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Just transitions in the oil and gas sector: Considerations for addressing impacts on workers and communities in middle-income countries

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CONTENTS

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HIGHLIGHTS

- Oil and gas production plays a major role in many middle-income developing countries by supporting local economies and jobs and generating sizable government revenues.
- Periodic market volatility and mounting global pressure to achieve net-zero carbon emissions by midcentury raise questions about the sector's stability and long-term future.
- Although shifting away from fossil fuels is beneficial, phasing down oil and gas production over the coming decades will cause significant revenue loss for middle-income countries that produce these fossil fuels, with implications for public spending on social programs and infrastructure, public sector employment, and fossil fuel subsidies for vulnerable groups.
- Though the oil and gas industry is not typically a major direct employer, it generates large numbers of indirect and induced jobs that are often geographically concentrated, with outsize influence on subnational governments (SNGs) and local communities.
- Other characteristics of this workforce, including varying unionization rates, the presence of large numbers of contract workers, relatively high pay, and low female participation, will be essential to consider for a just energy transition.
- The challenges of transitioning away from oil and gas can be mitigated by prioritizing place-based economic diversification to generate alternative revenue sources and new jobs, including in the clean energy economy, and developing just transition strategies to aid impacted workers, communities, and SNGs.

EXECUTIVE SUMMARY

Background

The need to reach net-zero carbon emissions globally by midcentury has created pressure to shift from fossil fuels to cleaner energy sources. Investors are increasingly attempting to reduce their exposure to the financial risks posed by climate change, including the risks of stranded assets in the oil and gas production sector. Aided by technological advances and the declining costs of various clean technologies, many governments are also investing in climate-friendly projects across energy, transportation, water, and other priority sectors to reduce emissions and adapt to the impacts of climate change.[1]

The transition to clean energy, along with a shift away from overdependence on oil and gas production, can create important economic benefits, but it poses major challenges for oil- and gas-producing nations, especially middle-income developing countries. Whereas richer countries should be expected to go first and fastest in phasing down fossil fuel production, middle-income countries—responsible for 48 percent of the world's oil production and 52 percent of its gas production—are poorly positioned to weather the coming shifts (Calverley and Anderson 2022). The economies of many such countries are not adequately diversified, and the oil and gas sector accounts for a significant share of exports and government revenue. This heightens their vulnerability not just to temporary economic shocks and price volatility caused by wars, pandemics, or recessions but also to the necessary phasedown of fossil fuel production.[2]

Although the respective roles of international oil companies (IOCs) and national oil companies (NOCs) will be important for the transition, NOCs will play a significant role in influencing the pace of the energy transition in oil- and gas-producing middle-income countries.[3] IOCs are facing shareholder and investor pressure to cut their emissions and diversify their portfolios. Some have begun to divest small portions of their oil and gas assets, including in middle-income countries, though they remain important actors in those nations. When they do depart from countries, often after years of reaping economic benefits, IOCs may leave behind legacies of environmental damage and economic challenges. NOCs, meanwhile, do not face the same investor pressures as IOCs and are motivated to maximize resource extraction for their governments.[4] Many NOCs in middle-income countries are expanding their market share and investing in expensive oil and gas projects, which risk becoming stranded assets as the shift away from fossil fuels accelerates (Heller and Manley 2021).

About This Working Paper

This working paper examines the potential challenges facing middle-income countries that need to transition away from reliance on oil and gas production. Thus, it focuses on the implications of phasing down oil and gas production rather than transition issues around oil and gas consumption. The paper seeks to spur increased dialogue, analysis, and action to make that transition more just and equitable.

The concept of *just transition* is evolving and can mean different things to different people (see Box 1 in the Introduction). This paper evaluates the impacts of the energy transition on workers directly and indirectly supported by oil and gas and on local communities and SNGs whose budgetary resources and public service offerings may be impacted as the industry contracts.

This paper focuses on middle-income developing countries (henceforth referred to as *middle-income countries*). This classification is based on the World Bank's calculation of countries' gross national income (GNI).[5] It excludes high-income oil and gas producers such as Saudi Arabia and the United States. Furthermore, the paper prioritizes middle-income countries whose economies rely heavily on oil and gas revenues—measured by the share of oil and gas revenues in the total government revenues, the share of oil rents in the gross domestic product, or the share of oil and gas exports in the total exports.

Our research included a literature review of academic and nonacademic articles and reports focusing on just transition, the oil and gas industry and its role in middle-income countries, government revenues from the oil and gas sector, employment in the oil and gas sector, and economic diversification and workforce transitions. We also consulted with and interviewed experts and stakeholders in middle-income oil- and gas-producing countries, including Argentina, Mexico, and Nigeria (Appendix A).

Summary Findings

Middle-income oil- and gas-producing countries could face a significant drop in government revenue due to the low-carbon transition, with fewer years available for oil and gas production before those investments become stranded assets. Although there can be tremendous uncertainty around oil and gas prices from year to year, over a longer time horizon we expect decreasing global demand for these fossil fuels as the imperative to decarbonize strengthens. The implications will likely be wide-ranging for oil- and gas-producing middle-income countries. By no means do all oil and gas revenues support

public goods. Often, they can be siphoned off by elites in many countries, with extractive industries such as oil and gas often fueling corruption, rent seeking, and poor governance (Arezki and Brückner 2009; Barma 2021; Peck and Chayes 2015). Yet our analysis finds that falling oil and gas revenues could have the following effects:

- Limiting a government's ability to provide public services such as education, health care, and physical infrastructure.
- Reducing the revenue available to be passed along to SNGs, impacting their ability to provide services to local communities.
- Shrinking public sector employment, which represents a large proportion of formal employment in many middle-income countries.
- Precipitating overly abrupt cuts in fossil fuel subsidies—especially due to volatile prices—for the most vulnerable and lowest-income consumers. Although subsidies are costly, inefficient, inequitable, and harmful for the planet and should be reformed and eliminated whenever possible, their abrupt removal can negatively impact vulnerable sections of the population.

The long-term shift away from oil and gas, along with the periodic market volatility that is characteristic of the industry, will contribute to job displacement and insecurity for workers directly and indirectly supported by the industry. Most analyses show net employment gains globally from a low-carbon transition, but there will still be localized losses in some sectors and communities (Jaeger et al. 2021). Data gaps make it difficult to determine how many workers in middle-income countries will be impacted by the energy transition, but our analysis reveals the following:

- Oil and gas production creates relatively few direct jobs but many more indirect ones. This, combined with the industry's geographic concentration within countries, will exacerbate the transition's impacts on a wide swath of workers and local communities.
- Workers who are unionized may receive more attention and support in navigating the transition, but unionization rates in the oil and gas industry vary by region and job type.
- Many workers are contract workers with lower wages, precarious working conditions, and little or no union representation. Thus, strategies will be needed to include their voices in just transition discussions.
- Compensation in the oil and gas industry tends to be above the local average for jobs requiring comparable skills and education. Countries will need to ensure the creation of good, well-paying jobs in former oil and gas regions that are attractive to displaced oil and gas workers.
- Women are rarely directly employed in this sector, but many are indirectly supported by the industry. Its decline, and the knock-on economic impacts on the broader community, will affect them as well.

Key Considerations for Policymakers

Policymakers in many oil- and gas-producing middle-income countries have not yet begun to grapple with the many challenges of planning for a just transition away from oil and gas. Strategies to diversify the economy and enable a just transition may take decades to bear fruit, so it is prudent for policymakers to start planning for this transition now by taking the following steps:

- **Pursuing economic diversification.** Policymakers will need to consider how they want to diversify and in which sectors as well as how businesses and educational, legal, and other social systems can support those efforts. They will need to study the potential to grow other sectors, including the clean energy industry, depending on their particular national and subnational contexts and what role NOCs might play in enabling the clean energy transition.
- **Developing proactive, long-term, and place-based planning.** Policymakers will need to close data gaps on the demographics, wages, and skills of oil and gas workers as well as the economics of regions and communities likely to be impacted by the transition. They will need to consult a range of stakeholders, develop inclusive plans for transition assistance to dislocated workers and affected communities, and strengthen social safety nets to assist vulnerable workers and communities.
- **Creating robust funding mechanisms to finance the transition.** Dedicated domestic sources of funding can come from earmarking taxes on fossil fuels; reforming subsidies and reallocating their benefits; using income from sovereign wealth funds; and requiring the oil and gas industry, especially IOCs, to help cover the costs of environmental remediation and support for workers and communities. Although middle-income countries may at times be able to draw on their own domestic resources to finance just transition policies, it will be essential for richer countries and international finance institutions to provide financing and technical assistance to enable middle-income countries to pursue just transition strategies.

INTRODUCTION

Growing Pressure to Move Away from Fossil Fuels

The oil and gas industry faces significant pressures due to increasing concerns about the climate and environmental impacts of fossil fuels, investor skepticism about the future demand for oil and gas, the rapid deployment of clean energy technologies, and the growth of green policies to meet decarbonization goals. The broader context is the urgent need to transition away from fossil fuels to avoid warming above 1.5°C, which would unleash the worst impacts of climate change, and to limit the financial risks posed by stranded fossil fuel assets.

The energy transition will have enormous implications—both in terms of opportunities presented and challenges posed—for middle-income oil- and gas-producing countries. Although the quantity of oil and gas some middle-income countries produce is small, collectively, these countries accounted for approximately half the world's oil and gas in 2021 (Table 1). Their economies rely on these fossil fuels. Volatile prices in the past have already left these countries struggling to balance their budgets when oil and gas revenues fall. A more permanent decline in oil and gas production and consumption could have devastating impacts on middle-income producer nations unless the transition is managed carefully. The risks include declines in government revenue, export revenue, jobs, and revenues that flow to subnational governments (SNGs).

The Net Zero Emissions by 2050 (NZE) Scenario of the International Energy Agency (IEA) finds that staying within a 1.5°C pathway would require no exploitation and development of new oil and gas fields beyond those already approved for development (IEA 2021d).[6] Oil demand is estimated to decline by about 75 percent, from 88 million barrels per day (mb/d) in 2020 to 24 mb/d by 2050, and demand for natural gas is expected to fall 55 percent, to 1,750 billion cubic meters (bcm), over the same period.[7] Consistent with the IEA's NZE Scenario, oil prices would decline to US$35/barrel by 2030 and $25/barrel by 2050.[8]

Demand for both oil and gas products is expected to decline at different rates due to differences in their markets (including in oil's larger role as a global commodity), in their eventual end uses and products, and in how quickly they may have to decline to slow climate change.[9] The IEA's NZE Scenario suggests that oil production and use will need to fall faster and further than gas to achieve 1.5°C, largely due to oil's greater carbon intensity.[10] Oil may also face particular pressures due to vehicle electrification.[11]

Demand for gas may be propped up by policymakers in some countries who view it as a solution to provide energy access to millions of residents who lack electricity as well as an option for transport and cooking fuel. In 2021, the Nigerian government declared the 2020s the "Decade of Gas" and launched an initiative to use gas to power the economy by 2030 (Delay 2021; Esiedesa 2021).[12] Alternatives to gas—including renewable energy combined with battery storage—may soon eclipse gas as the most cost-effective way to generate electricity.[13] However, gas is used in many sectors of the economy—including in industry, largely as feedstock or for process heat, and as cooking fuel—unlike oil, which is largely used as a transportation fuel.

Nonetheless, recent analyses reveal that, to limit global warming to 1.5°C, oil production at 20 of the world's largest oil companies needs to decline by 50 percent or more by the 2030s, and global oil and gas production must decline by 3 percent every year until 2050 (Dalman and Coffin 2021; Welsby et al. 2021). This has major implications for producing countries and com-

Table 1 | **Distribution of Oil and Gas Production by Income Group of Countries (2021)**

INCOME GROUP	OIL PRODUCTION (%)	GAS PRODUCTION (%)
High-income countries	51.9	47.9
Middle-income countries	47.6	52.0
Low-income countries	0.5	0.1

Note: Countries have been grouped into high-, middle-, and low-income based on the World Bank's classification of countries by income level.

Source: Authors' calculations based on data from EIA (n.d) and Sonnichsen (2022b).

panies that may be banking on monetizing oil and gas reserves in the future but instead may be left with stranded assets in a low-carbon world.

The Role of Oil and Gas Companies in the Energy Transition

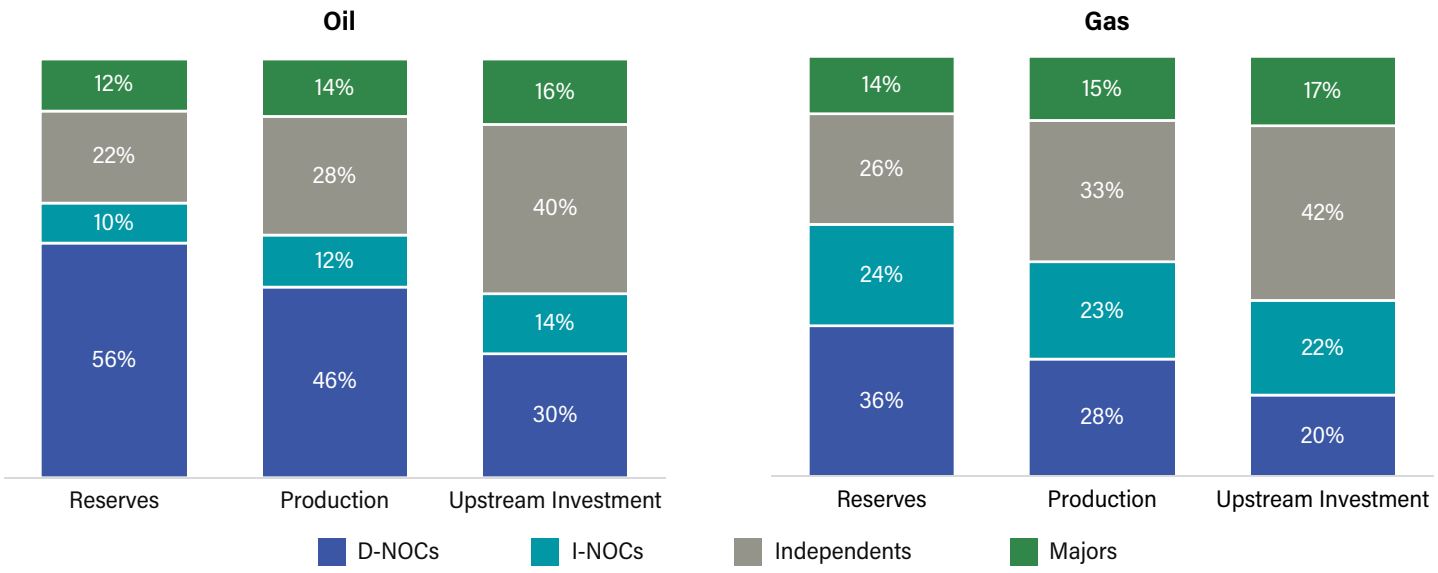
Although international oil companies (IOCs) and national oil companies (NOCs) will both influence the pace of the transition, NOCs that are central to the economic systems of oil- and gas-producing middle-income countries will be key players in navigating the transition.

Some IOCs have begun to expand their businesses into clean technologies such as renewable energy, hydrogen, and carbon capture technologies.[14] Nevertheless, this still represents less than 1 percent of their total capital expenditures (IEA 2020a; Larson 2021). Driven by climate commitments, community restiveness, and security risks from armed groups, some IOCs are also divesting small portions of their fossil fuel assets. For instance, Shell is divesting from its onshore oil assets in Nigeria, and Chevron, ExxonMobil, BP, Shell, Total, and Eni have sold $28.1 billion in assets globally between 2018 and mid-2021 (Hurst 2021; Nwaoku 2021).

However, in the countries they are departing, IOCs may be leaving behind local environments heavily polluted and degraded by their operations, and questions could remain over who will pay for remediation. They might also be leaving behind economic legacies characterized by limited economic diversification along with a concentration of resources in fewer hands, which could hinder a just transition away from oil and gas.

NOCs, including those fully focused on domestic production and those with both domestic and international operations, are key players in the global market, accounting for over half of global oil and gas production and 40 percent of investment in the sector (Manley and Heller 2021; Figure 1). When IOCs divest from fossil fuels, NOCs and domestic producers often step in to buy these discarded assets, and what they do with these assets will be increasingly important (Adams-Heard et al. 2021; Raval 2021).

Figure 1 | **Ownership of Oil and Gas Reserves, Production, and Upstream Investment by Company Type (2018)**



Notes: Oil and gas companies are grouped into four categories. Domestic national oil companies (D-NOCs) and international NOCs (I-NOCs) are fully or majority owned by national governments. Whereas D-NOCs focus on domestic production, I-NOCs such as Equinor and Petronas also have international operations. Majors are integrated companies listed on U.S. and European stock markets. Independents are either fully integrated companies like the majors but smaller in size or independent upstream operators. This paper uses the term NOCs to refer to both domestic and international national oil companies and IOCs to refer to majors and independents.

Source: IEA 2020a.

Although the largest NOCs are in the Middle East, NOCs are also present in African, Latin American, and Asian middle-income countries (IEA 2020a).[15] NOCs play a central role in these countries' political economies and are subject to domestic political pressure to employ citizens, generate revenues to pay for government programs, supply inexpensive domestic energy, and advance their governments' domestic and foreign policies (Alkadiri and Ewers 2020; Muttitt et al. 2021).

Unlike IOCs, NOCs are not facing the same level of shareholder and investor pressure to reduce emissions and diversify their portfolios to include more clean energy.[16] On the contrary, in countries that depend on the revenues they distribute, NOCs are more likely to expand production and grow their market share by investing in new oil and gas projects (Cahill 2021). Because of their significant role in their national economies, NOCs' actions and decisions are closely intertwined with the political ambitions and policy directions of their governments. Therefore, engagement with NOCs needs to start with an understanding of the bigger-picture plans and ambitions of national governments (Gillies et al. 2021).

In addition to facing less pressure to diversify toward clean energy, many NOCs can shield themselves from oversight and scrutiny from government and civil society (Heller and Kaufmann 2019). Institutional frameworks and accountability mechanisms may not be in place to ensure that NOCs or smaller private operators provide safe workplaces, have the capacity to clean up spills, or reduce methane/natural gas flaring (Adams-Heard et al. 2021).[17]

Debt could also make it hard for NOCs to slow oil and gas production. Some NOCs are carrying large amounts of debt, as much as 10–20 percent of their countries' gross domestic product (GDP), posing financial risks for their countries (Heller and Mihalyi 2019). Governments have had to spend billions of dollars bailing out NOCs in recent years, causing a significant drain on public finances. Mexico's Petróleos Mexicanos (Pemex) is the most indebted oil company in the world, with $110 billion in debt on its balance sheet (Reuters 2021). Moody's has estimated that subsidies to Pemex could cost the Mexican government 2.3 percent of GDP annually (Webber 2020).

NOCs' large role in global oil and gas production—which could expand as IOCs diversify—and their historical lack of operational transparency carry significant implications for how the energy transition will transpire in their respective countries.[18] In some middle-income countries, the economic clout of NOCs could stall efforts to diversify away from oil and gas production.

The Benefits and Risks of Transitioning Away from Oil and Gas

Failing to plan for or begin the transition away from oil and gas will delay a range of benefits the transition could offer while creating risks for middle-income producer countries.

Shifting away from fossil fuels could alleviate the negative impacts of oil and gas extraction on local communities and the environment (Johnston et al. 2019). The Niger Delta is just one place where oil extraction has contaminated land, water, and air, with devastating consequences for people's lives and livelihoods (Elum et al. 2016).

Diversifying away from oil and gas, and finding growth opportunities in the clean energy economy, can serve as a buffer against volatile commodity price cycles and offer a more stable path for equitable development. Technological advances have driven down the cost of renewable energy, and investing in it could help provide affordable energy to 3.6 billion people living in energy poverty across Africa and Asia (Cozzi et al. 2022; Curtin et al. 2021). Investment in distributed renewable energy could also boost employment. According to one estimate, this includes 25 million direct jobs and 520 million downstream jobs made possible by giving communities across Africa and Asia access to electricity (Curtin et al. 2021).

Transitioning away from oil and gas can also help mitigate or reduce the "resource curse," which encompasses a wide variety of social, economic, and political challenges that have prevented many countries from benefiting from the exploitation of their own abundant natural resources (NRGI 2015a; Ross 2015). Some countries that rely on extracting oil and gas often fail to adequately diversify national or local economies and tend to be more prone to authoritarianism, conflict, corruption, and economic stagnation than their resource-poor peers (Lashitew et al. 2021; NRGI 2015a; Ross 2015).

But the transition from fossil fuels will need to be planned and managed carefully. The economies of many middle-income oil- and gas-producing countries are not diversified, which has already made them vulnerable to the boom-and-bust cycle of commodity prices and created volatility. A more permanent decline in the oil and gas industry will exacerbate those challenges. Although a number of metrics can be used to determine the extent of a country's dependence on the oil and gas industry, our analysis of three metrics—oil and gas revenues as a share of total government revenues, oil rents as a share of GDP, and fossil fuel exports as a share of total exports—highlights the

vulnerability of several middle-income oil- and gas-producing countries to a decline of this industry (Figure 2). Without growth in other sectors to offset losses, a long-term contraction in the oil and gas industry, resulting in curtailed production and loss of revenue, could have major repercussions for these countries (UNU-INRA 2019).[19] Section 2 describes these issues.

The long-term shift away from oil and gas will contribute to job displacement and insecurity for workers and communities supported by the oil and gas industry. Section 3 describes the workforce characteristics of workers directly and indirectly supported by the sector and their relevance for enabling a just transition.

Unless policymakers act now to align their policies with future investment trends and develop and implement just transition policies, they will be left with stranded oil and gas infrastructure assets along with impacted workers and local communities. Section 4 proposes three key considerations for policymakers as they begin planning for a just transition away from oil and gas.

Box 1 | Meaning and Evolution of Just Transition

There is a wide spectrum of approaches for defining and interpreting the term *just transition*. A focus on decent work and social dialogue, aimed at addressing the impacts of the transition on workers and affected communities, has been essential to the labor movement's efforts and laid the essential groundwork for a just transition lens. Decent work involves paying fair wages, ensuring the security of work and safe working conditions, providing benefits or social protection, and allowing for labor rights, career growth, and for workers to have a voice in what affects them.[a] Further, the International Labour Organization (ILO) guidelines on just transition emphasize social dialogue, which includes "all types of negotiation, consultation and exchange of information between or among representatives of governments, employers and workers on issues of common interest relating to economic and social policy."[b]

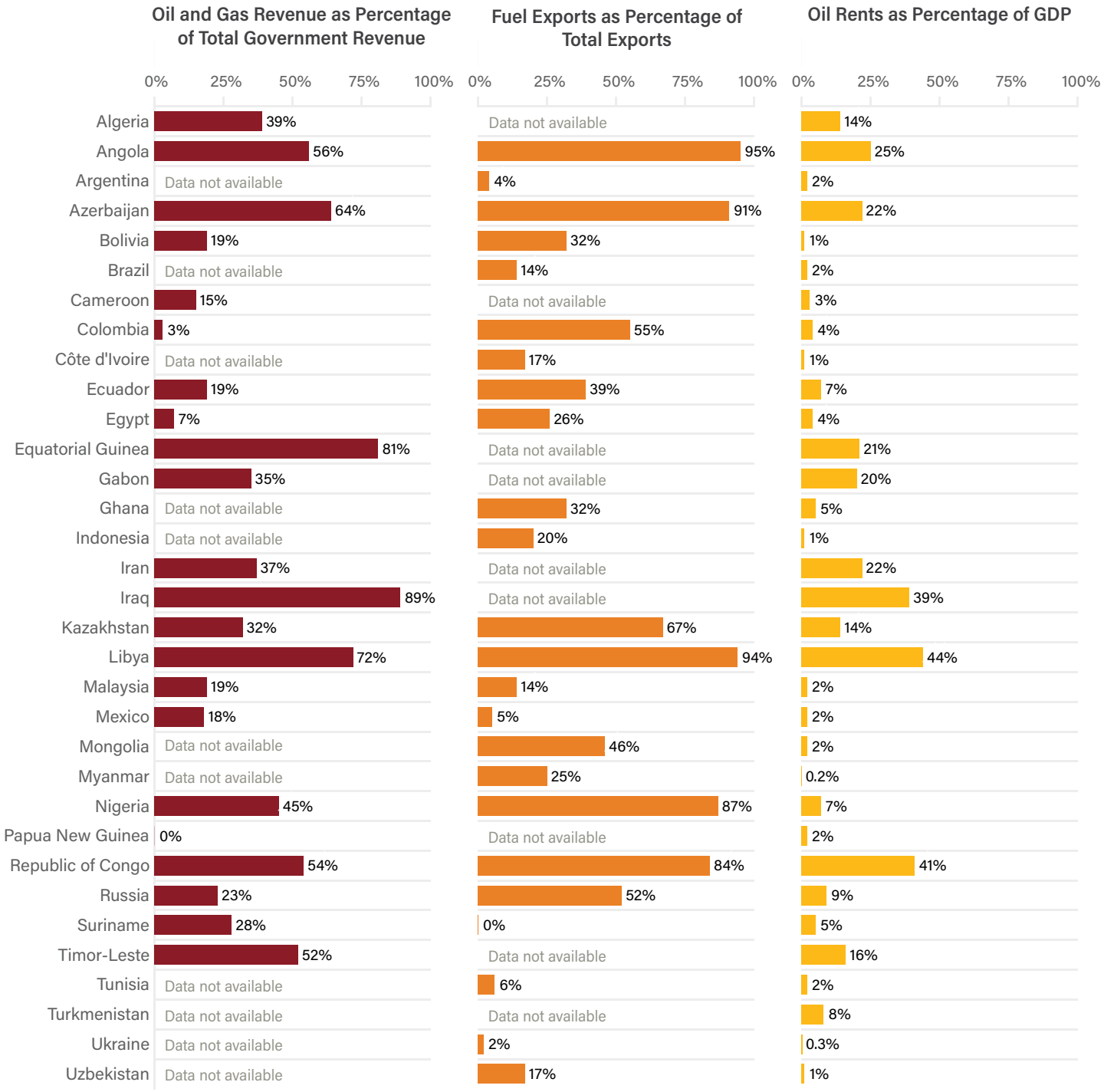
Recently, perspectives on just transition have emerged that go beyond issues of workers and their affected communities to encompass a broader range of marginalized groups of people, such as women, Indigenous peoples, and people of color. In addition, some interpretations of just transition have broadened to encompass a broader set of sectoral and systemic changes.[c] The aim is to apply principles of equity and justice to wider aspects of society and economies as the zero-carbon transition takes place.[d] These more transformative forms of just transition can include changing dominant economic and power systems, promoting ecological resilience, and pursuing approaches that center marginalized groups.[e] In addition, building resilience and adapting to climate impacts, as well as addressing loss and damage due to climate change, have also been incorporated in some recent approaches to just transition.[f]

Although the concerns of affected workers and communities remain central, the term *just transition* is often now associated more widely with the need to shift in equitable ways to societies and economies that are zero-carbon and sustainable.[g]

The issue of just transition has gained increasing traction over the past decade: the ILO developed guidelines for a just transition in 2015; the concept has been addressed in outcomes under the United Nations Framework Convention on Climate Change, including the Paris Agreement; multilateral development banks have signed onto high-level principles guiding their engagement around just transition; and a number of countries have included just transition in their nationally determined contributions or embarked on just transition policies.[h] Meanwhile, workers in trade unions continue to be highly active in promoting just transition.[i]

Sources: a. European Commission n.d.; Jaeger et al. 2021; b. ILO 2018a, 3; c. Morena et al. 2018; d. Pinker 2020; e. CJA 2019; Indigenous Environmental Network n.d.; Morena et al. 2018; f. PCC 2022; g. Pinker 2020; h. ADB et al. 2021; Fransen et al. 2022; ILO 2015; Pinker 2020; UNFCCC 2020; i. CUT Brasil 2021; IndustriALL 2019.

Figure 2 | **Middle-Income Countries among the Most Dependent on Oil and Gas Production**



Notes: Oil and gas revenue as share of total government revenue shows 2015–2018 average oil and gas revenues as a percentage of total government revenues. Data on oil and gas revenues as share of total government revenues (based on analysis by Coffin et al. identifying 40 countries with the greatest fiscal dependence on oil and gas revenues) is not available for Argentina, Brazil, Côte d'Ivoire, Ghana, Indonesia, Mongolia, Myanmar, Tunisia, Turkmenistan, Ukraine, and Uzbekistan. Oil rents are the difference between the value of crude oil production at regional prices and total cost of production. Oil rent data is shown for 2019 and is available from the World Bank. Fuel exports include natural gas, coal, oil, and oil products. Fuel exports data is shown for 2019 and is available from the World Bank. Fuel exports data for 2019 was unavailable for Algeria, Cameroon, Equatorial Guinea, Gabon, Iran, Iraq, Papua New Guinea, Timor-Leste, and Turkmenistan.

Source: Coffin et al. 2021; World Bank n.d.a, n.d.b.

REVENUE LOSS AND IMPLICATIONS FOR NATIONAL ECONOMIES

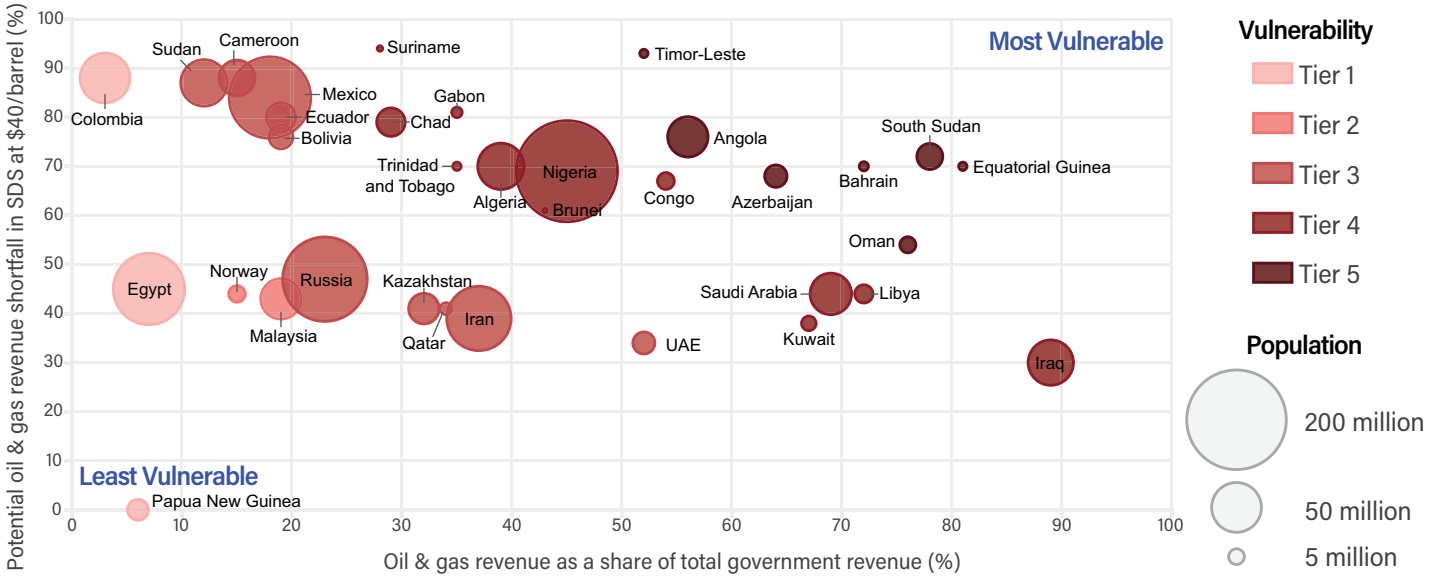
Phasing down global oil and gas production, in line with either IEA's NZE Scenario or Sustainable Development Scenario (SDS), could lead to significant revenue loss for oil- and gas-producing middle-income countries.[20] A recent analysis, comparing the business-as-usual scenario assuming a $60/barrel long-term oil price with IEA's SDS, which assumes a long-term oil price of $40/barrel, estimated an average 46 percent decline in revenues (approximately $9 trillion) between 2021 and 2040 for 40 "petrostate" countries with the greatest fiscal dependence on oil and gas revenues (as a share of total government revenues) if oil prices fall to $40/barrel (Coffin et al. 2021).[21]

The loss in revenues will not be felt equally by all countries. For instance, over the next two decades Mexico's average annual revenues are expected to drop by 84 percent and Nigeria's by 69 percent, compared to their 2015–19 revenues (Coffin et al. 2021).

Figure 3 plots countries' dependence on oil and gas revenues against their estimated revenue decline in a scenario of $40/barrel prices to illustrate each country's risk. Some 400 million people live in the 19 most vulnerable countries (Tiers 4 and 5), which include Nigeria, with a population of 206 million (Coffin et al. 2021). Emerging producers with plans to expand oil and gas production, such as Ghana, Guyana, and Mozambique, risk both the loss of potential revenue if expected new income does not materialize and stranded assets from investment in infrastructure to bring these fossil fuel resources online (Coffin et al. 2021; Dwazu et al. 2021; Muchira 2021).

As the energy transition picks up and demand for oil and gas goes down, the impact of declining oil and gas revenues will be felt widely within oil- and gas-producing middle-income countries.

Figure 3 | **Vulnerability of Oil- and Gas-Producing Countries to Declining Oil Prices**



Notes: SDS = Sustainable Development Scenario; UAE = United Arab Emirates. The estimated decline in oil and gas revenues is based on fossil fuel demand under the International Energy Agency's SDS (2021–40), which assumes a long-term oil price of $40 per barrel. Myanmar, Turkmenistan, Ukraine, Uzbekistan, Venezuela, and Yemen are not included due to lack of data. Coffin et al. (2021) organize countries according to tiers, with Tier 1 being least vulnerable and Tier 5 being most vulnerable. Vulnerability is determined by the potential total government revenue shortfall between 2021 and 2040. The more vulnerable a country is, the higher risk it would endure during a transition.

Source: Adapted from Coffin et al. 2021.

Decreased Spending on Social Programs and Public Infrastructure

The boom-and-bust nature of the oil and gas industry makes producer economies that rely on this revenue especially vulnerable to shortfalls in public spending budgets. Reduced revenues from the oil and gas sector could depress public spending on social services and infrastructure projects, such as transport and digital connectivity, with the impact likely disproportionally borne by disadvantaged groups and at the local level (UNU-INRA 2019). Most middle-income countries are already spending too little on social protection programs to provide necessary services to local communities, and current spending often fails to benefit the poorest in society or reduce inequality (ILO 2011; Lawson and Martin 2019).[22]

The 2014 oil price crash led Mexico to slash public spending (amounting to about 0.7 percent of GDP), including on education (Wilkinson 2015). The same crash led Angola and Nigeria, Africa's largest oil-producing countries, to roll back plans for key infrastructure spending, including a $5 billion electricity access program and road construction plans in Angola (Greve 2015). In 2020, Nigeria proposed 55 percent and 42 percent cuts in education and health spending, respectively, due to dwindling oil sales and the latest crash in global oil prices (Adeyeye 2020). Nigeria already underfunds its health and education sectors—4 percent and 6 percent of the 2020 federal budget was allocated to health and education, in comparison with the United Nations Educational, Scientific and Cultural Organization's recommended spending of 15 percent and 20 percent, respectively—and further cuts could worsen the country's health and education outcomes (Bakare and Fatai 2020). Countries with high levels of debt also have to balance debt repayment with much-needed spending on their residents (Jubilee Debt Campaign et al. 2020).

Decreased SNG Revenue

Loss of revenue could spill over to SNGs, affecting their ability to deliver services and pursue economic development. In many middle-income oil- and gas-producing countries, SNGs receive most of their funds as transfers from national governments (Table 2).[23] As a result, these governments are subject to the ebbs and flows of national government revenue allocations.

Countries that derive significant revenues from nonrenewable natural resources such as oil and gas have developed special formulas to distribute those revenues to SNGs (Bauer et al. 2016). In derivation-based systems, revenues are transferred back to their area of origin, with the aim of compensating producing regions for the environmental and social impacts of resource extraction. This is a common form of revenue sharing, including in Angola, Brazil, Colombia, Ecuador, Ghana, Mexico, Nigeria, and Uganda. In indicator-based systems, revenues are geographically distributed based on indicators such as population, poverty, or total revenue generation, and the focus is on greater equalization among different regions of the country (Bauer et al. 2016; NRGI 2015b). In some cases—for instance, in Ecuador, Mexico, Nigeria, and Uganda—revenue transfers are based on a combination of these approaches. In Nigeria, before the 2021 passage of the Petroleum Industry Act, 54 percent of revenues were distributed to state and local governments (Table 2). Of that, 41 percent of revenue transfers were indicator-based, where the central government transferred revenues to both producing and nonproducing regions. The remaining 13 percent were sent to regions from which the income was generated.

The manner in which oil and gas revenues are shared with SNGs impacts how SNGs experience the volatility, benefits, and downsides of the industry, with implications for the political economy of the transition away from oil and gas.

Derivation-based systems, in particular, can create equity, volatility, and public financial management challenges that SNGs are ill-equipped to handle. For instance, prior to the passage of Nigeria's Petroleum Industry Act, more federal spending was allocated to Nigeria's oil-producing regions in the South than to nonproducing regions in the North, even though the North scores lower on most human development indicators than the South (Box 2).[24] Boom times incentivize wasteful spending on projects, and busts lead to painful spending cuts at the subnational level. In Brazil, large oil royalties to municipalities led to overspending on wasteful urban infrastructure projects while there was deterioration in public service provision, including decreased access to piped water, sewage networks, and garbage collection (Bauer and Gankhuyag 2020). Finally, the derivation-based system can encourage greater resource exploitation, especially when resource-hosting regions are poor and oil and gas revenues account for a large share of subnational revenues (Bauer and Gankhuyag 2020).

Table 2 | **Distribution of Oil and Gas Revenues in Selected Countries (2014)**

			BOLIVIA (OIL AND GAS)	BRAZIL (OIL AND GAS)	COLOMBIA (OIL)	ECUADOR (OIL)	INDONESIA (OIL)	MEXICO (OIL)	NIGERIA (OIL)	PAPUA NEW GUINEA (OIL AND GAS)
REVENUE TO NATIONAL GOVERNMENT AND CENTRALIZED FUNDS			37%	31%	52%	98%	85%	83%	46%	93%
REVENUE TO SUBNATIONAL GOVERNMENTS	DERIVATION-BASED	PRODUCING REGION/STATE	28%	45%	10%	1%	3%	-	13%	3%
		PRODUCING LOCALITIES	13%	17%		1%	6%	-	-	2%
		LOCALITIES IN PRODUCING REGIONS	-	4%	-	-	6%	-	-	-
	INDICATOR-BASED	REGION/STATE	9%	-	38%	-	-	17%	23%	-
		LOCALITIES	13%	-		-	-	-	18%	-
REVENUE TO OTHERS (FOR INSTANCE, PRIVATE LANDLORDS)			-	3%	-	-	-	-	-	2%

Note: In derivation-based systems, revenues are transferred back to a subnational entity in the location where the resource was extracted. In indicator-based systems, revenues from these resources are geographically distributed to subnational entities based on indicators such as population, poverty, or total revenue generation.

Source: Adapted from Arellano-Yanguas and Mejía-Acosta 2014.

Box 2 | Nigeria's Petroleum Industry Act Promotes Oil Exploration in the Country's North

Nigeria's 2021 Petroleum Industry Act (PIA) changes both oil revenue allocations as well as the regulatory and governance frameworks of the country's oil and gas sector. It also intends to attract further investment in Nigeria's oil and gas industry and reduce conflict in oil-producing regions.[a]

Thirty percent of oil revenues collected by the Nigerian National Petroleum Corporation (NNPC) and 10 percent of rents on petroleum prospecting licenses and petroleum mining leases will be apportioned to the Frontier Exploration Fund, a new entity to pursue state-backed oil and gas exploration in Nigeria's northern inland basins.[b]

Nigeria's North lags behind the South on almost all economic and human development indicators, leading to concerns that the new law, with its emphasis on more oil exploration, may worsen the North's already precarious socioeconomic situation. These concerns are based on the experience of the relatively richer oil-producing Niger Delta in the South, which, despite being the center of oil resources, remains marginalized, poor, polluted, and has seen political instability with the emergence of armed groups since 2004.[c] Instead of potentially replicating these problems in the North, Nigeria could transfer resources from the oil sector to invest in other industries that can promote more sustainable growth and help diversify Nigeria's economy. Civil society and research organizations propose alternative uses for the 30 percent allocation to the Frontier Exploration Fund, including support for energy transition plans, economic diversification, renewable energy, environmental remediation in oil-producing regions, and social programs.[d]

Three percent of an oil and gas operator's annual expenditures will fund host community development trusts (HCDT), mandated by the PIA to be incorporated by operating companies for community development in areas of oil and gas exploitation.[e] Seventy-five percent of the HCDT funds will be allocated to infrastructure projects, 20 percent to a reserve fund for when oil and gas operations end, and 5 percent to administrative costs.[f] However, companies will determine who meets the PIA's definition of a host community, and the community will be held collectively responsible if oil and gas production is disrupted or infrastructure is damaged, with the cost of repairs subtracted from their HCTF allocation.[g] There has been pushback against the new law. Host communities advocated for higher HCTF allocations,[h] Nigeria's 36 state governors claimed the law was unconstitutional,[i] and Nigerian environmental groups criticized the PIA's exemptions and low penalties for gas flaring.[j]

Sources: a. Nwuke 2021; b. Tayo 2021; c. McBain 2022; Tayo 2021; d. Egbejule 2021; HOMEf 2021; Nwuke 2021; Pers. Comm. Felix 2021; personal communication between the authors and an engineering consultant in the Nigerian oil and gas industry, August 6, 2021; e. Federal Republic of Nigeria 2021; Deloitte n.d; f. PwC 2021a; g. Nwuke 2021; h. Erunke 2021; HOMEf 2021; McBain 2022; i. Ebolosue et al. 2021; j. HOMEf 2021.

How local economies in a derivation-based system deal with a long-term decline in revenues could become a central challenge, especially in planning for a managed transition away from oil and gas. The challenge will be exacerbated if SNGs do not have access to the full details of oil and gas revenues collected and transferred to SNGs. Currently very few national governments share the details of their revenue-sharing system, making it difficult for SNGs to budget and plan for the future and undermining trust between the national government and SNGs (Bauer 2013; Bauer and Gankhuyag 2020). Most SNGs also have less information available to them about prospects for a country's oil and gas reserves or prospective revenue flows they might receive based on project-by-project projections. This will leave them poorly equipped to handle the fiscal and economic consequences of phasing down oil and gas production.

Public Sector Job Loss

In many middle-income countries, the government employs a large share of the formal sector workforce. Argentina's and Mexico's public sectors employ roughly 17 percent and 12 percent of the formal workforce, respectively (OECD 2020). In Nigeria, more than half of salaried/wage jobs are in the public sector (World Bank 2015). Furthermore, across most of Africa, the share of government spending devoted to government employee compensation is 30–50 percent, compared with 5–15 percent in Europe (Ortiz-Ospina and Roser 2016). Declining oil and gas revenues could jeopardize the sustainability of public sector employment, especially in scenarios where the domestic workforce is relatively young and set to expand in the coming years (IMF 2016).

In the recent past, the double blow of the pandemic and the oil price shocks spurred cuts to public sector wages in some oil-exporting middle-income countries (Cornish and al-Omar 2020). In 2020, Nigeria's Kaduna state government implemented 25 percent and 50 percent pay cuts for public servants and political appointees, respectively (NAN 2020). The Nigerian federal government also initiated efforts, including a payroll review of public sector employees aimed at reducing personnel costs in response to dwindling revenues (Ajimotokan 2021).

Large employment or wage cuts of such a sizable share of the workforce would have widespread impacts on livelihoods. Public sector workers in middle-income countries, in general, receive higher wages and larger benefits than their private sector peers, which means the loss of well-paying jobs in the event of job cuts (Gindling et al. 2020). Cuts in public sector employment or wages carry implications for economic opportunities for women and other marginalized groups. The public sector is not only a large employer of women but generally pays a wage premium for them, as well as for less educated and lower-skilled workers, compared to the private sector.

Finally, the potential loss of income when the public sector lays off workers could affect the rest of the economy. This includes adverse impacts on the informal economy because wage workers represent a significant source of demand for goods and services sold by the informal sector. Informal sector employment is a main income source for 60 percent of African households (Fox and Signé 2020).

Impacts on Fossil Fuel Subsidies

Periodic market volatility and longer-term decline in oil and gas production might force governments to abruptly and inequitably cut expenditures on fossil fuel subsidies in ways that harm the most vulnerable and lowest income groups in society.

To be clear, fossil fuel subsidies—both production- and consumption based—are a drain on national budgets and undermine efforts to address climate change by increasing the use of fossil fuels (Urpelainen and George 2021). In many places, such as Ghana and Indonesia, they have been regressive and inefficient, with subsidies distorting the market and benefiting wealthier portions of society more than the poor they are supposed to help (Arze del Granado et al. 2010; Crawford 2012). Fossil fuel subsidies also limit public spending in other sectors, including health, education, and poverty alleviation programs. Mexico's proposed 2022 budget suggested spending as much as 4.8 percent of the country's GDP to support Pemex and the state-owned utility, the Federal Electricity Commission—more than the 3.5 percent proposed for education (Prud'homme 2021).

Although these subsidies hamper the shift to clean energy and need to be phased out to meet mounting climate ambition, how it is done will matter.[25] Their overly abrupt and inequitable removal could disproportionately burden low-income households and exacerbate inequality and social unrest if not carefully managed. This happened in Ecuador in October 2019 after the government announced a phaseout of gasoline and diesel subsidies. Following widespread protests, the government reintroduced the subsidies (Sanchez et al. 2020).

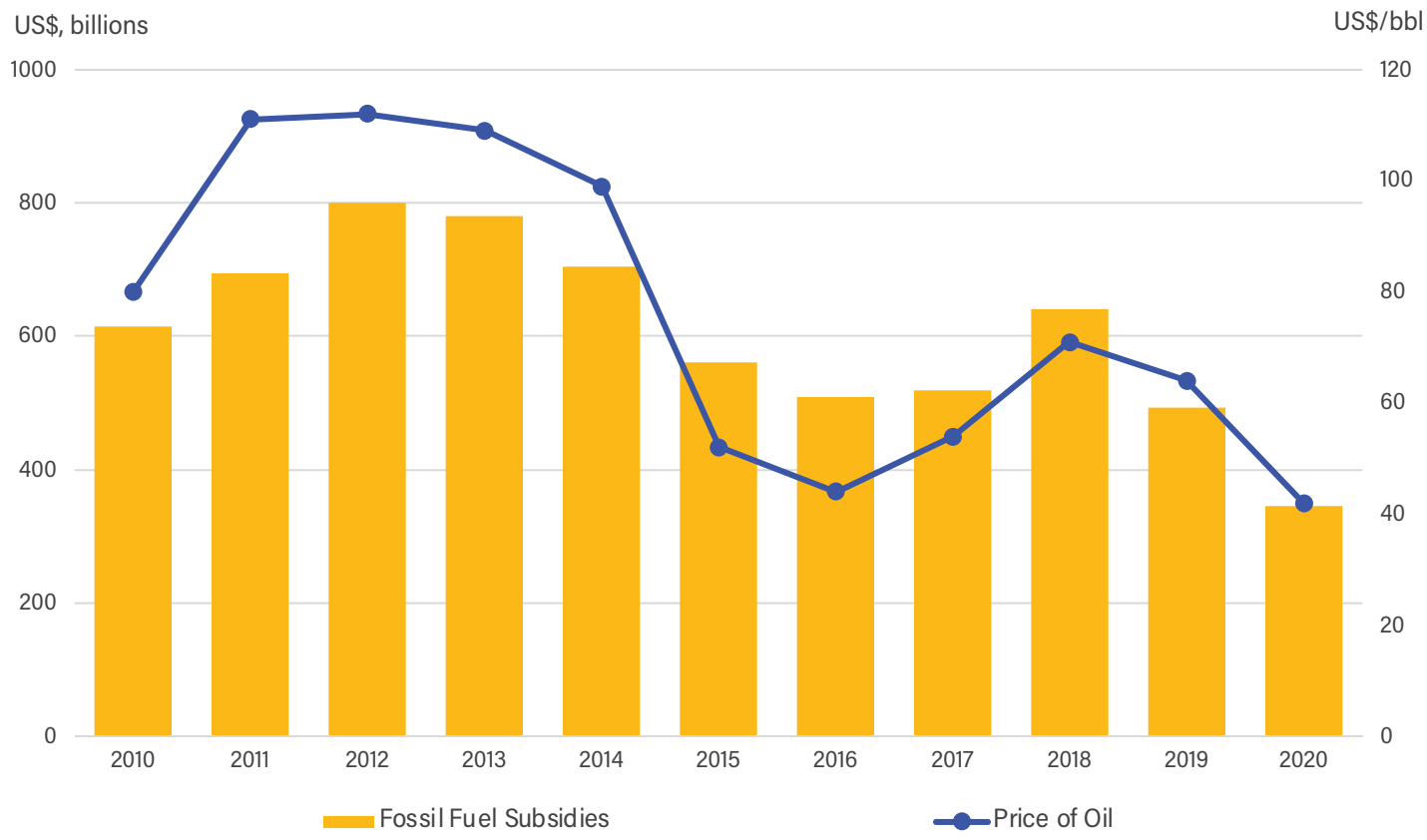
Fossil fuel subsidies are often influenced by the price of oil (Figure 4), and these fluctuations can be disruptive. In 2020, a number of countries, including Nigeria and Venezuela, cut back fuel subsidies and raised taxes on gasoline and diesel fuel because the pandemic had reduced both consumption and the price of oil (Krauss 2020). That year, fossil fuel consumption subsidies dropped to a record low of $180 billion, down by

40 percent compared to 2019 (IEA n.d.a). Rapid declines in subsidies can disproportionately harm those with lower incomes given that the subsidy removed will be a larger proportion of their income (Coady et al. 2015).

On the other hand, events such as the war in Ukraine will likely prompt governments to raise subsidies to shield consumers from high fuel costs (Browning and Kelly 2022). This can result in decreased government revenue available to spend on other public purposes. Nigeria, for example, increased spending on gasoline consumption subsidies in 2022 to offset high global oil prices driven by the Ukraine war. The increased spending—from $5.0 million in January 2022 to $7.8 million in May 2022—meant the NNPC failed to make any deposits into Nigeria's Federation Account, which allocates revenue to Nigeria's federal, state, and local governments for spending (Nnodim 2022). There is also a risk of countries increasing production-based subsidies to diversify supply away from Russia. Over the long term, however, as oil and gas revenues shrink, governments may not have much option but to phase down or eliminate fossil fuel subsidies.

A well-managed and careful phaseout of fossil fuel subsidies can benefit oil- and gas-producing middle-income countries by freeing up funds to provide necessary social services and strengthen social safety nets, invest in local economic development and diversification, and support the policies, programs, and infrastructure necessary to enable a just transition away from oil and gas (Gass and Echeverria 2017).

Figure 4 | **Fluctuation in Fossil Fuel Subsidies Influenced by Price of Oil**



Notes: bbl = barrel of crude oil. The above graph shows government spending on fossil fuel (including coal, electricity, natural gas, and petroleum) subsidies for 52 countries, including 18 Group of Twenty members and 42 emerging economies. Data on fossil fuel subsidies are from OECD and IEA (2021). Data on price of oil are from Statista (Sonnichsen 2022a) and shows average annual Brent crude oil price.

Sources: OECD and IEA 2021; Sonnichsen 2022a.

ENERGY TRANSITION IMPLICATIONS FOR WORKERS SUPPORTED BY OIL AND GAS

It is difficult to estimate the total number of people working in the oil and gas sector across countries. The International Labour Organization (ILO) estimates that globally 6 million people were directly employed by the oil and gas industry, and indirect employment in the industry's supply chain supported an estimated 60 million people (ILO n.d.). The IEA estimates global direct and indirect labor forces of fuel supply in 2019's oil and gas sectors to be 8 and 3.9 million, respectively (IEA 2022a). There is also a rapid increase in the pace of automation and use of digital technology across the whole value chain of the industry—exploration, production, and supply chain—that is creating downward pressure on employment.[26]

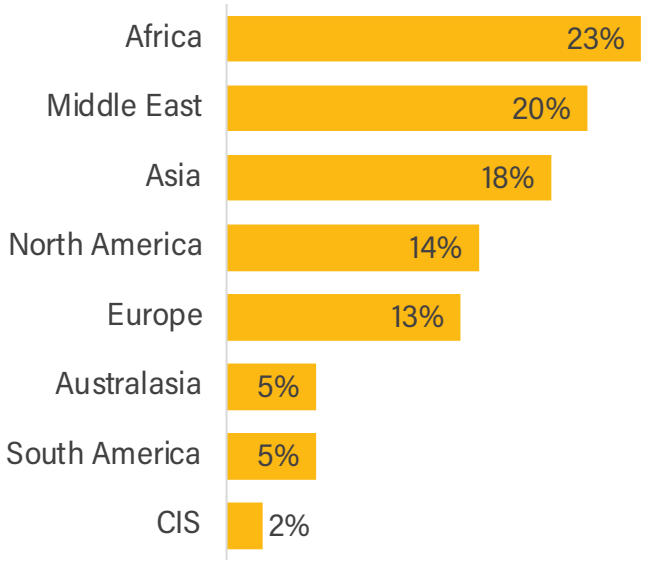
Many middle-income countries do not provide national employment data for oil and gas production.[27] Public data on employment in the oil and gas industry, if available, is often subsumed within data for mining and industry or does not capture informal workers and those supported indirectly by the oil and gas industry. Industry survey data (Figure 5) indicate the majority of oil and gas workers in direct employment are located in Africa (23 percent), the Middle East (20 percent), and Asia (18 percent) (Airswift and Energy Jobline 2022).[28] Given existing data limitations, it is difficult to say how many workers directly and indirectly supported by the oil and gas industry in middle-income countries will be impacted by the energy transition, but that number is not insignificant.

Impact on Employment of Phasing Out Oil and Gas

Employment in the oil and gas industry is strongly correlated with oil prices. Past price crashes have led to severe job cuts in the industry. COVID-19 caused oil demand and prices to drop dramatically and forced the industry to shed thousands of jobs. In 2020, nearly one in three workers worldwide in the industry faced pay cuts (Sharafedin 2021). Conversely, higher prices can create jobs because it becomes economically viable for companies to exploit higher-priced oil and gas deposits.[29]

In addition to employment impacts due to the industry's cyclical volatility, workers also face long-term implications from the energy transition. Although the low-carbon transition will lead to an overall increase in energy-related jobs, recent studies provide hints of the potential job losses in the entire fossil fuel sector (IEA 2021d; IRENA 2018; Pai et al. 2021). According to analysis by Pai et al. (2021), jobs in the energy sector as a whole would grow from a current 18 million to 26 million by 2050 if action is taken to keep global warming to well below 2°C. Renewable energy jobs would increase from 4.6 million to 22.0 million, and fossil fuel jobs globally would decline from 12.6 million to 3.1 million. Job loss would be especially concentrated in coal, oil, and gas extraction, which employs 9.2 million workers. The trajectory of energy jobs under stronger climate policies will vary significantly between different regions and countries.[30]

Figure 5 | **Distribution of Oil and Gas Workers across Regions**

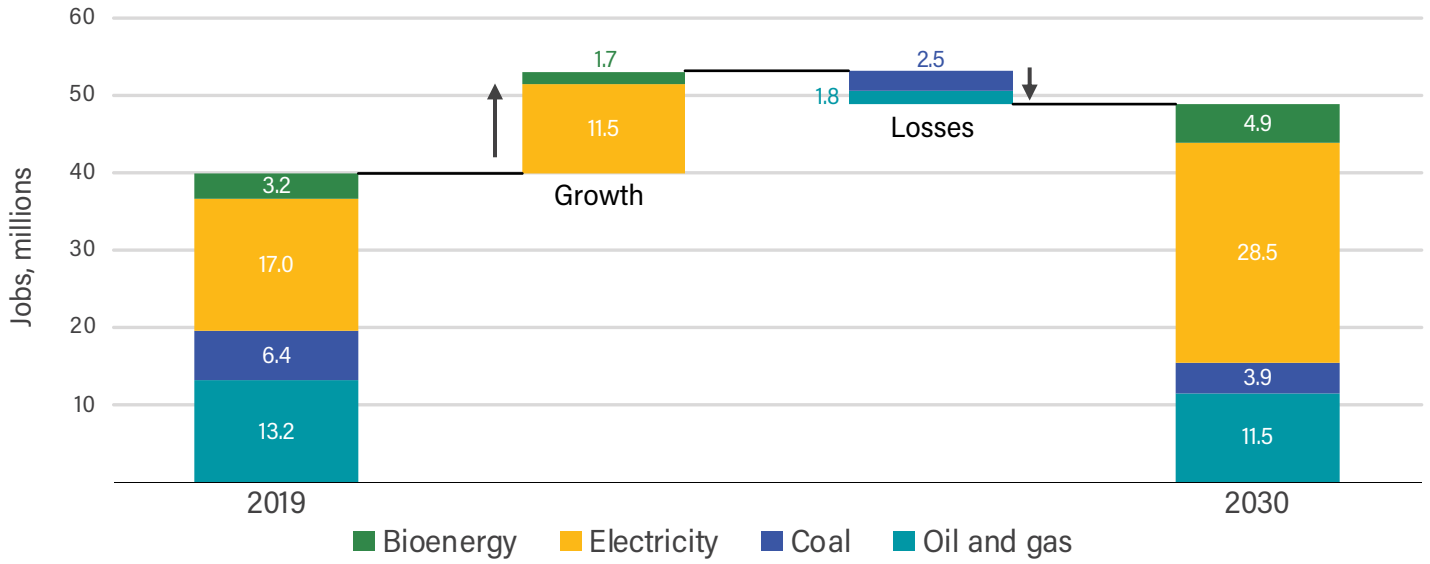


Note: CIS = Commonwealth of Independent States.
Source: Airswift and Energy Jobline 2022.

Other studies have reached similar conclusions about job loss in fossil fuels (IEA 2021d; IRENA 2018; NCE 2018). IEA's NZE Scenario, for instance, forecasts an increase in clean energy employment by 14 million by 2030, but employment in oil and gas is projected to decline by 1.7 million (IEA 2021d; Figure 6).

A wide range of analyses conclude that, in most cases, disappearing fossil fuel jobs will be offset by rising employment in the clean energy economy, but even countries with net job gains will not necessarily be adding new jobs in the same regions where fossil fuel jobs are lost. This will lead to geographic inequity in the costs and benefits of the energy transition. Even if new jobs emerge in the same regions where old ones vanish, it will take effort to upskill, reskill, and adapt the transferrable skills from oil and gas to new jobs in the clean energy economy.

Figure 6 | **Global Employment in the Energy Sector in IEA's Net Zero Emissions Scenario, 2019 and 2030 Comparison**



Note: The IEA's 2020 Sustainable Recovery report (IEA 2020b) provides further detail on global direct employment within the energy sector. As of 2019, an estimated 40 million people total were directly employed in the sector, including in: Bioenergy (production, transport, and distribution); Electricity (generation and networks); Coal (production, transport, and distribution); Oil and gas (production, transport, and distribution).

Source: IEA 2021d.

Just Transition Implications Arising from Employment Characteristics of Workers Supported by Oil and Gas

There is enormous heterogeneity within the oil and gas workforce and among the type, quality, and characteristics of the skills needed by workers (ILO n.d.). Some of this diversity is due to varying job needs in each phase of the industrial process as well as different locations for specific extraction methods. Technological advancements in recent decades have shifted the location and nature of many oil and gas jobs: a rise in offshore drilling has created jobs on remote rigs, where work schedules often consist of several weeks on and off (Greenpeace 2020; Jensen and Laursen 2014), and fracking and horizontal drilling have grown the industry in places where extraction had previously been uneconomical.

Circumstances and conditions for workers differ across countries and are often more closely related to a country's labor standards and economic context than to the oil and gas industry in particular. This is especially true of wages, social protections, safety standards, and to some extent unionization levels. Therefore, in many cases, a major factor in the quality of an oil or gas job is the state of workers' rights in the country.

However, despite the critical role of country-specific contexts for workers, we have identified a set of five key characteristics of employment in the oil and gas industry that are relevant across a number of countries. These characteristics should be carefully considered during just transition planning to support workers displaced by the industry.

- **Extractive industries, including oil and gas production, do not create many direct jobs, but they generate large numbers of indirect and induced jobs that will need to be considered in just transition planning.**

Most of the direct jobs are created during the development phase—constructing and installing drilling rigs—which is more labor intensive (Pegram et al. 2018; UNCTAD 2015). Once the oil and gas fields begin operations, they generate little direct employment. In Nigeria, the oil and gas industry was estimated to directly employ roughly 19,820 workers in 2018, accounting for 0.03 percent of the country's labor force (NEITI 2019). Approximately 5,600 workers were estimated to be working in Ghana's oil and gas sector in 2015, whereas the total labor force

was estimated to be at 12.5 million (Cooper 2019). Mexico's Pemex employed 125,735 workers in 2020, accounting for 0.3 percent of the labor force (WBA 2021; World Bank 2022a). Nationally, therefore, the oil and gas industry is not a major direct employer in its own right.

However, when indirect jobs (in the supply chain of the oil and gas industry) and induced jobs (in other goods and services purchased by those employed in the industry) are considered, the total employment impact can be significant. A number of African countries have adopted local content policies requiring or encouraging multinational companies to hire local workers and purchase goods and services from domestic companies as a way to stimulate broad-based economic development (Kinyondo and Villanger 2016; Ovadia 2016). Though these policies have often achieved mixed results, the large number of inputs required for oil and gas exploration and production offers numerous avenues of generating indirect and induced jobs (Ackah and Mohammed 2018; Ovadia 2014).

Moreover, the oil and gas industry also tends to be concentrated in specific regions, such as the Niger Delta in Nigeria and the states of Tabasco and Veracruz in Mexico, or even in specific cities, such as Luanda in Angola and Sekondi-Takoradi in Ghana (WECP n.d.a, n.d.b). Even if the number of direct jobs lost in these communities is small, it will have knock-on effects on the broader local economy supported by the oil and gas industry, underscoring the importance of enabling a just transition for oil and gas communities, including place-based economic development to support other employment opportunities.

- **Workers who are unionized may receive more attention and support in navigating the transition, but unionization rates in the oil and gas industry vary by region and job type (ITUC 2019a).**

Countries with more mature oil and gas industries, such as Argentina, Mexico, and Nigeria, tend to have higher levels of unionization in the industry than emerging producers. Argentina's largest oil union, the Sindicato de Petróleo y Gas Privado de Río Negro, Neuquén y La Pampa, represents 24,000 workers (Raszewski 2022). Even in countries where the oil and gas industry is mature, unionization rates can vary. In Mexico, Pemex employees are unionized, but employees of IOCs operating in Mexico are primarily nonunionized contract workers. Although most direct jobs in Nigeria were once permanent and standard, the past few decades have seen IOCs operating in the country shift toward nonstandard and temporary jobs (Aye 2017). As a result, Nigeria's two well-established oil and gas unions have faced challenges in representing the country's many contract workers (Aye 2017; Pers. Comm. Olawale 2021).[31] Since contract workers have short-term employment contracts, they often do not feel the need to belong to a union (Ajonbadi 2015).[32]

The level of unionization for a country's oil and gas workforce is highly correlated with job quality and wages. Union membership leads to higher wages, job security, and better benefits. A permanent junior worker belonging to Nigeria's National Union of Petroleum and Natural Gas Workers (NUPENG), which organizes blue-collar workers, earns a monthly average of $490, whereas a contract worker earns between $140 and $225 (Houeland 2015). If the oil and gas industry shifts more toward hiring contract workers, unions could have more trouble organizing and effectively fighting for their members' working conditions.

Unionized workers may be in a better position to demand protection, retraining, or income support during a transition away from fossil fuels, but there are concerns about how some unions might approach just transition discussions (Kalt 2022). The role that they will play in enabling—or resisting—a just transition will be highly consequential. Some have been open to the low-carbon transition, but it may be difficult for unions representing oil and gas workers to advocate moving away from industries with relatively well-paid jobs and benefits. Moreover, with some companies in the emerging clean energy industry generating precarious employment, unions are concerned about transitioning from high-quality fossil fuel jobs to lower-quality jobs (Carmona 2019; Castro 2020). Attempts to prioritize just transition by governments and other stakeholders can become more complicated where unions play a significant role politically—such as with the Sindicato de Trabajadores Petroleros de la República Mexicana (STPRM), the Mexican oil workers' union, which is politically important and also sits on Pemex's governing board (Abad and Maurer 2018; Huizar 2015).[33]

However, some unions are taking proactive steps to explore what transitioning could mean for their workers. In 2017, the Nigeria Labour Congress and Environmental Rights Action–Friends of the Earth Nigeria began to explore what a just transition could look like for petroleum and agricultural workers (Ojo and Mustapha 2019).[34] Collaboration across different groups, such as civil society and unions, will be key for advocating for just transition efforts, building social acceptance across multiple groups in society, and planning for processes and outcomes that are just (TNI 2020).

- **The oil and gas industry in middle-income countries is characterized by a high proportion of contract workers, with precarious employment conditions and the potential to be left out of just transition discussions.**

The term *contract workers* describes a wide range of employment relationships in the industry.[35] It includes short-term or part-time workers with a direct contract, day laborers, informal workers, and workers in employment relationships with a contractor to an oil and gas company (I. Graham 2010).

The precise number of contract workers in the industry is not known but is growing faster than in other industries. This stems, in large part, from employers' efforts to operate flexibly given the sector's boom-and-bust cycles (Dickson et al. 2020). This incentivizes hiring contract workers who can be employed when needed but let go when demand slackens. They are, therefore, vulnerable to job cuts when the industry is not doing well. These cycles have been accentuated in recent decades with the shift toward nontraditional sources such as shale oil and gas because fracked wells produce for shorter periods of time. According to the 2022 Global Energy Talent Index survey of workers in the oil and gas industry, 33 percent identified themselves as contractors, 41 percent identified as permanent staff, and 26 percent were unemployed (Airswift and Energy Jobline 2022).[36]

Contract workers in middle-income countries may have fewer workplace protections than those hired as employees. Unions in Nigeria report increased casualization of the oil and gas workforce, resulting in different treatment of permanent and contract workers, who receive fewer opportunities for training, lower wages, and no benefits (Fapohunda 2012; IndustriALL 2018; Pers. Comm. Olawale 2021).[37]

The shift toward more precarious employment points to challenges for transition planning. Reliance on contract workers could grow as the energy transition progresses and work becomes less predictable. They are less likely to have long-term job security or to be represented by unions, and they are potentially more likely to be excluded from just transition discussions, including around issues such as retraining. Ignoring the needs and voices of significantly large numbers of contract workers will make the energy transition inherently unjust.

- **Oil and gas jobs pay high wages, and it will be a challenge to replace them with similarly well-paid jobs.**

Oil and gas wages typically are above the local average for jobs requiring comparable skills and education. High wages perhaps reflect the dangerous or short-term nature of the work or the industry's historically high profits (Airswift and Energy Jobline 2020; Dickson et al. 2020). As of 2010, NOCs outside the Organisation for Economic Co-operation and Development generally pegged wages for their permanent staff at 25–50 percent above the average national wage (I. Graham 2010). The highest-paid jobs tend to be in engineering and management, with administrators and accountants among the lower-paid roles (Airswift and Energy Jobline 2022). In Latin America, for example, a salaried administrator might earn $17,400 per year, or $131 per day on a contract basis, which compares extremely favorably to Mexico's 2018 median annual household income of approximately $4,500 (Airswift and Energy Jobline 2022; OECD 2021a). Notably, even within the same region, the same job roles are performed by both permanent and contract workers. Appendix B shows the compensation by job role, employment status, and region for a selection of jobs and regions.

As the oil and gas industry shrinks in the coming decades, relatively well-paying jobs in middle-income countries will be lost, threatening the livelihoods of thousands and impacting the local economies. It will be important to determine what substitute industries in erstwhile oil and gas regions are attractive to former workers in terms of wages, job security, and other elements of job quality in just transition discussions.[38]

- **Despite women's low participation rates in the direct oil and gas workforce, they are likely to be significantly impacted by the industry's decline.**

Globally, women make up just 22 percent of the oil and gas workforce, compared with 32 percent in renewable energy (IRENA 2019). In Nigeria, women only account for 15 percent of the oil and gas workforce, and mostly in administrative, public relations, medical, and legal positions (Aye 2017). The underrepresentation of women is more acute in NOCs than in IOCs (Rick et al. 2017).

However, women often make up a large share of workers whose jobs depend on the industry. These induced or indirect jobs—in industries such as public service, retail, education, or food service—would be vulnerable to the wider economic effects of the industry's decline. Women's caregiving roles would also be affected. For instance, despite the environmental and health risks of oil and gas flaring events, women in some oil- and gas-producing communities who cannot afford cooking gas rely on the heat from gas flares for cooking (Adams 2021).

High salaries in the oil and gas industry mean that spouses, children, or elderly relatives often depend on the income of a male household member. Losing this income may force younger or female household members to enter the workforce, increase their working hours, or leave the paid workforce to provide household labor (especially childcare) that had been outsourced before. As a result, discussions around just transition and economic diversification should focus on strategies that can benefit women, improve working conditions in female-dominated sectors,

restructure local employment opportunities to promote gender equity, and ensure a fairer distribution of care work within family and society (ADB et al. 2021; Dhir 2017; Walk et al. 2021).

KEY CONSIDERATIONS FOR POLICYMAKERS TO ENABLE A JUST TRANSITION AWAY FROM OIL AND GAS

Strategies to bring about a just transition may take years or sometimes even decades to bear fruit, so it would be prudent for policymakers to envision a future where the industry contracts significantly and plan for it now. The literature on just transition for fossil fuel workers and local communities identifies a number of elements that policymakers should consider, including proactive planning that incorporates social dialogue and stakeholder engagement (ADB et al. 2021; Galgóczi 2018; Gerasimchuk et al. 2021; ILO 2015; Pai et al. 2020; UNFCCC 2020). Although that literature focuses particularly on coal workers and communities, and on high-income rather than middle-income countries, key insights and recommendations apply to oil and gas workers and communities as well.[39]

This section will discuss important considerations for policymakers to keep in mind as they begin planning for a transition away from oil and gas.

Pursuing Economic Diversification

Middle-income oil- and gas-dependent countries can benefit now and in the future by diversifying their economies to include new economic sectors such as manufacturing, clean energy, and agricultural processing. However, there is no silver bullet for achieving economic diversification; it is a complex process and can take years to materialize (Lahn and Bradley 2016). Middle-income countries with heavy dependence on oil and gas will need to determine which path to take to achieve such a goal and what changes to implement in their business, education, legal, and other social systems to support economic diversification. In many cases, countries might explore whether and how they could use revenues from the oil and gas sector to fund efforts to diversify into new sectors.

Growing the clean energy industries, especially renewable energy, will offer significant economic and employment opportunities for these countries, though it will be essential to understand whether these industries could grow in the same areas in which fossil fuels are declining. An important question is whether and how much NOCs can lean into the energy transition and help support the building of a clean energy economy.

Environmental remediation can also offer near-term job opportunities to workers and communities in transition while also restoring polluted sites to economic use, which could further aid diversification efforts.

Developing Proactive, Long-Term, and Place-Based Planning

National and subnational policymakers in oil- and gas-producing middle-income countries should engage in proactive transition planning to address the impacts of the low-carbon transition on oil and gas industry workers and local communities. Experience has shown that coming late to this planning process leaves communities vulnerable to economic shifts.[40] Moreover, an emphasis on place-based planning offers the potential to support a tailored approach to the social, political, economic, and environmental contexts of particular regions. However, undertaking effective transition planning is easier said than done. There are several considerations in front of policymakers, including the following:

- **Understanding the scale and scope of the problem.** More nuanced understanding is needed about which regions in a country are most vulnerable to contraction in the oil and gas industry and about the workforce and community-level impacts of the transition. Additional data on workforce demographics, skills gaps, and hiring needs and analysis of the distributional impacts of the transition can help governments better design programs for workforce development.
- **Incorporating social dialogue and stakeholder engagement.** It is crucial to ensure an inclusive and transparent planning process that incorporates local communities' perspectives and empowers them with resources to drive their own economic transitions. This is especially important in communities where the oil and gas industry may employ few direct workers but can still have a disproportionate impact on the broader community through indirect and induced employment. The high number of contract workers will also necessitate new approaches to just transition planning and will require addressing issues such as how to meaningfully incorporate the voices of contract workers in future planning discussions. Opportunities for collective bargaining should also be explored as a mechanism to increase worker power and to provide them with support (i.e., retraining support) to navigate the transition. Finally, power imbalances between different stakeholders can undermine the effectiveness of just transition planning and will require careful consideration of strategies that can promote equal participation, knowledge sharing, consensus building, and decision-making between groups.

- **Strengthening social safety nets and providing transition assistance to workers and communities.** Many middle-income countries do not have robust social safety nets, which can make it hard for them to respond to the fallout from the energy transition. Strengthening the social safety net for both formal and contract or informal workers by making the necessary investments in programs that provide employment insurance, childcare and health care for families, and poverty reduction services could be essential for ensuring that vulnerable workers and communities are able to survive periods of economic downturns (C. Graham 1997; Higdon and Robertson 2020).

  Furthermore, governments will need to consider how they can provide transition assistance to workers dislocated by the transition (including contract workers), which could take the form of support for workforce training to transition workers to another industry, early retirement for older workers, and funding or assistance for relocation. There could be opportunities to deploy dislocated oil and gas workers for environmental remediation work as well as to employ them, with additional training, in the emerging clean energy economy, including in offshore wind, bioenergy, geothermal, and green hydrogen fuel (Cozzi and Motherway 2021; Raimi 2020).[41] Most importantly, decisions about government retraining programs and whether to place workers in the clean energy industry or in a totally different industry should align with current employer demand and the job requirements of emerging employment opportunities in each region to ensure successful outcomes.

Creating Robust Funding Mechanisms to Finance the Transition

To be effective, just transition planning will need to incorporate both short-term (e.g., replacing lost revenue) and long-term support (e.g., training programs and economic diversification) for workers and communities. All this can only happen with dedicated funding that provides the certainty and predictability to support just transition plans that are put in place to guide spending and investment (Cha et al. 2019; Gerasimchuk et al. 2021; Zinecker et al. 2018). Although domestic sources of finance will be important, it is essential that international support be provided to support countries' efforts to transition. Policymakers face at least three key considerations:

- **Equipping SNGs to deal with revenue loss.** The loss of revenues as the oil and gas industry contracts could devastate local communities that depend on the industry. The ability of communities to compensate for the loss of revenues until new industries and employers take their place will likely vary considerably. National governments, therefore, will need to help affected communities and SNGs address the challenges of the transition. National governments can help SNGs plan ahead by incentivizing or mandating better subnational financial management of revenues and encouraging SNGs to invest these revenues during good times in building human, social, and physical capital to support the region's economic diversification (Bauer and Gankhuyag 2020; Bauer et al. 2016). International support will also be critically important to enable SNGs to address any revenue gaps they face, especially given the potential implications for health care, education, and social services.
- **Identifying domestic sources of funding.** Potential sources of funds—both to replace lost revenue and to support communities and workers—can come from earmarking or placing special taxes on fossil fuel extraction, reforming fossil fuel subsidies and reallocating their benefits, using income from sovereign wealth funds, or requiring the oil and gas industry to cover the cost of support for workers' and communities' transition and/or environmental remediation of polluted lands. In particular, IOCs that have operated in middle-income countries for years and have reaped the benefits of oil and gas extraction could also be expected to provide financial support for the transition. Furthermore, funding mechanisms should be closely tied to just transition plans, with the latter guiding spending and investment. Fiscal reform, more progressive taxation, and economic diversification might also provide revenues for governments that can be deployed for the transition.

  Policymakers will need to carefully consider the trade-offs for each. Fossil fuel subsidy reform and fuel taxation, for instance, can be effective tools to generate revenue to fund just transition mechanisms, better target social programs, and strengthen social safety nets (Gass and Echeverria 2017; Gençsü et al. 2022). However, care must be taken that such reforms and taxes are well designed, carefully managed, and well communicated to ensure that vulnerable groups are not unduly harmed and can still access energy (Geddes et al. 2020; Sanchez et al. 2020; WRI 2021a).

- **Leveraging international support.** At the global level, an energy transition that is equitable among countries will depend on those countries and institutions with greater resources supporting efforts in middle-income countries, especially those with low GDP per capita and high oil and gas shares of government revenue (Edmond 2022; IEA 2021a; Muttitt and Kartha 2020). Wealthy country governments and international institutions, including multilateral

development banks (MDBs), will have to step up to assist middle-income countries in addressing challenges involving government revenues, worker and community transitions, and economic diversification.[42] If scaled up and with appropriate accountability mechanisms, sustainable investment funds from private global investors could also provide an additional source of external revenue for countries seeking financial support for just transition efforts (Natalucci et al. 2021).[43] It may also be necessary to provide international support to middle-income countries that have recently discovered but not yet exploited oil and gas reserves; such support could enable them to pursue economic diversification strategies, including investing in clean energy, and resist economic pressure to produce oil and gas.

CONCLUSION

Although a decline in the oil and gas production sector will not happen overnight, it is nonetheless clear that the sector faces a challenging future. Oil and gas markets will likely continue to be volatile. And as technology for cleaner energy and transport advances, and worries about climate change mount, demand for oil and gas will slow over time.

Middle-income countries that depend on oil and gas revenues are likely to face the greatest challenges from this shift away from fossil fuels. A failure to proactively manage this transition will bring huge risks—to countries and local governments, communities, and workers.

It may be tempting to delay this planning, especially at moments when oil and gas prices are temporarily high. But the more that is done today—to build more diverse economies, to design support for workers and communities, and to develop broader sources of revenue—the less wrenching and costly and the more responsive to a country's critical needs the transition will be.

National and subnational governments and other key stakeholders in middle-income countries, including NOCs, must play a key role in driving a just transition. But the international community, particularly richer countries, must also lend support. It is in the world's interest to ensure that an inequitable energy transition in oil- and gas-producing middle-income countries does not jeopardize development and stability in those nations. Furthermore, failure to provide resources to these countries will make it difficult to reach the shared goal of global net-zero economies by 2050. IOCs that have been reaping the benefits of oil and gas extraction should also help finance this transition, clean up the sites polluted by their operations, and remediate the environmental damage they often leave behind.

The policies and financing that will be necessary for a just transition may not come easily, but without them many middle-income countries that depend on the oil and gas industry will find their economies, their governments, and their communities and workers at the whim of a shifting energy terrain. With a proactive and forward-looking approach, however, these countries can build stronger economies that will leave no one behind.

APPENDIX A: RESEARCH CONSULTATIONS

The authors consulted with the following experts:

- Professor Kenneth Amaeshi, Chair in Sustainable Finance and Governance, School of Transnational Governance, European University Institute
- Dr. Felix Amieyeofori, MD/CEO Entek Integrated Resources Limited
- Mervin Azeta, SLB, USA
- Juan Carlos Belausteguigoitia Rius, Director, Centro ITAM Energía y Recursos Naturales, Instituto Tecnológico Autónomo de México (ITAM)
- Professor Gabriel Blanco, Centro de Tecnologías Ambientales y Energía, Facultad de Ingeniería, Universidad Nacional del Centro, Argentina
- Mauro Fernández, Founder & President of Sociedad y Naturaleza, Senior Atlantic Fellow for Social and Economic Equity at the London School of Economics and Political Science, Independent Consultant
- Philip Gass, International Institute for Sustainable Development
- Olumide Idowu, Executive Director, International Climate Change Development Initiative
- Eugene Itua, Natural Eco Capital
- Marco Jano Ito, Centro Mario Molina
- Antonia Juhasz, oil and energy analyst
- Eric Ling, Vivid Economics
- Enrique Maurtua Konstantinidis, Senior Consultant on Climate Change Policy
- Huzi I. Mshelia, Director, Clean Energy Consult, Abuja
- Hauwa Mustapha, Focal Point, Climate Change Program, Nigeria Labour Congress
- Greg Muttit, International Institute for Sustainable Development
- Chigozie Nweke-Eze, Founder, Integrated Africa Power (IAP) Ltd.
- Pedi Obani, University of Bradford
- Osemhen Okenyi
- Chukwumerije Okerere, Director of the Centre for Climate Change and Development at Alex Ekwueme Federal University Ndufu-Alike Nigeria and a World Resources Institute (WRI) consultant specializing in Nigeria
- Comrade Afolabi Olawale, General Secretary of the Nigeria Union of Petroleum and Natural Gas Workers, affiliate of Nigeria Labour Congress and IndustriALL Global Union
- Rosario Osobase, Managing Director, Tenaris Nigeria
- Dr. Richard Victor Osu, Energy Transition and Climate Consultant
- Oladunni Owo, CEO / Principal Consultant, Blackgold Energy Authorities & Advisory, Nigeria
- Sandeep Pai, Center for Strategic and International Studies
- Daniel Raimi, Resources for the Future

In addition to the individuals above, the authors also consulted other stakeholders from Argentina and Nigeria from a cross section of society, including representatives from government, nongovernmental organizations, members of civil society and unions, and the private sector.

All research consultations were conducted virtually between February and September 2021.

APPENDIX B: COMPARISON OF COMPENSATION FOR WORKERS ACROSS AFRICA, LATIN AMERICA, AND ASIA

	AFRICA		LATIN AMERICA		ASIA	
	PERMANENT (US$/YEAR)	CONTRACT (US$/DAY)	PERMANENT (US$/YEAR)	CONTRACT (US$/DAY)	PERMANENT (US$/YEAR)	CONTRACT (US$/DAY)
Accountant	42,921	392	30,500	206	35,662	291
Administrator	20,958	140	17,400	131	18,908	131
Chemical engineer	75,810	554	35,100	256	50,696	387
Civil engineer	50,776	511	43,200	256	44,482	336
Commissioning engineer	82,826	770	25,000	345	69,612	511
Construction engineer	74,443	715	46,800	327	62,352	471
Construction manager	84,265	899	59,700	414	75,518	583
Contracts manager	54,559	700	46,900	377	42,518	384
Drilling engineer	74,636	880	70,000	510	68,589	616
Drilling supervisor	124,927	1,232	105,800	842	103,897	886
Electrical engineer	70,026	714	54,6000	385	57,011	476
Finance manager	71,678	680	58,100	437	59,250	455
Geophysicist	78,999	1,088	60,400	425	63,043	488
Health, safety, and environmental manager	71,192	690	45,100	343	60,291	504
Inspection engineer	75,779	687	63,300	389	68,839	490
Instrumentation engineer	80,769	756	58,500	403	53,244	403
Maintenance engineer	71,537	729	52,000	297	56,753	415
Mechanical engineer	63,478	634	52,900	372	49,415	371
Process engineer	80,899	816	58,000	378	66,198	482
Production engineer	68,703	623	57,700	432	52,498	386
Project engineer	76,811	721	50,900	334	65,053	482
Project manager	77,769	817	56,400	381	66,800	497
QA/QC inspector	63,652	647	46,759	292	56,282	428
Reservoir engineer	88,075	817	62,800	438	81,663	544
Welding engineer	61,786	816	39,650	261	40,477	279

Notes: QA/QC = quality assurance/quality control. All figures are in 2022$.

Source: Airswift and Energy Jobline 2022.

ABBREVIATIONS

APS	Announced Pledges Scenario
bcm	billion cubic meters
CIS	Commonwealth of Independent States
D-NOC	domestic national oil company
GDP	gross domestic product
GNI	gross national income
HCTF	host community trust fund
IEA	International Energy Agency
ILO	International Labour Organization
I-NOC	international national oil company
IOC	international oil company
JETP	Just Energy Transition Partnership
mb/d	million barrels per day
MDB	multilateral development bank
NLC	Nigeria Labour Congress
NNPC	Nigerian National Petroleum Corporation
NOC	national oil company
NUPENG	National Union of Petroleum and Natural Gas Workers
NZE	Net Zero Emissions by 2050 Scenario
Pemex	Petróleos Mexicanos (Mexican Petroleum)
PENGASSAN	Petroleum and Natural Gas Senior Staff Association of Nigeria
PIA	Petroleum Industry Act
QA/QC	quality assurance/quality control
SDS	Sustainable Development Scenario
SNG	subnational government
STEPS	Stated Policies Scenario
STPRM	Sindicato de Trabajadores Petroleros de la República Mexicana
YPF	Yacimientos Petrolíferos Fiscales (Fiscal Oilfield Deposits)

ENDNOTES

1 Going further, 11 national and subnational governments have pledged to move away from oil and gas. They have formed the Beyond Oil and Gas Alliance and have committed to ending new licenses for oil and gas extraction and phasing out production in coming years. For more details, see https://beyondoilandgasalliance.com/.

2 The oil and gas sector is highly vulnerable to market volatility, affecting producing countries' export and government budget revenues. Wars, economic recessions, and pandemics have impacted commodity markets for decades. The COVID-19 pandemic caused a sharp drop in oil prices in 2020. Two years later, Russia's invasion of Ukraine sent oil and gas prices to all-time highs. Although price increases may provide a temporary boost to some producing countries, they will also have implications for long-term demand by accelerating the shift to alternative sources of energy in many consuming countries.

3 NOCs are estimated to supply 65 percent of worldwide oil by 2050. As a result, they will likely play a significant role in shaping the future of the industry in their respective countries as well as in potential just transition discussions (Adams-Heard et al. 2021).

4 Though NOCs do not face the same pressure as IOCs, society at large and international markets still pressure them to reduce emissions and production. IOCs and NOCs respond differently to these different pressures, but both have started reporting on their sustainability goals and efforts to address climate change. However, no standard reporting framework exists, so it is difficult to track a company's actions; investors have criticized this process and called for increasing transparency (Hallez 2022; Palacios 2021; PwC 2021b; Viscidi et al. 2020).

5 As defined by the World Bank, "lower middle-income economies are those with a GNI per capita between $1,086 and $4,255; upper middle-income economies are those with a GNI per capita between $4,256 and $13,205" (World Bank 2022b). Based on this definition, this paper focuses on countries with a GNI per capita between US$1,086 and $13,205, referred to as middle-income countries.

6 IEA's World Energy Outlook uses a scenario approach to explore future energy trends. The NZE Scenario assumes an emissions trajectory consistent with limiting global temperature rise to 1.5°C. Three additional scenarios are modeled: the Sustainable Development Scenario (SDS), the Announced Pledges Scenario (APS), and the Stated Policies Scenario (STEPS). SDS maps out a pathway consistent with the "well below 2°C" goal of the Paris Agreement. APS and STEPS examine current policies and targets and estimate where they lead based on model representations of energy systems, including market dynamics and technological progress (IEA n.d.b).

7 IEA's World Energy Outlook 2022 provides an updated road map to net-zero emissions by 2050. The new analysis estimates that oil demand will decrease from 95 mb/d in 2021 to 75 mb/d in 2030 and less than 25 mb/d in 2050. Natural gas demand decreases from 4,200 bcm to 3,300 bcm in 2030 and 1,200 bcm in 2050. Oil price will decline to US$35 per barrel by 2030 and $24 per barrel by 2050 (IEA 2022b). In other words, IEA's 2022 analysis estimates an even more rapid decline in oil and gas demand by 2050.

8 There is no consensus on where oil prices will land by 2050 because different scenarios operate under different assumptions. However, other analyses also predict oil prices will be much lower than they are today. Under Wood Mackenzie's 2°C accelerated energy transition scenario, oil prices would fall to $37–$42/barrel in 2030 and to $10–$18/barrel in 2050 (Flowers 2021). Oil demand decreases by 70 percent to 35 mb/d by 2050 in this scenario. The volatility within the industry can make projecting prices difficult; most recently, major price crashes occurred in 2014 and 2020, and then prices skyrocketed in 2022.

9 Petrochemicals, which convert oil and gas into different products—such as plastics, fertilizers, clothing, packaging, tires, and more—are ubiquitous and could make the transition away from oil and gas more difficult. The growing role of petrochemicals is considered a key blind spot in the global energy debate (IEA 2018). Given these other uses of oil and gas, and until replacements are found, there could be continued production of oil and gas rather than a complete phaseout.

10 Even though gas emits less greenhouse gas than oil or coal, methane leakage (the second most significant climate pollutant) from the well, during transportation via pipelines, and in buildings where it is burned is a significant issue. More accurate accounting of methane leakage at every step of the way is needed to understand the climate impact of gas. According to the IEA, methane leakage across the entire gas value chain is higher than methane emissions from oil production (IEA 2021c).

11 The transportation sector accounts for approximately 60 percent of total oil demand (IEA 2021b). The rest is used in electricity, petrochemicals, heating, and other industries.

12 It is worth noting here that high-income countries such as the United States are also expected to increase their gas production, driven by rising demand for U.S. natural gas exports. The U.S. Energy Information Administration's Annual Energy Outlook 2022 projects that annual U.S. gas production will grow by almost 25 percent through 2050 (EIA 2022). Furthermore, as a result of the Ukraine war, governments are looking for alternatives to Russian energy, which could lead to more investments in new oil and gas fields.

13 Between 2010 and 2021 the cost competitiveness of solar and wind technologies significantly improved. During this period, the cost of electricity from utility-scale solar photovoltaic projects declined by 88 percent, that of onshore wind by 68 percent, and offshore wind by 60 percent (IRENA 2022). Whereas the cost of natural gas is tied to the fuel's volatile commodity price, the cost of renewables depends on technology costs, which have been decreasing year to year.

14 IOCs include the seven major companies (BP, Shell, Chevron, Total, ConocoPhillips, ExxonMobil, and Eni) as well as other privately owned oil and gas companies, such as Marathon Oil and Occidental.

15 Examples of NOCs in the Middle East include Saudi Aramco, the National Iranian Oil Company, and Qatar Petroleum; in Africa, the Nigerian National Petroleum Corporation, Sonatrach, and Sonangol; in Latin America, Petrobas, Petróleos Mexicanos (or Mexican Petroleum, known as Pemex), and Yacimientos Petrolíferos Fiscales (or Fiscal Oilfield Deposits, known as YPF); and in Asia, Pertamina and the China National Petroleum Corporation.

16 Based on assessments of capital that is at risk of stranding, shareholders have been motivated to engage IOCs on their management of climate-based financial risks. There is no comparable assessment of at-risk public finance that can serve as an entry point for stakeholder engagement with NOCs. More transparency and better data on NOC operations, including data on exploration and production, revenues, spending, and payments to government, can help stakeholder groups to better estimate the full scale of public finance that could be at risk under different transition scenarios (Bradley 2020).

17 Personal communication between the authors and an engineering consultant in the Nigerian oil and gas industry, August 6, 2021.

18 NOCs are not a uniform group. Some NOCs are among the world's more sophisticated oil and gas operators, with strong balance sheets and cutting-edge technology and project management expertise. Others are little more than shell companies that act as an arm of the government to take an ownership stake but leave operations to IOCs and other private operators. Thus, the evolving role of NOCs in the energy transition will depend on a confluence of factors, including government climate targets as well as NOCs' financial resources and access to capital, ability to diversify their businesses into low-carbon opportunities, and their cost competitiveness (Cahill 2021). In general, though, most are seen as poorly positioned and/or lacking incentives to navigate the energy transition (IEA 2020a; Manley and Heller 2021).

19 Volatile oil and gas prices have already created challenges for many middle-income countries, highlighting the importance of planning for longer-term trends and understanding that oil and gas prices can swing in either direction during the transition period. The historic decline in global oil demand caused by COVID-19 is estimated to have led to a 50–80 percent drop in net income for key oil-producing countries between 2019 and 2020. Nigeria's oil and gas income was projected to decline from $45 billion in 2019 to $11 billion in 2020, and Angola's was projected to fall by more than 75 percent (Gould and Al-Saffar 2020). The war in Ukraine has shifted prices in the other direction, a dynamic projected to provide a significant boost in government revenue for oil-producing nations. Although Brent crude oil price had dropped to $22/barrel in March 2020 during the COVID-19 crises, it soared to $130/barrel in March 2022 as a result of Russia's invasion of Ukraine and subsequent sanctions on Russian energy exports. Yet the oil and gas industry has clearly recognized that prices could drop substantially once again, and producer nations will almost certainly continue to face volatility in revenues.

20 IEA's NZE Scenario assumes a more rapid decline in oil and gas demand compared to its SDS. For example, oil demand in the NZE Scenario is estimated to be 20 percent below the SDS in 2030, and gas demand is estimated to be 8 percent below the SDS in 2030.

21 The 40 petrostates span low-income, middle-income, and high-income countries and include Azerbaijan, Algeria, Angola, Bahrain, Bolivia, Brunei, Ecuador, Egypt, Equatorial Guinea, Cameroon, Chad, Colombia, Congo, Gabon, Iran, Iraq, Kazakhstan, Kuwait, Libya, Malaysia, Mexico, Myanmar, Nigeria, Norway, Oman, Papua New Guinea, Qatar, Russia, Saudi Arabia, South Sudan, Sudan, Suriname, Timor-Leste, Trinidad and Tobago, Turkmenistan, the United Arab Emirates, Ukraine, Uzbekistan, Venezuela, and Yemen.

22 According to the World Bank, 75 percent of the global population lives in middle-income countries, including 62 percent of the world's poor (World Bank 2022c).

23 In some countries, including Argentina, which is a middle-income country, SNGs collect significant revenues directly from oil, gas, and mining companies (Bauer et al. 2016).

24 It is estimated that 87 percent of the population living in poverty in Nigeria live in the country's North. Seven out of 10 states, which have the highest unemployment rates, are also in the North (Tayo 2021; Vishwanath 2021).

25 According to the Global Subsidies Initiative, 34 countries reformed their consumer subsidies, 14 countries increased consumer taxation, and 7 countries did both between January 2015 and May 2020 (Sanchez et al. 2020). Morocco is a good example of subsidy reform being done well. In 2014 the country reformed subsidies for gasoline, fuel oil, and diesel, decreasing spending on fossil fuel subsidies from $3.68 billion that year to $1.1 billion in 2016. At the same time, subsidies for butane were maintained to prevent disproportionate effects on poor and rural populations reliant on that energy source (WRI 2021a).

26 Automation, especially in drilling operations—which are cost intensive and involve working in dangerous conditions—and inspection, maintenance, and repair—which are ideal for robotic solutions—have impacted oil and gas sector employment. It is estimated that 20 percent of jobs in oil and gas could become automated this decade (Rystad Energy 2021). Although automation is happening at a faster pace in high-income oil- and gas-producing countries such as Canada, Norway, the United Kingdom, and the United States, it will likely spread to middle-income countries, impacting oil and gas employment.

27 In Nigeria, there are a range of estimates for the numbers of workers in the industry. The Nigeria Extractive Industries Transparency Initiative estimates the oil industry directly employed 19,820 workers in 2018, representing 0.03 percent of the country's total employment (NEITI 2019). The Petroleum and Natural Gas Senior Staff Association of Nigeria (PENGASSAN) union (representing middle- and upper-level formal employees) estimates 200,000 Nigerians worked in the sector in 2020 (Owolabi and George 2020). In Mexico, Pemex was estimated to employ 123,900 workers in 2020, a decline of 19 percent compared to 2014 (Alves 2021).

28 The 2022 Global Energy Talent Index survey draws on the views of almost 10,000 energy professionals (across renewables, oil and gas, petrochemicals, and nuclear industries) of 144 different nationalities spanning 161 countries. The survey contains 84 questions, administered over a period of eight weeks in November and December 2021.

29 Higher oil prices may not always lead to more investment in new projects, resulting in new jobs being created. That is because companies may be spending differently by paying out more profits to shareholders in the form of dividends and buybacks or investing in existing projects (Worland 2022). In addition, the significant potential for boom-and-bust can limit industry appetite for additional investment or employment.

30 The Middle East, North Africa, and the United States are expected to see net job gains driven by significant renewable energy deployment. There will be a net loss of energy jobs in fossil fuel–exporting regions, including Australia, Canada, China, and Mexico. Latin America, South Asia, and Sub-Saharan Africa—which includes oil exporters Angola and Nigeria, as well as the continent's largest coal exporter, South Africa—will see limited gains in net jobs. This loss of employment in the extraction sector, where most energy jobs are currently concentrated for these fossil fuel–exporting countries, is unlikely to be compensated by expansion of renewable energy jobs (Pai et al. 2021).

31 PENGASSAN and the National Union of Petroleum and Natural Gas Workers (NUPENG) are the two unions representing senior and junior workers, respectively. PENGASSAN, which represents senior and middle management workers in Nigeria, only represents 4,500 permanent workers of Shell Nigeria, leaving out over 50,000 contract workers as well as expatriate workers (Ajonbadi 2015).

32 It is also worth pointing out that a significant portion of direct oil and gas workers are expatriates and not covered by unions. In Nigeria, estimates of expatriates range from one-fifth to one-third of workers (Houeland 2015). Expatriates earn considerably more than domestic workers for the same job. Even though local content policies set limits on the share of expatriates holding management positions or forbid expatriates in lower positions, these policies are often not enforced and unions have complained that the "expatriate quota" is often violated.

33 Between 2017 and 2019, the Mexican government tripled support for fossil fuels, paying for new Pemex infrastructure and covering debt and pension liabilities (OECD 2021b). Pemex's fiscal challenges and massive debt load have been partially attributed by some to overstaffing and generous benefits and pensions for its workers, who are defended by a powerful union (Stojanovski 2008). In 2008, it was reported that about 600 members of STPRM continued to receive full salary and benefits despite not working for five years. These workers were crew members of oil tankers that Pemex stopped using because they did not meet safety standards. These workers could not be relocated to other jobs within the company because workers' contracts prohibit that. As a result, Pemex paid $270 million to those workers over five years (Huizar 2015). Political corruption also has been a long-standing problem with Pemex and STPRM. In 2001, it was found that funds from the workers' union were used to support the 2000 presidential campaign of Francisco Labastida, the candidate for the ruling political party that controlled both the legislative and executive branches of government (Thompson 2002). In 2019, the powerful boss of STPRM, facing formal accusations of corruption, stepped down as head of the union after 26 years (Malkin 2019).

34 In another example from South Africa, unions have emerged as powerful allies of just transition and are working actively to ensure that workers' voices and rights are incorporated in all discussions. South Africa's presidential cabinet adopted a just transition framework in August 2022 that outlines a shared vision of transitioning to an equitable and just zero-carbon economy and identifies key policy areas and principles to achieve that vision (Connolly 2022).

35 The meaning of *contract worker* can differ from country to country and also sector to sector, which adds to the complexity of comparing the number of these workers across countries. *Casual worker* or *casual labor* is also used in the oil and gas industry in some countries (Aye 2017; I. Graham 2010). Other sources use the term *nonstandard forms of work* (Aye 2017; ILO 2016; ITUC 2019b) as well as *informal workers* for workers not employed in the formal sector more generally (Gausi 2016; ILO 2019).

36 The 2022 Global Energy Talent Index survey draws on the views of almost 10,000 energy professionals across renewables, oil and gas, petrochemicals, and nuclear industries from 161 countries. The survey contains 84 questions, administered over a period of eight weeks in November and December 2021.

37 *Employment casualization* refers to the process of employment shifting from a predominance of full-time and permanent positions to contract and casual positions, with significant differences in job security, payment systems, and hours worked between the two types of positions. The nature of contract work in high-income countries may be different where oil and gas contract workers are paid more in lieu of forgoing benefits and job protections given to permanent workers.

38 Quality jobs are those that provide good wages and benefits, work security, opportunities for growth, safety at work, opportunities for social dialogue, and inclusivity of marginalized and historically excluded communities (Jaeger et al. 2021). Other organizations also use the term *decent work* or *decent job* (ILO 2018b; ITUC and Millennium Institute 2012).

39 A literature review of 33 articles found that 18 articles focused on a just transition of the coal sector, 5 on fossil fuels in general, and 10 were unspecified. Eleven articles focused on the United States, while 9 had a global focus, 6 focused on Australia, and 7 on other countries. Collectively, these articles highlight 17 elements of just transition, including the requirements for long-term planning, community engagement, the role of unions, diversified economies, worker transition service, and local infrastructure development (Pai et al. 2020).

40 Failure to proactively plan for a transition away from fossil fuels can create economic challenges, as happened in Wałbrzych, Poland. The economy of Wałbrzych significantly depended on coal mining. However, rapid closure of those mines during the 1990s led to 14,000 coal workers losing their jobs. Even though economic development strategies were initiated at a later date, including the creation of a special economic zone and a business development agency, it was late in the game. Over two decades after the mine closures, Wałbrzych and surrounding areas still suffer from high unemployment and poverty (WRI 2021b).

41 In Nigeria, Actemium Oil and Gas Training is helping oil and gas workers transition to the offshore wind industry by offering courses developed by Opito, a global skills organization for the energy industry (Leke et al. 2022).

42 Recently, the Just Energy Transition Partnership (JETP) has emerged as a potential model to support just transition efforts in developing countries. In November 2021, four developed countries and the European Union pledged $8.5 billion to support South Africa's just transition, decarbonization, and economic diversification efforts as the country moves away from coal (European Commission 2021; Farand 2021). South Africa's JETP provides a significant opportunity to align the country's just transition efforts with international climate finance donor support. However, the outcome is far from guaranteed, with many questions remaining about the details of the arrangement, including how concessional or grant based the financing will be, especially to support workers and communities in the transition (Burton 2022). MDBs can also play an important role in supporting just transition efforts. The European Bank for Reconstruction and Development's Just Transition Initiative could serve as a model with its dedicated programs for just transition across the countries where it provides financing (EBRD 2020). The $2 billion Accelerating Coal Transition initiative launched by Climate Investment Funds has a similar mission to help developing countries exit coal and facilitate a just transition to clean energy (CIF 2021). These kinds of initiatives, currently focused on moving away from coal, could be expanded as the transition away from oil and gas accelerates. A number of MDBs have also signed onto high-level principles guiding their engagement around just transition (ADB et al. 2021).

43 For example, the Collective Impact Coalition formed recently to deal with the lack of seriousness from oil and gas companies in addressing the social impacts of their low-carbon strategies (see WBA 2022).

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ABOUT WRI

World Resources Institute is a global research organization that turns big ideas into action at the nexus of environment, economic opportunity, and human well-being.

Our challenge

Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth's resources at rates that are not sustainable, endangering economies and people's lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

Our vision

We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

Our approach

COUNT IT

We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

CHANGE IT

We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

SCALE IT

We don't think small. Once tested, we work with partners to adopt and expand our efforts regionally and globally. We engage with decision-makers to carry out our ideas and elevate our impact. We measure success through government and business actions that improve people's lives and sustain a healthy environment.