chetwynd, 2023).

The government has recently begun preparing for the decommissioning of end-of-life oil and gas infrastructure through new regulations that provide guarantees and stimulate investments to remediate abandoned wells and other exploration and production facilities (Barboza Mariano et al., 2023).

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

While Brazil has relatively limited coal production, the coal mining and consumption industry still accounts for nearly USD 1 billion in annual revenues and 20,000 direct and indirect jobs in the state of Santa Catarina (SIECESC, 2022). A legal framework issued in 2022 encompasses a just transition policy while also extending the lifetime of the region's coal power generation from 2025 to 2040 (Diário Oficial da União, 2022).

There are currently no official policies or discourses related to just transition in the oil and gas industry. The significant contribution to federal, state, and municipal government budgets, reaching USD 21.4 billion including royalties and windfall profit tax in 2022, highlights Brazil's fiscal dependency on fossil fuels (MME, 2020a, 2020b). The United Federation of Oil Workers is actively championing investments in new oil refining capacity and gas power as a means to generate high-quality jobs (FUP, 2021).

Kazakhstan

Announced climate ambitions

In 2016, Kazakhstan set an unconditional NDC target to reduce GHG emissions to 15% below 1990 levels by 2030, and a conditional target of 25% below 1990 levels by 2030, subject to international investment (Ministry of Ecology and Natural Resources, 2023). In 2020, the government announced a goal of achieving carbon neutrality by 2060 (Government of the Republic of Kazakhstan, 2021). In February 2023, the government approved a strategy document that identified the transformations needed to achieve the carbon-neutrality goal (Government of the Republic of Kazakhstan, 2023b).

Government views on domestic fossil fuel production

Kazakhstan is a net exporter of fossil fuels (IEA, 2023a). The oil and gas sector is a significant part of Kazakhstan's economy, contributing nearly 20% of GDP in 2021 (National Bureau of Statistics Kazakhstan, 2023). The government seeks to increase domestic production and processing of gas and petrochemicals (Haidar, 2022). The country's carbon-neutrality strategy states that the "decarbonization of the energy sector requires the use of natural gas as an intermediate fuel" and encourages the exploration of new gas fields (Government of the Republic of Kazakhstan, 2023b). The government has announced plans to increase shale gas production (Vladimirskaya, 2022). Additionally, the government is exploring the possibility of developing other unconventional reserves, such as shale oil (KAZENERGY, 2022; Official Information Source of the Prime Minister, 2022).

Kazakhstan has the 10th-largest coal reserves in the world, estimated at about 29.4 billion tonnes across 49 deposits (KAZENERGY, 2021), and the government's carbon-neutrality strategy foresees continued production of coal (Govern-

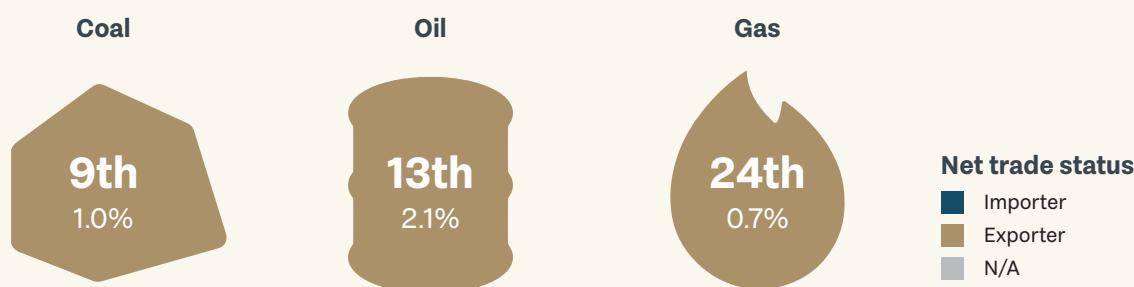
ment of the Republic of Kazakhstan, 2023b). Due to its high ash and sulfur content and low calorific value, Kazakh coal exports are not financially competitive, especially in markets with stringent emission controls or coal standards, like the European Union (KAZENERGY, 2021; Ministry of Energy, 2020). Instead, there are plans to invest in the production of high-value-added coal-based products and technologies, and in exploring alternative uses of coal such as in building materials or products to clean contaminated soil and water (Kuzekbay, 2021; Mannapbekov & Hampel-Milagrosa, 2021; Government of the Republic of Kazakhstan, 2023b).

Plans and projections for domestic fossil fuel production

The 2021 National Energy Report, produced by a consortium of government agencies, projects oil and gas production to increase slightly in the near term before gradually declining after 2025, while coal production is projected to decline from 2020 onwards, as shown in Figure 3.15 (KAZENERGY, 2021). These projections are broadly consistent with government production targets for 2026 of 115 million tonnes of coal, 99 million tonnes of oil, and 35 Bcm of commercial gas (Government of the Republic of Kazakhstan, 2022).

The government plans to achieve a near-term increase in oil production by expanding production in mature fields and developing new fields. This involves significant investment in infrastructure and technology, including enhanced oil recovery techniques, as well as collaboration with foreign partners (Official Information Source of the Prime Minister, 2021). Kazakhstan exports nearly 80% of its oil via the Caspian Pipeline Consortium pipeline through the Russian Federation (KAZENERGY, 2021; Reuters, 2023c). New plans focus on diversifying oil export routes across the Caspian Sea and China (Government of the Republic of Kazakhstan, 2023b).

Rank of country in, and share of, global production, and net trade status



Fossil fuel transition capacity and dependence indicators

Income level
Upper-middle income

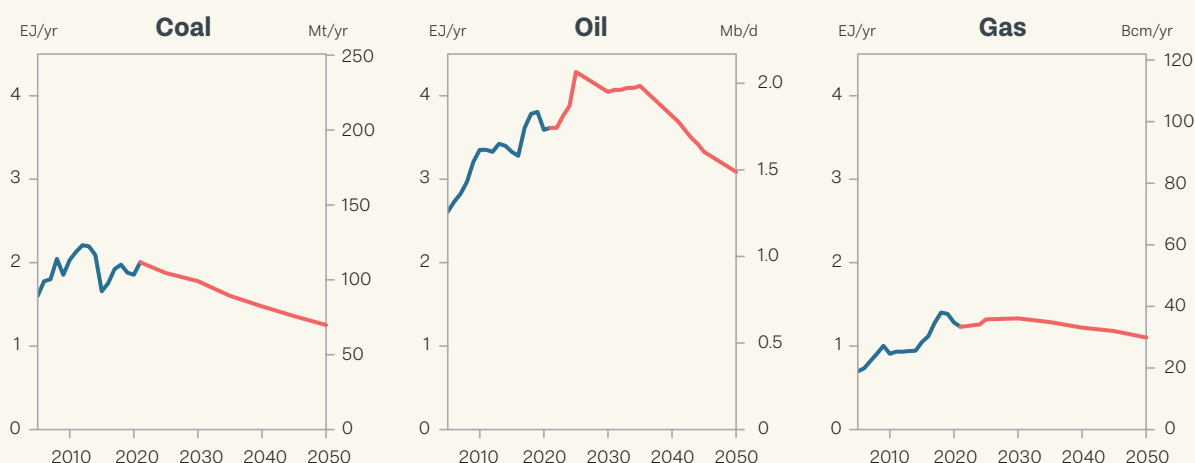
Coal direct employment
3.2 coal miners per 1,000 workers

Coal economic dependence
Low Medium High Very high

Share of GDP from oil & gas production
13%

Figure 3.15

Historical (2005–2021) and projected coal, oil, and gas production for Kazakhstan. Sources: Projections are from the National Energy Report 2021 (KAZENERGY, 2021). The projected gas production (as shown) does not include fractions that are re-injected and used by producers, which is expected to account for around 50% of total gas production. Historical coal and gas data are from the IEA (2023a); historical oil data are from National Energy Report 2021.



Kazakhstan also plans to increase its gas exports to neighbouring countries such as China, though rapidly increasing domestic demand may see export volumes diverted to the local market (Satubaldina, 2023). Several investments in pipelines and processing facilities are planned by the national gas company, QazaqGaz, to support this growth, including the Beineu-Zhanozen second line with a capacity of 5.8 Bcm, and the Makat-Northern Caucasus gas pipeline with a capacity of 13.1 Bcm (Turan Times, 2023).

Government support for domestic fossil fuel production

■ The government provides incentives and direct subsidies for companies engaged in coal, oil, and gas production, including exemptions from value-added, income, and property taxes and other direct financial support such as accelerated depreciation and low-interest loans and grants. The government also provides indirect subsidies such as access to infrastructure and social services (KAZENERGY, 2023; State Revenue Committee, 2023).

■ In 2023, the government introduced an enhanced model contract for hydrocarbon production that grants a package of fiscal and regulatory preferences designed to stimulate investment, including exemptions from taxes and export customs duties (Ministry of Energy, 2023b; Satubaldina, 2023).

■ The government invests in research and development to improve the efficiency and competitiveness of the fossil fuel industry (Government of the Republic of Kazakhstan, 2023a). Companies are obliged to put 3% of production costs

towards oil and gas research and development projects, including education and training programmes (Government of the Republic of Kazakhstan, 2017, 2018).

Government support for international fossil fuel production

No support was identified.

Policies and discourses on 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

Kazakhstan's carbon-neutrality strategy notes that "the most important priorities for low-carbon development should be a just transition and job creation" (Government of the Republic of Kazakhstan, 2021). The strategy supports social protection measures and retraining programmes for workers who have lost their jobs in the fossil fuel industry and proposes retraining in green jobs or assistance with developing green businesses (Government of the Republic of Kazakhstan, 2023b).

Kuwait

Announced climate ambitions

Kuwait submitted a revised NDC in 2021, which included a pledge to cut GHG emissions to 7.4% below business-as-usual levels by 2035 (State of Kuwait, 2021a). At COP27 in November 2022, the Government of Kuwait pledged to achieve carbon neutrality in the oil and gas sector by 2050, and the rest of the economy by 2060 (Kuwait News Agency, 2022).

Government views on domestic fossil fuel production

Oil is central to Kuwait's economy and the energy sector is under full state ownership. Kuwait holds around 7% of the world's current proven reserves of oil (ITA, 2022). The oil industry accounts for about 90% of government revenue and 95% of total exports (ITA, 2022). Kuwait's oil fields are aging and have struggled to attract investment (EIA, 2023a; Gnana, 2022). Foreign investment in the oil and gas sector is prohibited by Kuwaiti Law (WTO, 2012). Kuwait Vision 2035, launched in 2017, does not necessarily seek to reduce or move beyond oil dependence, but rather aims to diversify economic activity into non-oil sectors (State of Kuwait, 2021b). A priority for the Kuwait Oil Company — a subsidiary of state-owned Kuwait Petroleum Corporation (KPC) — is to increase gas production to meet local demand and reduce reliance on imported LNG (Al-Abdullah et al., 2020, pp. 8–9; Mohamed, 2022). KPC also aspires to achieve operational net-zero emissions by 2050 (KPC, n.d.-b).

Plans and projections for domestic fossil fuel production

KPC plans to raise oil production capacity to 3.5 Mb/d by 2025 and 4 Mb/d by 2035, maintaining the latter up to 2040 (Gnana, 2022; KPC, n.d.-a). The KPC strategy also states a target for non-associated (but not total) gas production of 2 billion cubic feet per day by 2040 (approximately 21 Bcm/yr) (KPC, n.d.-a). According to the 2019 Kuwait Energy Outlook published by the Kuwait Institute for Scientific Research, total gas production is expected to increase by 57% between 2017 and 2035, reaching around 27 Bcm/yr (KISR, 2019, p. 48). Officials in 2022 announced plans to accelerate spending on oil production, exploration, and other projects, including new gas developments, between 2022 and 2025 as part of the Kuwait National Development Plan 2020–25 (State of Kuwait, 2019; Zawya Projects, 2022).

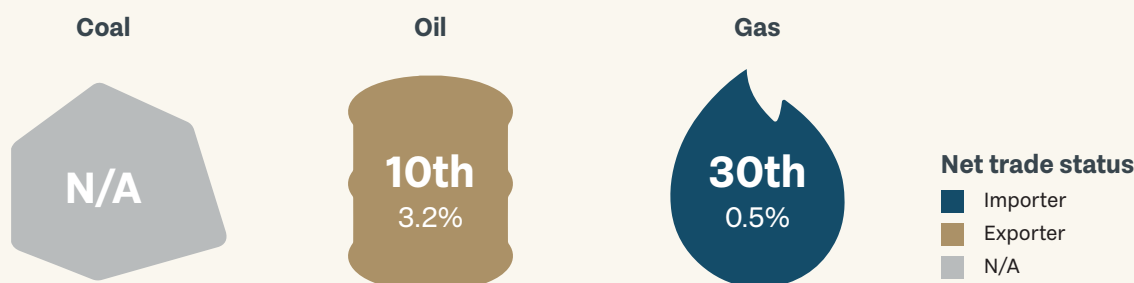
Government support for domestic fossil fuel production

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

Government support for international fossil fuel production

The Kuwait Foreign Petroleum Company (KUFPEC), a subsidiary of KPC, is engaged in the exploration, development, and production of crude oil and fossil gas outside Kuwait. In 2021, KUFPEC was involved in 49 projects in 13 countries, produced its first oil from fields in Malaysia and Norway, and announced its largest-ever hydrocarbon discovery, a gas find in Malaysia (KUFPEC, 2021, pp. 10–19).

Rank of country in, and share of, global production, and net trade status

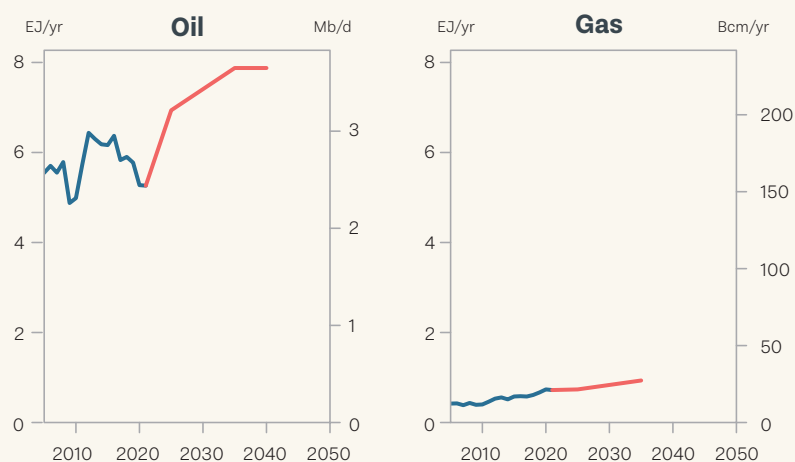


Fossil fuel transition capacity and dependence indicators

Income level	Coal direct employment	Coal economic dependence	Share of GDP from oil & gas production
High income	N/A	N/A	40%

Figure 3.16

Historical (2005–2021) and projected oil and gas production for Kuwait. No coal is produced. Sources: 2025, 2035, and 2040 oil production are assumed to scale with the respective increases in production capacity targets (Gnana, 2022; KPC, n.d.-a). 2025 and 2035 gas production projections are from the 2019 Kuwait Energy Outlook published by the Kuwait Institute for Scientific Research (KISR, 2019, p. 48). Historical data are from the IEA (2023a).



Policies and discourses on 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.

Mexico

Announced climate ambitions

At COP27 in 2022, Mexico updated its NDC targets to a 35% unconditional, and 40% conditional GHG emissions reduction by 2030 relative to its baseline scenario, up from 22% and 36%, respectively, in its prior NDC (INECC, 2020, 2022). For the unconditional pledge, a 30% reduction is to be achieved with national resources and the other 5% with already-agreed international finance for clean energy.

Government views on domestic fossil fuel production

The current Mexican administration has stated that it wants to expand oil and gas production in order to end fossil fuel imports and guarantee “energy sovereignty” for Mexico (Galeana, 2023). Since 2018, government investment and infrastructure packages have aimed at reversing declining production trends at Pemex (Calles Almeida et al., 2023), an SOE that accounts for 97% of Mexico’s oil and gas production. During the Major Economies Forum on Energy and Climate 2022, the government announced that Pemex would invest a total of USD 2 billion to reduce methane emissions from exploration and production by up to 98% by 2024 (Obrador, 2022).

Plans and projections for domestic fossil fuel production

The Ministry of Energy has not updated its longer-term oil and gas production projections last published in 2018, which are shown in Figure 3.17 (SENER, 2018a, 2018b). However, the National Commission for Hydrocarbons (CNH), an independent regulator, has provided quarterly nearer-term projections (Comisión Nacional de Hidrocarburos, 2022). Based on existing reserves and development plans, CNH

has continuously revised its oil production projections downwards, and gas production upwards, out to 2028.

Government support for domestic fossil fuel production

■ Starting in 2022, the government reduced Pemex’s shared utility tax from 52% to 40%, a further decrease from 65% prior to 2020 (SHCP, 2021). The tax reduction amounts to an estimated subsidy of MXN 83 billion in 2021 (USD 4.1 billion) (OECD, 2023b).

■ Overall, tax expenditures for oil and gas production totalled MXN 158 billion (USD 7.8 billion) in 2021 (OECD, 2023b).

■ In 2021, the federal government injected capital of USD 3.5 billion to strengthen Pemex’s finances (SHCP, 2021).

Government support for international fossil fuel production

No data were found to suggest support for production in other countries. Pemex does, however, invest in midstream activity, and spent USD 596 million to purchase ownership in the Deer Park refinery in Houston, US in 2022 (EIA, 2023c).

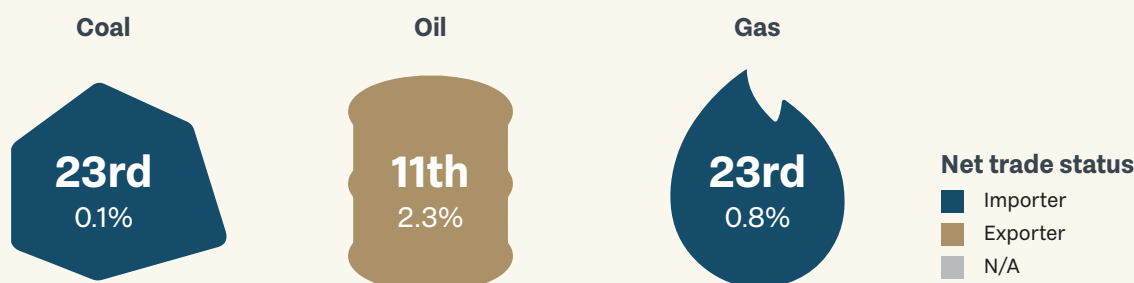
Policies and discourses on a managed wind-down of fossil fuel production

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.

Rank of country in, and share of, global production, and net trade status

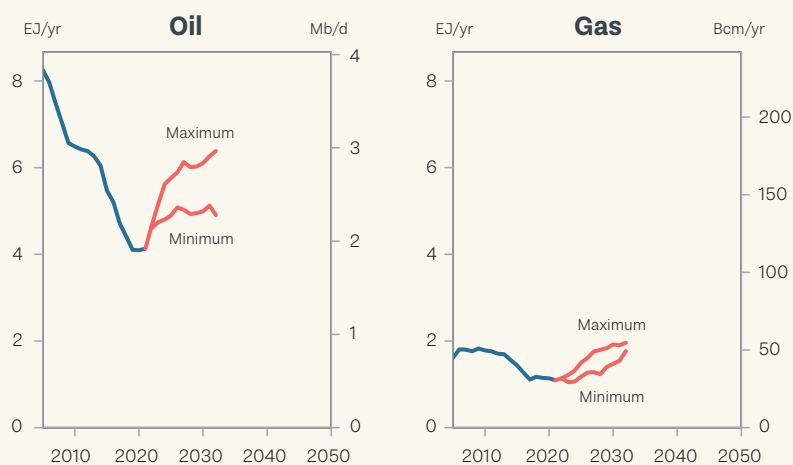


Fossil fuel transition capacity and dependence indicators

Income level Upper-middle income	Coal direct employment No data	Coal economic dependence No data	Share of GDP from oil & gas production 4%
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Figure 3.17

Historical (2005–2021) and projected oil and gas production for Mexico. Coal production is small (<0.5 EJ/yr) and not shown. Sources: 2018–2032 production projections under two scenarios, “maximum” and “minimum”, are reported in the 2018 outlook (SENER, 2018a, p. 71, 2018b, p. 60). Since these documents have not been updated since 2018, we apply the projected changes under each scenario to the 2021 historical oil and gas production values to estimate 2022–2032 production projections. Historical data are from the IEA (2023a).



Nigeria

Announced climate ambitions

Nigeria's updated NDC, submitted in 2021, targets an unconditional GHG emission reduction of 20% below a business-as-usual baseline projection by 2030, and a 47% reduction conditional on international support (Federal Ministry of Environment, 2021). The 2021 Climate Change Act of Nigeria sets a target for net-zero GHG emissions between 2050 and 2070 (Government of Nigeria, 2021). Later in 2021, at COP26, the President of Nigeria committed to achieving net-zero emissions by 2060 (The State House, 2021).

Government views on domestic fossil fuel production

Nigeria has long been Africa's largest oil producer and has the second-largest oil reserves in Africa, after Libya (OPEC, 2022). The Government of Nigeria considers oil and gas a mainstay of the economy, as it contributes approximately 40% of the federal government's revenue and 85–90% of export earnings (Central Bank of Nigeria, 2023a). However, the petroleum industry represents only 6% of GDP (Central Bank of Nigeria, 2023b).

With significant gas reserves amounting to 209 trillion cubic feet as of January 2023 (Addeh & Uzoho, 2023), the government declared 2020–2030 as the “decade of gas”, during which gas would serve as a major generator of revenue and jobs (GECF, 2021). Nigeria's Energy Transition Plan (ETP) “recognizes the role natural gas must play as a transition fuel on the path to net zero” (ETP, 2022). Government initiatives aim to reduce the GHG emissions intensity of oil and gas production, including through the implementation of regulations to reduce flaring and industry guidelines on reducing fugitive methane emissions (Federal Government of Nigeria, 2018; NUPRC, 2022).

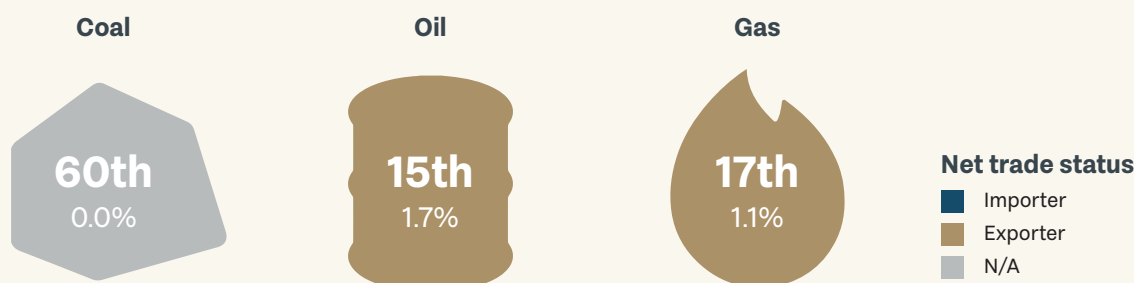
There is growing interest in exporting coal to Europe as a result of the war in Ukraine (Ezeugwu, 2022). The government signalled a return to coal exploration in 2023 through the sale of new coal blocks held by state-owned Nigerian Coal Corporation (New Telegraph, 2023).

Plans and projections for domestic fossil fuel production

Nigeria's crude oil production declined between 2020 and 2022 due to oversupply in the industry and damage to oil infrastructure in the Niger Delta, with daily production falling below 1 Mb/d, the lowest level since 1983 (Addeh, 2023; IEA, 2023a). Following the adoption of new security measures by the federal government, official production increased to 1.4 Mb/d in the first quarter of 2023 (Akpan, 2023; Elumoye et al., 2023). According to Nigeria Agenda 2050, a national development plan released in May 2023, oil production is projected to reach 2.4 Mb/d by 2025, decline to 2 Mb/d by 2030 and then to 1 Mb/d by 2050 (Federal Government of Nigeria, 2023). However, the government has also signalled a more ambitious oil production target of 4 Mb/d by 2030 (Ndwaru, 2022).

Nigeria Agenda 2050 also foresees a ramp-up of domestic gas production, approximately doubling by 2030 and increasing fourfold by 2050, compared to 2020 levels (Federal Government of Nigeria, 2023). The Ajaokuta-Kaduna-Kano gas pipeline from Nigeria's gas-rich east to the north of the country is under construction, and is part of a proposed trans-Saharan pipeline, which, if built, would enable gas exports to Europe (Mojjido, 2023).

Rank of country in, and share of, global production, and net trade status

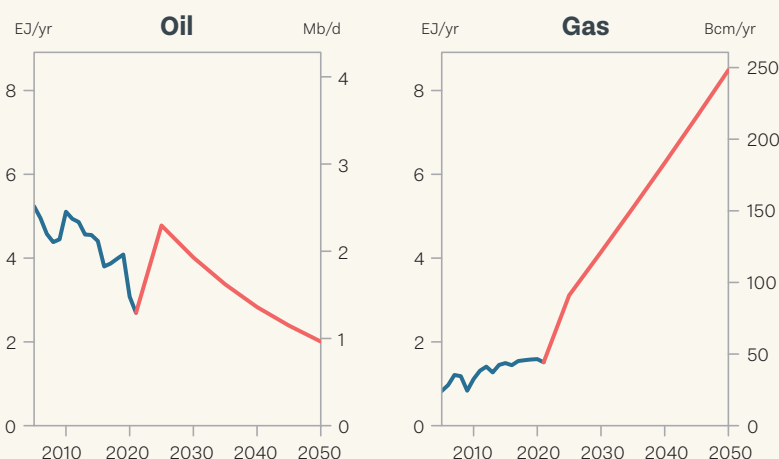


Fossil fuel transition capacity and dependence indicators

Income level Lower-middle income	Coal direct employment No data	Coal economic dependence No data	Share of GDP from oil & gas production 10%
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Figure 3.18

Historical (2005–2021) and projected oil and gas production for Nigeria. Coal production is small (<0.5 EJ/yr) and not shown. Projections are from the Nigeria Agenda 2050 plan (Federal Government of Nigeria, 2023). The projected gas production (as shown) does not include fractions that are re-injected and used by producers and flared, which accounted for around 25% of total production in 2020 and is expected to reduce to 20% by 2050 according to Nigeria Agenda 2050. Historical data are from the IEA (2023a).



Government support for domestic fossil fuel production

■ In 2021, the government signed the Petroleum Industry Act (PIA) into law (Federal Government of Nigeria, 2021) to reform the governance and regulation of the petroleum industry and encourage investment in fossil fuels. The PIA commercializes the Nigerian National Petroleum Corporation (NNPC), codifies transparency, accountability, and good governance over fossil fuel resources, and allocates funds towards developing host communities where fossil fuels are produced. The PIA also establishes a fund to support exploration in frontier basins using a portion of leasing rents and NNPC's profits (Federal Government of Nigeria, 2021). It also provides tax holidays of up to 10 years for midstream gas operations and lowers the maximum tax rate on profits from upstream oil and gas operations from 85% to 60%. For companies operating in deep offshore areas, the maximum tax rate is even lower at 30% (PwC Nigeria, 2021).

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

Government support for international fossil fuel production

No support was identified.

Policies and discourses on 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

A key objective of Nigeria's ETP is to promote a "fair, inclusive and equitable energy transition in Africa that will include gas as a 'transitional fuel'" (ETP, 2022). The Initiative for Climate Action Transparency in partnership with Nigeria's Federal Ministry of Labour and Productivity seeks to implement the Just Transition and Gender Initiative that includes a focus on the energy sector (ICAT, 2023).

Colombia

Announced climate ambitions

Colombia's updated NDC, submitted in 2020, pledged not to emit more than 169.44 MtCO₂eq by 2030 (Government of Colombia, 2020). This is equivalent to a 51% emissions reduction from a revised 2030 reference scenario, compared to a 20% reduction in the first NDC (UNDP, 2022). In December 2021, Colombia enshrined a 2050 net-zero GHG emissions target into law (Congreso de Colombia, 2021b).

Government views on domestic fossil fuel production

The extractive sector, which is dominated by fossil fuels, accounts for almost 11% of government revenues and over 50% of the country's export earnings (EITI, 2020; Moloney, 2022; Portafolio, 2023). Colombia generally exports more than 90% of its produced coal, which accounted for about 13% of total exports in 2020 (NMA, 2022). In 2022, Colombia's newly elected administration announced that it will not approve any new oil and gas exploration licenses (Taylor, 2023). However, there is some uncertainty about the country's future energy policy direction (Moloney, 2023; Paula Rubiano A., 2022). For example, the Ministry of Finance has stated that the country remains open to new oil and gas projects, and the government's strategy for advancing a just and sustainable energy transition includes plans for continued exploration and production of oil and gas to ensure energy self-sufficiency (MME, 2023b; Taylor, 2023). However, the Ministry of Mines and Energy has reaffirmed the exploration ban and indicated that pilot fracking projects would also be halted (Forbes, 2023).

Plans and projections for domestic fossil fuel production

Colombia's draft 2022–2052 National Energy Plan, which was being finalized as of August 2023, presents scenarios of

coal, oil, and gas production based on varying estimates of reserves and resources, with Scenario 1 having the “greatest certainty” (UPME, 2023). These production scenarios are one of many elements that inform five different energy scenarios presented in the plan. As shown in Figure 3.19, under the “Actualización” (updated) energy scenario featuring fossil fuel production Scenario 1, coal production is projected to more than double between 2021 and 2035, before declining by around 70% by 2050. Oil and gas production are expected to decline by 67% and 45%, respectively, between 2021 and 2050. Colombia's oil and gas production have fallen steadily since 2013 due to a combination of factors, including low success rates in exploration, instability in oil-producing regions, and reduced oil demand during the COVID-19 pandemic (ACI-PET, 2016; Smith, 2020; Tarazona, 2022).

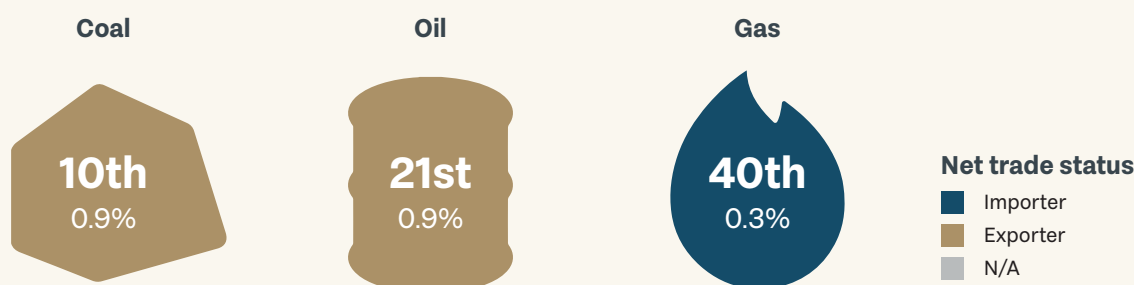
Government support for domestic fossil fuel production

■ Colombia provides subsidies through tax expenditures and budgetary transfers to coal, oil, and gas production that totalled COP 2.3 billion (USD 610 million) in 2021 (OECD, 2023b). About 52% of this value goes toward public funding of Colombia's National Hydrocarbons Agency (OECD, 2023a).

■ Colombia provides tax incentives for non-conventional energy projects, including blue hydrogen, which indirectly provides tax benefits for coal and gas production (Congreso de Colombia, 2021a; MME, 2021a).

■ State ownership of Ecopetrol, Colombia's largest oil company, is 88.49% (Ecopetrol, 2022a). Ecopetrol has committed to investing USD 17–20 billion between 2022 and 2024, with 69% of this investment going towards domestic and international oil and gas exploration and production projects, and annual investments of about USD 5.2–6 billion continuing until at least 2040 (Ecopetrol, 2022b).

Rank of country in, and share of, global production, and net trade status



Fossil fuel transition capacity and dependence indicators

Income level

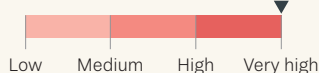
Upper-middle income

Coal direct employment

1.7

coal miners per 1,000 workers

Coal economic dependence

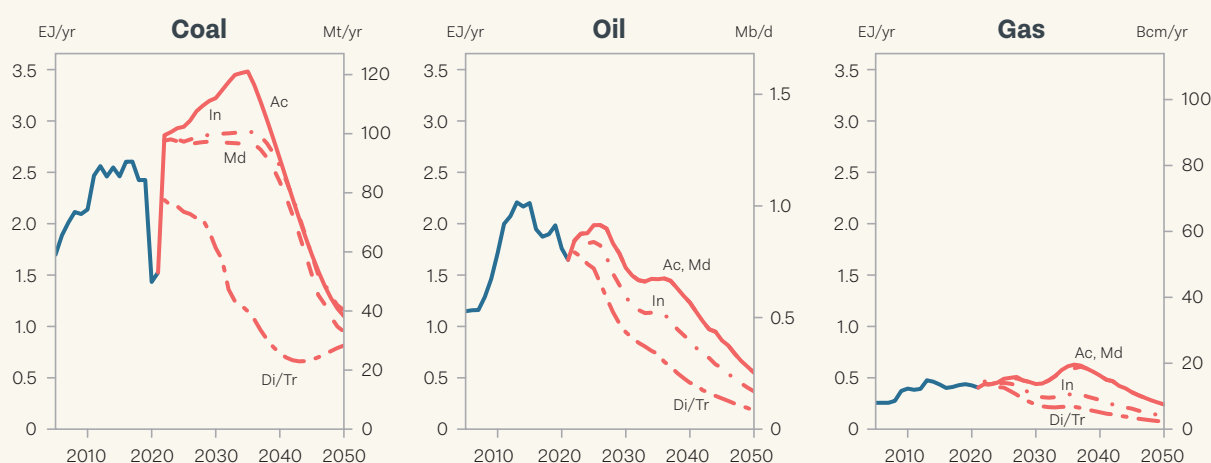


Share of GDP from oil & gas production

5%

Figure 3.19

Historical (2005–2021) and projected coal, oil, and gas production for Colombia. Sources: Projections are from the draft 2022–2052 National Energy Plan (UPME, 2023). Five different energy scenarios are presented: Actualización (Ac); Modernization (Md); Inflection (In); Disruption (Di); and Transition (Tr). (The Ac and Md scenarios overlap for oil and gas, while the Di and Tr scenarios have the same fossil fuel production projections.) Historical data are from the IEA (2023a).



Government support for international fossil fuel production

Ecopetrol's planned investments include USD 1.87 billion by 2024 in the US's Permian basin and an unspecified amount in Brazil (Ecopetrol, 2022b, 2022c).

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

As of August 2023, the current administration's pledge to ban new oil and gas exploration projects was not yet reflected in adopted policy or legislation (Forbes, 2023). Instead, recent efforts have focused on reviewing existing contracts and implementing measures to improve resource recovery efficiency (MME & ANH, 2022). The Congress of Colombia recently dropped a proposal to ban new open-pit coal mines from the country's latest National Development Plan (DNP, 2023). In May 2023, the Senate of Colombia approved a bill to ban fracking; this bill is currently pending review and approval by Congress (Congreso de Colombia, 2022).

The Colombian administration has called for multinational banks to stop financing fossil fuels (Echeverria, 2022). In August 2023, Colombia signed on to the Beyond Oil and Gas Alliance (BOGA) as a "Friend of BOGA", making it the largest fossil fuel producer to join BOGA to date, and the only country out of the 20 profiled here to sign on to an international initiative focused on phasing out fossil fuel production (MME, 2023d).²⁵

Ecopetrol has committed to reaching net-zero emissions in 2050 from its oil and gas production activities and aims to reduce its total emissions (including those from the combustion of its produced fossil fuels) by 50% by 2050 (Ecopetrol, 2023). However, none of these commitments translate to a planned reduction in production.

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

In recent years, the concept of a just energy transition has appeared in many government discourses. For example, Colombia's updated NDC included a commitment to develop a just energy transition for workers (Government of Colombia, 2020), and the latest four-year National Development Plan aims to accelerate a just energy transition by using financial surpluses from coal and oil production to fund alternative sectors leading to a greener economy (DNP, 2023). The concept of a just energy transition is also reiterated throughout the draft 2022–2052 National Energy Plan (UPME, 2023). However, concrete policies and implementation are still lacking. According to the Ministry of Mines and Energy, a detailed just energy transition roadmap will be released in February 2024 (MME, 2023a). The roadmap is keenly anticipated by civil society, especially in light of the country's high fiscal and economic dependency on fossil fuels and the socioeconomic and environmental impacts resulting from the abrupt closure of two major coal mines in 2020 (Paula Rubiano A., 2022; Tarazona, 2023; Yanguas-Parra et al., 2021).

²⁵ There are three BOGA membership levels: Core Members, Associate Members, and Friends of BOGA (see <https://beyondoilandgasalliance.org/who-we-are/>).

United Kingdom of Great Britain and Northern Ireland (UK)

Announced climate ambitions

In its latest NDC, the UK committed to reducing GHG emissions to at least 68% below 1990 levels by 2030 (UK Government, 2022, p. 1). The country has also established legally binding targets of reducing GHG emissions by around 77% by 2035 and achieving net-zero by 2050 (UK BEIS, 2019; UK Government, 2021b).²⁶

Government views on domestic fossil fuel production

The UK's oil and gas policy is governed by a statutory duty to "maximise economic recovery" (UK Public General Acts, 1998). To meet this principal objective, the relevant authority, the Oil and Gas Authority — now known as the North Sea Transition Authority (NSTA) — develops a strategy on a four-year cycle, including obligations for the oil and gas industry. In its latest strategy, the NSTA placed, alongside the principal objective, a requirement for the industry to assist the government in meeting the 2050 net-zero target (OGA, 2021). This includes halving production-based emissions by 2030 compared to a 2018 baseline, and broader initiatives to support CCUS and the development of hydrogen production (UK BEIS & OGA, 2021). The government considers continued domestic oil and gas production as key to its energy security (UK DESNZ, 2023), and consistent with its net-zero ambition (Environmental Audit Committee, 2023, p. 14; UK BEIS, 2022a). However, the government's own Climate Change Committee has stated that "Expansion of fossil fuel production is not in line with Net Zero" (UK CCC, 2023, p. 15).

Coal production in the UK has been in decline for many years; demand has plummeted as the UK government aims to phase out unabated coal use in power generation by October 2024 (UK BEIS, 2021c). Nevertheless, the government approved a major new coal mine in 2022, the first in over 40 years, which

is intended to supply coal for the steel industry in the UK and abroad (UK DLUHC, 2022). This project has faced significant opposition by civil society on climate grounds (BBC News, 2023; Friends of the Earth, 2023).

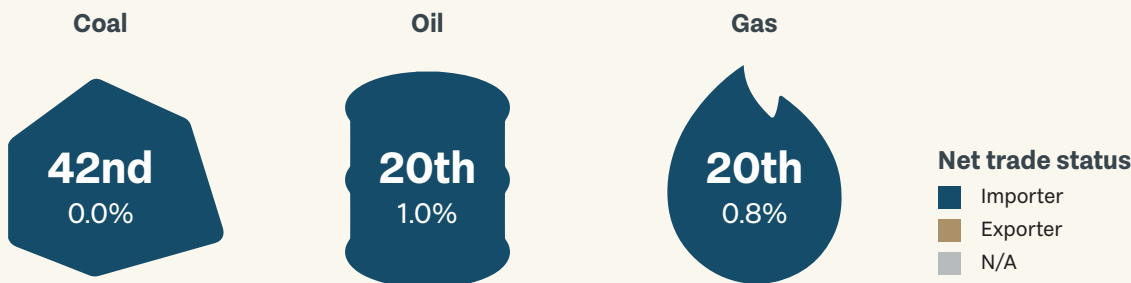
Plans and projections for domestic fossil fuel production

The NSTA's oil and gas production projections as of February 2023 are shown in Figure 3.20 (NSTA, 2023). Compared to prior projections (NSTA, 2021), UK oil and gas production are now projected to drop faster between 2021 and 2040, by 69% and 82%, respectively (compared to 58% and 70% previously). However, previous projections by the NSTA have underestimated actual production in subsequent years (Hall, 2019, pp. 18–22), and there are limited details on how these projections are developed (NSTA, 2022a).²⁷ The UK government has argued that the NSTA's estimated annual decline rates in oil and gas production are consistent with the country's net-zero goal and with 1.5°C-aligned global reduction pathways as estimated in the 2021 Production Gap Report and other studies (UK BEIS, 2022c, pp. 464–465).

Government support for domestic fossil fuel production

- In 2021, the UK provided tax expenditures for oil and gas production totalling GBP 2 billion (USD 2.8 billion) (OECD, 2023b).
- In recent years, profits from oil and gas production have been subject to a "ring fence corporation tax" at an effective rate of 40% (Seely, 2023). This constitutes one of the lowest oil and gas tax and royalty regimes in the world, with the global average at 70% (Graham, 2022).
- In 2022, the government brought in an Energy Profits Levy of 25%. This additional but temporary windfall tax on oil and gas company profits was then increased to 35% in January

Rank of country in, and share of, global production, and net trade status

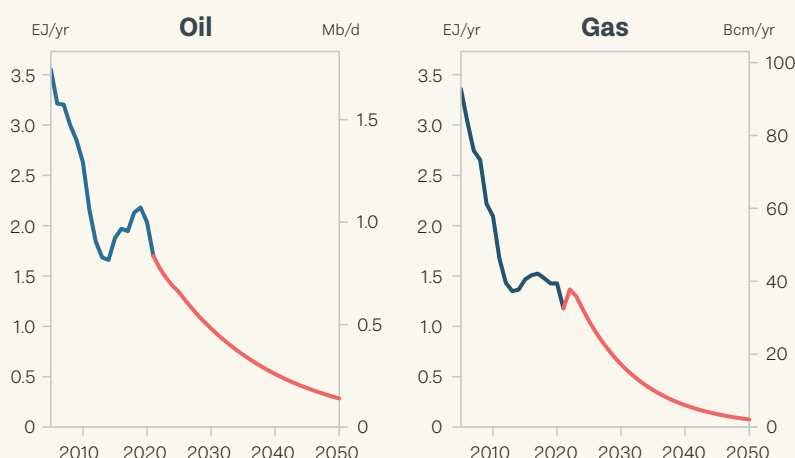


Fossil fuel transition capacity and dependence indicators

Income level	Coal direct employment	Coal economic dependence	Share of GDP from oil & gas production
High income	0.0 coal miners per 1,000 workers	No data	1%

Figure 3.20

Historical (2005–2022) and projected oil and gas production for the UK. Coal production is small (<0.5 EJ/yr) and not shown. Sources: Historical data and projections are from the North Sea Transition Authority's February 2023 oil and gas production projections (NSTA, 2023).



2023, and was set to remain in place until 2028 (UK HMRC, 2022). However, the levy comes with a generous tax relief for investments in new oil and gas fields; for every British pound invested, just over 91% is returned in tax relief (Graham, 2022).

■ In 2022–2023, the UK opened new licensing rounds for oil and gas exploration and expansion in the North Sea with more than 100 awards expected (NSTA, 2022b). The government argued that this would boost the country's energy security and economy, and is not in conflict with the country's net-zero goal (NSTA, 2022b).

■ Between 2023 and 2063, the UK will provide an estimated GBP 12.7 billion (USD 15.6 billion) in tax relief to oil and gas companies for the GBP 40 billion (USD 49 billion) cost of decommissioning offshore infrastructure (UK Government, 2023).

Government support for international fossil fuel production

Effective from March 2021, the UK government issued a policy of no longer providing “new direct financial or promotional support for the fossil fuel energy sector overseas”, including support provided by UK Export Finance (UKEF) (UK BEIS, 2021a, p. 4). Unabated gas generation and associated infrastructure may still receive support if certain conditions are met (UK BEIS, 2021a, p. 7). The UKEF financing of up to USD 1.15 billion for the Mozambique LNG project was approved in 2020 (UK Export Finance, 2021). The UK also signed onto the Glasgow Statement pledging to end international public financing for unabated fossil fuel projects at COP26 (UK Government, 2021a).

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

The current government's position is that “continued oil and gas licensing is not inherently incompatible with the UK's climate objectives” (UK BEIS, 2022a, p. 3). This position was established following a review in late 2020 (UK BEIS, 2020), and again following a public consultation on designing a “climate compatibility checkpoint” launched in late 2021 (UK BEIS, 2021b). The initially proposed checkpoints included emissions from both production- and consumption-based activities, as well as a consideration of the “global production gap” (UK BEIS, 2021b, p. 24). Ultimately, the checkpoint tests focused on production-based emissions only and became an “informative” rather than a “deterministic” process, meaning a licensing round could be permitted even if the tests were not met (UK BEIS, 2022a, 2022b). Therefore, this report has found no evidence that the UK government is actively winding down oil and gas production.

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

The North Sea Transition Deal, a partnership between the UK government and the oil and gas sector published in March 2021, highlighted that it will invest in skills and job training oriented around CCS and hydrogen, complementing continued oil and gas production (UK BEIS & OGA, 2021). The devolved government for Scotland, where most of the UK's oil and gas sector is located, established a Just Transition Commission in 2018 to support “a net zero and climate resilient economy in a way that delivers fairness and tackles inequality and injustice” (Scottish Government, n.d.).

²⁶ The UK's Sixth Carbon Budget codified a target to reduce GHG emissions to 965 MtCO₂e between 2033–2037. This means that emissions (including from international aviation and shipping) will be about 77% lower in 2035 than in 1990.

²⁷ The NSTA publishes projections of domestic oil and gas production out to 2050 twice a year to inform the Office for Budget Responsibility's fiscal forecasts. The extent to which new licensing rounds, such as that launched in 2022 (NSTA, 2022a), and other fiscal measures that have been considered in the projections are unclear. The NSTA's description notes that “projections are not modelled but, instead, are based on informed judgement”; production projections for the next five years are more carefully developed, after which compound annual decline rates of 6% and 9% are applied to oil and gas respectively.

Germany

Announced climate ambitions

The Government of Germany amended its Climate Change Act to establish legally binding targets of carbon neutrality by 2045 and GHG emission reductions of at least by 65% by 2030, relative to 1990 levels, following a ruling by Germany's Federal Constitutional Court in 2021 (IEA, 2022d).

Government views on domestic fossil fuel production

Germany closed down its last hard coal mine in 2018, but remains the world's second-largest producer of lignite, the most carbon-intensive type of coal, after China (BGR, 2022). It is a relatively marginal producer of oil and gas (IEA, 2023a), with modest and dwindling reserves (OECD, 2023b). Hydraulic fracturing ("fracking") of unconventional oil and gas deposits was banned in 2017 (Government of Germany, 2017).

The 2020 Coal Phase-out Act states that coal-fired power generation will end in 2038 at the latest (Government of Germany, 2020); in 2021, the current government agreed to "ideally" bring this date forward to 2030 (Government of Germany, 2021). In response to the 2022–2023 global energy crisis, the government amended certain laws to temporarily delay some short-term coal generation phase-out deadlines, but did not change its long-term goals. For example, the Replacement Power Plant Availability Act allowed for a delayed closure of certain hard-coal-fired power plants and the re-activation of both hard-coal- and lignite-powered power plants from the grid reserve until 31 March 2024 (Government of Germany, 2022). An amendment to the Coal Phase-out Act delayed the retirement of 1.2 gigawatts (GW) of lignite-fired power plants from 2022 until 31 March 2024 and, at the same time, brought the coal phase-out in the western lignite mining

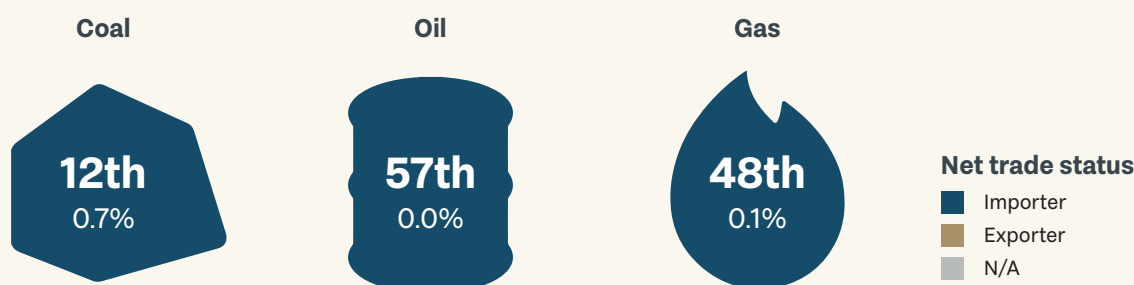
region forward from 2038 to 2030 (for 3 GW of lignite-fired power plants) (Enerdata, 2022). These measures helped to replace some Russian gas imports; nevertheless, Germany's domestic coal consumption remains in structural decline.

Although Germany's Coal Phase-out Act does not explicitly address production, it has strong implications for lignite mining, given that the country consumes all of its produced lignite (IEA, 2023a) and that Germany's open-pit lignite mines and power plants work in tandem (BMWK, 2023a). It is also worth noting that in response to the energy crisis, the government took steps to accelerate the energy transition, including raising the target for the share of renewables in the power sector from 65% to 80% by 2030 (Government of Germany, 2022a). This will structurally reduce the share of fossil fuels in the energy mix, and thus the need for their production, especially in the case of lignite.

Plans and projections for domestic fossil fuel production

Figure 3.21 shows the projected declines in Germany's lignite coal, oil, and gas production to 2030 based on the "climate action plan" scenario consistent with Germany achieving carbon neutrality by 2050, as published in the Integrated National Energy and Climate Plan (NECP) adopted in June 2020 (BMWK, 2020). These do not yet reflect recent policies, such as more ambitious climate and energy targets in Germany and the EU. For example, reforms of the EU Emissions Trading Scheme are likely to significantly increase the price of coal beyond 2030 (European Council, 2023), creating enabling conditions for an earlier coal phase-out. A final version of the new NECP is expected in 2024.

Rank of country in, and share of, global production, and net trade status



Fossil fuel transition capacity and dependence indicators

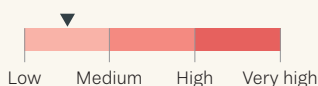
Income level

High income

Coal direct employment

0.3 coal miners per 1,000 workers

Coal economic dependence

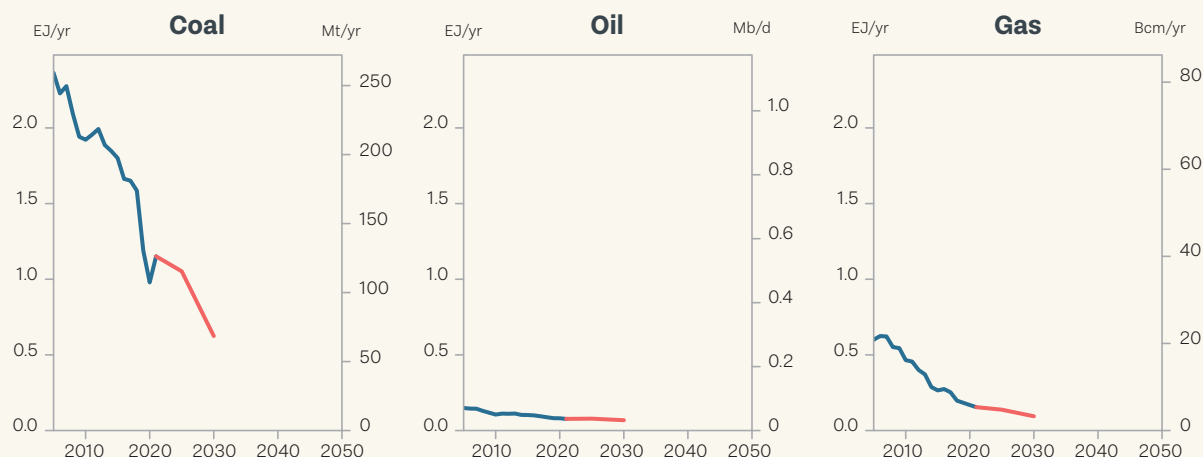


Share of GDP from oil & gas production

No data

Figure 3.21

Historical (2005–2021) and projected coal, oil, and gas production for Germany. Sources: Projections are from the “climate action plan scenario” from the 2020 Integrated National Energy and Climate Plan (BMWK, 2020). Historical data are from the IEA (2023a).



Government support for domestic fossil fuel production

■ Lignite coal producers benefit from mining royalty and water fee exemptions, amounting to EUR 49.5 million (USD 58.5 million) in 2021 (OECD, 2023b).

■ The rehabilitation and clean-up of abandoned open-pit coal mines is an expensive and long-term process, and these financial liabilities have often fallen to the state and federal governments of Germany, including for mines that were closed over a century ago (Öko-Institut, 2022; rbb24, 2023). The federal government is spending around EUR 266 million (USD 306 million) annually to help rehabilitate lignite mining sites in Eastern Germany (OECD, 2023b).

■ The government is also financing early retirement payments for hard coal miners and other assistance in North-Rhine Westphalia, home to most of Germany's traditional coal-mining areas; the total value in 2021 is estimated to be EUR 606 million (USD 697 million) (OECD, 2023b).

Government support for international fossil fuel production

■ Germany's export credit agency (Hermes Cover), the German development bank (KfW), and the German Investment and Development Corporation jointly invested USD 2.8 billion a year in public finance for fossil fuels in 2019–2021 (O'Manique et al., 2022). It is unclear how much of this investment went towards upstream projects. KfW does not invest in coal projects and limits investment in upstream oil and gas, but has stated that up to one-third of its energy investment may go to fossil gas until 2030 (E3G, 2022). Hermes Cover's latest policies exclude new coal plants and oil production with routine flaring (BMWK, 2023b).

■ At COP26 in 2021, Germany signed onto the Glasgow Statement pledging to end international public financing for unabated fossil fuel projects by the end of 2022 (UK Government, 2021a). However, a draft policy released by Germany's export credit agency in July 2023 indicates that the agency

plans to continue supporting the development of new gas fields and related transport facilities until 2025 when justified by national security and in compliance with the Paris Agreement targets (BMWK, 2023b; Civillini, 2023b).

■ In light of Europe's efforts to phase out gas imports from the Russian Federation and given Germany's high gas dependency, the government views ensuring the short- to medium-term availability of gas on the global market as crucial for energy security, and has recently pushed for continued public investment in the gas sector by the G7 countries (Mooney et al., 2023). The government also plans to build more LNG import terminals than any other EU country, spending at least EUR 9.8 billion (USD 11.3 billion) between 2022 and 2038 (Kędzierski, 2023). Along with seeking long-term supply contacts, this buildout of new terminals indirectly encourages international gas production, as it signals long-term demand to producers.

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

Germany's Coal Phase-out Act commits to ending coal-fired power generation by 2038 at the latest. The government is supporting the affected regions (see below).

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

In 2019, the Commission for Growth, Structural Change and Employment made a proposal to phase out coal by 2035 or 2038 along with conditions for a just transition, with minimal socioeconomic fallout and based on collective agreements and societal acceptance. Upon its recommendation, the government committed EUR 40 billion (USD 42 billion) to managing the transition of coal regions, targeting employment (supporting workers through training and early retirements) and a move towards a more sustainable economy, as well as compensating operators (Government of Germany, 2023).



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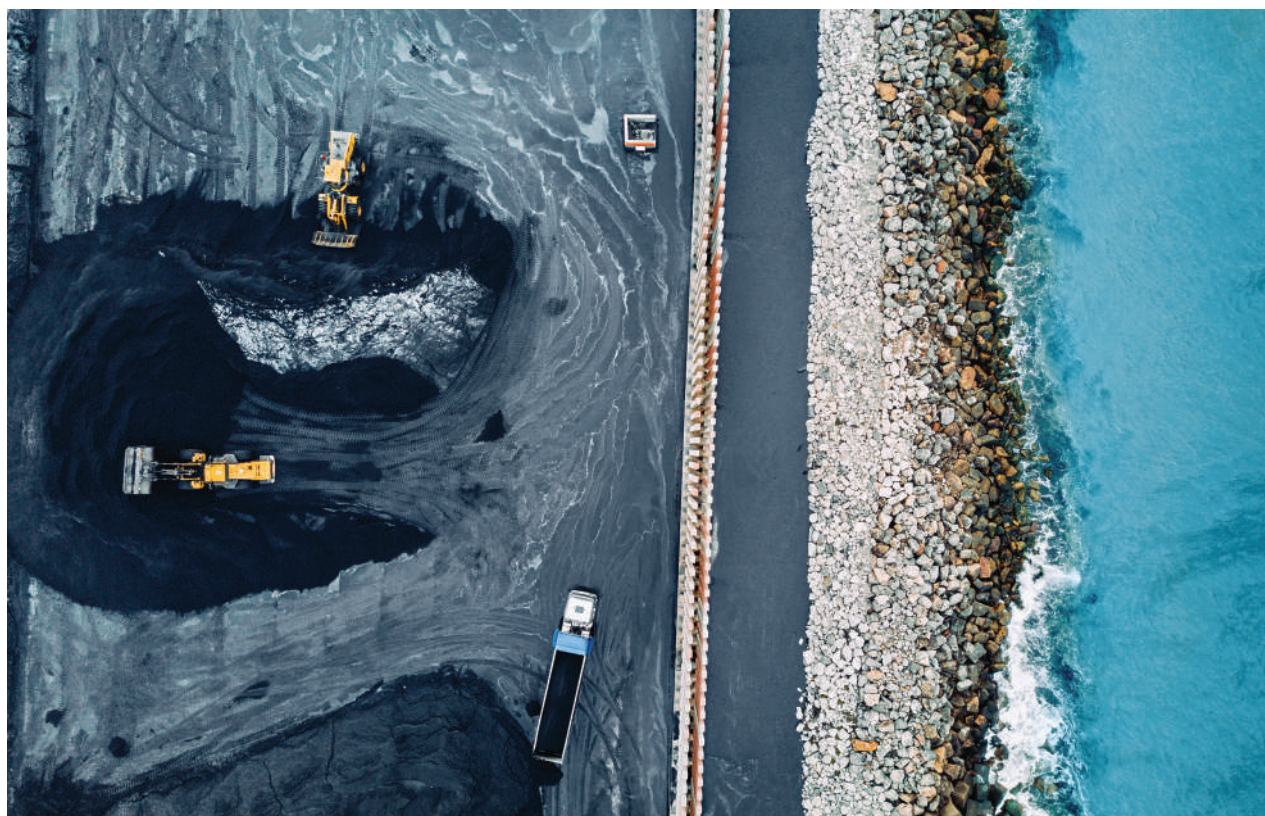
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