



EQUITABLE FOSSIL FUEL PHASEOUT

SCIENCE AND RESPONSIBILITY





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EXECUTIVE SUMMARY

The outcome of the first Global Stocktake (GST) gaveled in December 2023, was significant as it set a clear mandate for countries for “transitioning away from fossil fuels in energy systems, in a just, orderly and equitable manner, accelerating action in this critical decade, so as to achieve net zero by 2050 in keeping with the science”. However, it falls short of laying out a differentiated timeline for phaseout of fossil fuels, in which developed countries take the lead and do so on an urgent schedule, and developing countries are given more carbon space to grow, albeit on low-carbon growth paths. It also fails to emphasize the urgent ramping up of financial support needed in developing countries that developed countries must provide to enable this transition away from fossil fuels. Thereby, the text dilutes the very principle of equity by placing an equal mitigation burden on all countries and fails to account for the historical emissions of developed countries who must lead this transition.

This paper attempts to fill that gap by providing a framework to analyse which countries have a responsibility, and the requisite capacity to lead the transition away from fossil fuels.

- Since 1900, economies such as the United States of America (USA), European Union-27 (EU), Russia, Japan, United Kingdom (UK) and Canada have contributed to more than 50 per cent of the cumulative CO₂ emissions. China, owing to its rapid pace of industrialisation from the start of the 21st century, has had a steep increase in its CO₂ emissions and now holds a share of 15 percent of the global CO₂ emissions between 1900 and 2022.
- Coal, oil and natural gas have continued to be the main sources of fuel that are widely used for production and consumption by the top historical emitters mentioned above. The discovery of oil in the Middle East has spurred economic growth for petrostates such as Qatar, the United Arab Emirates (UAE), Saudi Arabia

and Kuwait; but their heavy dependence on it implies that their transition becomes more complex.

- In order to address the most critical question of who leads the way for a fossil fuel phase out, this paper outlines a methodology towards a rules-based system as a way forward. Based on a review of the literature and expert consultations, we arrived at a set of indicators to determine what a roadmap to an equitable fossil fuel phaseout (EFFPO) would look like. This method is centered around determining the historical responsibility of a country to lead a fossil fuel phaseout. It then determines the capacity of a country to withstand the potential economic and social impacts of a phaseout. The method is ultimately rooted in equity and common but differentiated responsibilities (CBDR) to highlight which countries should and can lead the transition.

A probable sequence for an equitable fossil fuel phaseout

Who must lead the fossil fuel phaseout?			
	High capacity	Moderate capacity	Low capacity
High responsibility	<ul style="list-style-type: none"> • USA • Canada 	<ul style="list-style-type: none"> • Qatar • UAE • Russia • Saudi Arabia • China • Trinidad and Tobago 	<ul style="list-style-type: none"> • Kuwait
Moderate responsibility	<ul style="list-style-type: none"> • Australia • Germany • UK • Norway • Japan • France 	<ul style="list-style-type: none"> • Brunei • Kazakhstan • Poland • Mexico • Argentina • Indonesia 	<ul style="list-style-type: none"> • Iran • South Africa • Iraq • Algeria • India
Low responsibility		<ul style="list-style-type: none"> • Barbados • Brazil • Thailand • Colombia • Vietnam 	<ul style="list-style-type: none"> • Nigeria • Egypt • Bangladesh • Mozambique

- The analysis makes it clear that developed countries must lead the phase out in the short term, in particular countries such as the USA and Canada that can make the transition away from fossil fuels with little to no negative consequences. Countries such as Australia, Norway, Germany, Japan, UK, France, Poland, and Russia also have a high capacity to phase out, however they continue to invest and sustain their economies on fossil fuels.
- Petrostates are economies that are heavily dependent on the production and export of oil and natural gas. They are key players for a successful fossil fuel transition. The wealth accrued by these countries from fossil fuels has also made them some of the wealthiest nations in the region. Their 'moderate capacity' status is primarily due to their extreme economic dependence on oil and gas, signaling the need to explore economic diversity and policies to support the same.
- Lastly, for the Least Developed Countries (LDCs), due to their lower development status and reliance on fossil fuel imports, none showed up in our analysis as responsible for leading the phaseout.

1. Introduction

The 28th Conference of Parties (COP28) in Dubai in 2023 ended with a historic call for countries to 'transition away from fossil fuels'.¹ The call culminated in the first ever Global Stocktake—a report card on international progress towards the Paris Agreement goal. It seemed that eight years since the Agreement, member countries had finally identified the root of the climate crisis: fossil fuels.

However, as is the case with any policy document, particularly those with global and far-reaching implications, reading between the lines revealed significant gaps. The document did not specify differentiated timelines for the transition. It did not acknowledge historical responsibility as a factor in the transition. It also highlighted the role of 'transitional fuels'.²

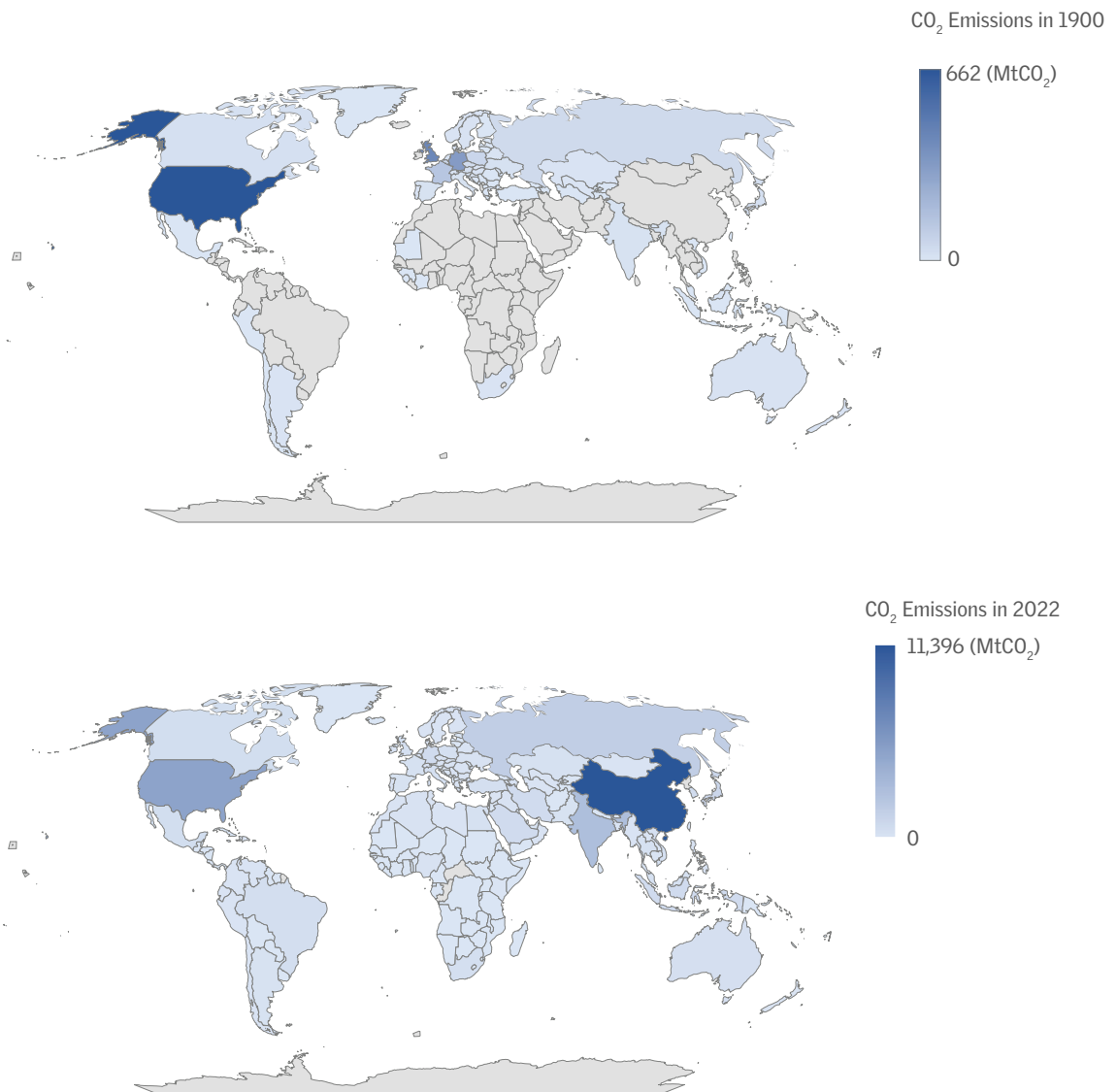
*Who must transition first? Who has overshot their right to pollute in the pursuit of development? Who is rightfully allowed to utilize the remaining global carbon budget? Do transitional fuels mean natural gas? Is this acknowledgement giving major gas exporters a right to pollute further?*³

Despite the questions that have been left unanswered, the Global Stocktake must not be considered a complete failure. It did recognize the need for a fossil fuel phaseout to achieve the Paris Agreement goal of limiting the global temperature rise to 1.5C—a feat that was possible only after turbulent rounds of negotiation. However, the negotiations stopped short of operationalizing equity.

Equity is a key principle of the United Nations Framework Convention on Climate Change (UNFCCC),⁴ alongside the principle of common but differentiated responsibilities (CBDR). CBDR acknowledges that some countries have a greater responsibility than others to act on climate change. These include rich, developed countries such as USA, UK, Canada, Australia, Japan and the European Union. These countries had an early advantage in using fossil fuels to drive their industrialization, which has led to a significant portion of today's

carbon dioxide emissions contributing to climate change. However, in matters of international climate policy, these countries exhibit a distinct lack of ownership or political will to proactively enable equitable climate action. This is perhaps why colloquialisms have shifted from 'industrialized/developed economies' to 'historical polluters' when referring to them.

Map 1: The changing concentration of CO₂ emissions (1900 and 2022)



Source: Our World in Data

During climate negotiations, it has been seen that historical polluters are increasingly pointing towards the changing map (see *Map 1: The changing concentration of CO₂ emissions, 1900-2022*), highlighting the role of a newer group of countries in contributing to annual emissions today.⁵ The list includes countries such as India, South Africa and Brazil whose significant annual emissions are indicative of their growing economies. China has consistently ranked as the highest annual CO₂ emitter since surpassing USA in 2005, and there is ongoing debate around whether China can still be categorized as a developing or emerging economy.⁶ It is necessary for these countries to gradually move towards cleaner sources of energy, while balancing the wellbeing of their populations. Nevertheless, it is unfair for historical emitters to push for accelerated mitigation from emerging economies when they themselves have shown little progress in doing the same. In fact, in recent years developed countries have continued to export and import oil and natural gas while calling out coal dependency which is incidentally concentrated in the Global South.⁷

Over time, scientific developments and international pressure have moved the focus from emissions and temperatures to the source—fossil fuels, which contribute to over 75 per cent of global greenhouse gas (GHG) emissions.⁸ Understanding what an equitable fossil fuel phaseout should entail is critical to ensure that the burden of the transition is distributed fairly. Deciding who should take up the most responsibility begins with looking at where it all started.

2. Historical trends in fossil fuel use

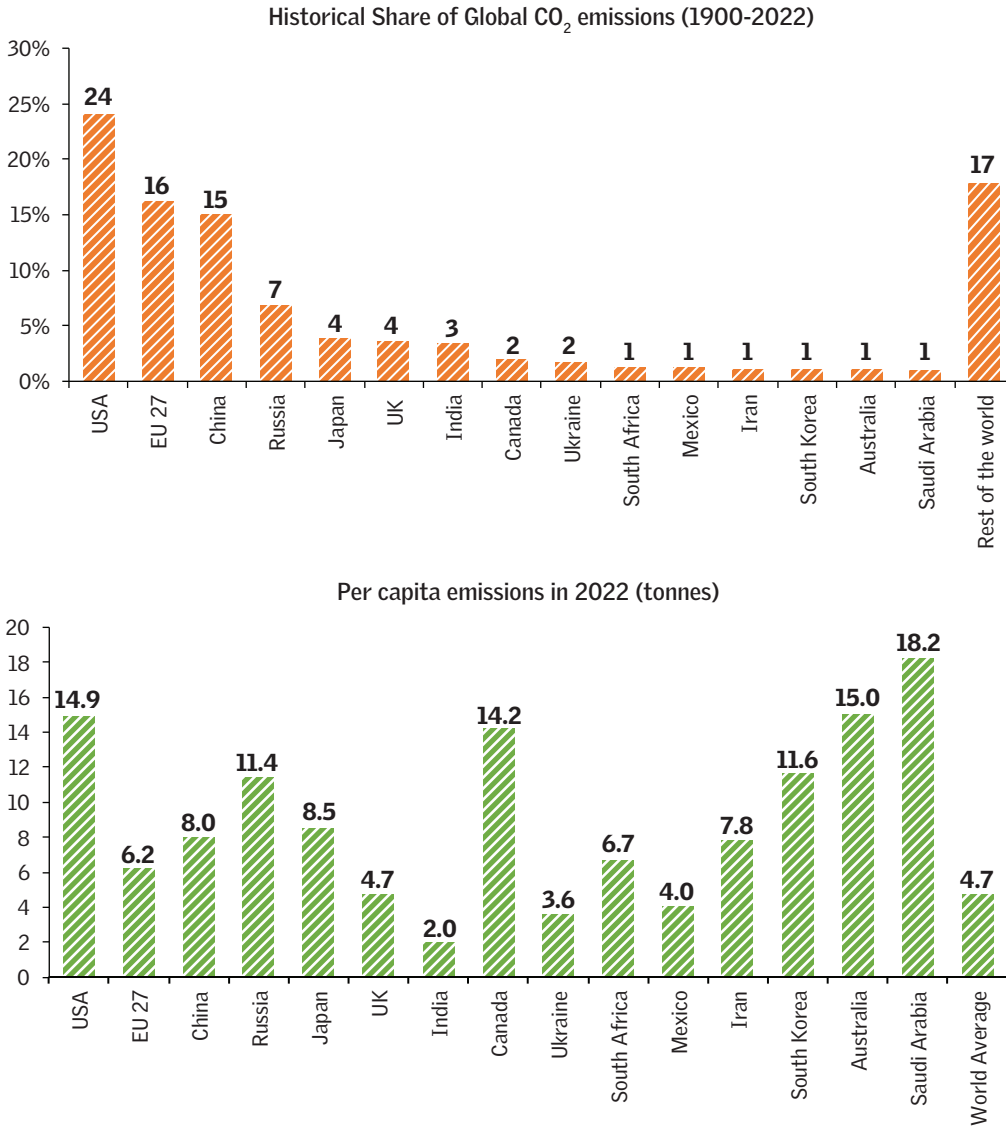
A global rise in human-led emissions is associated with the advent of industrialization.⁹ Multiple studies have led to the Intergovernmental Panel on Climate Change (IPCC) declaring that these emissions have caused a rise in the global temperature.¹⁰ The assessment of historical emissions as a share of global emissions from 1900 to 2022 clearly shows that the USA, EU 27, UK, Japan, Russia and Canada have remained the top polluters.¹¹ China saw a rapid rise in emissions with a growing economy in the early 21st century, and is now rapidly catching up with historical emitters.

Graph 1 below shows the historical share of emissions of the top 15 polluters compared to the rest of the world and their corresponding per capita emissions in 2022.

Countries such as India and South Africa are among the countries that have rising emissions today but have contributed markedly less to the historical share. It is also pertinent to note that the trajectory of their industrialization points towards significant population wellbeing and upliftment. The richer countries in the Global North have already achieved this milestone for their relatively smaller populations. Gulf countries such as Saudi Arabia, Iran and Kazakhstan are countries with economies heavily dependent on fossil fuels and hence represent emissions-intensive economies with relatively smaller populations.

Other overlooked factors may also play a role in downplaying the emissions burdens of countries. For example, the decline in emissions for USA has been attributed to the declining share of carbon-intensive coal in their energy mix. At the same time, there has been an uptake of oil and gas in the country that have a higher possibility of methane emissions—these, however, have not been adequately captured in calculations. Similarly, concepts of equity

Graph 1: Historical shares of global CO₂ emissions, and per capita emissions in 2022



Source: Global Carbon Budget (2023), Our World in Data, CSE Analysis.

and justice in terms of a fossil fuel transition remain theoretical and difficult to integrate into actionable international policies.

2.1 COAL

Coal has been called an incumbent energy source. Over the years, it has served as a fundamental pillar of industrial progress for numerous countries, fueling train and ship transportation,

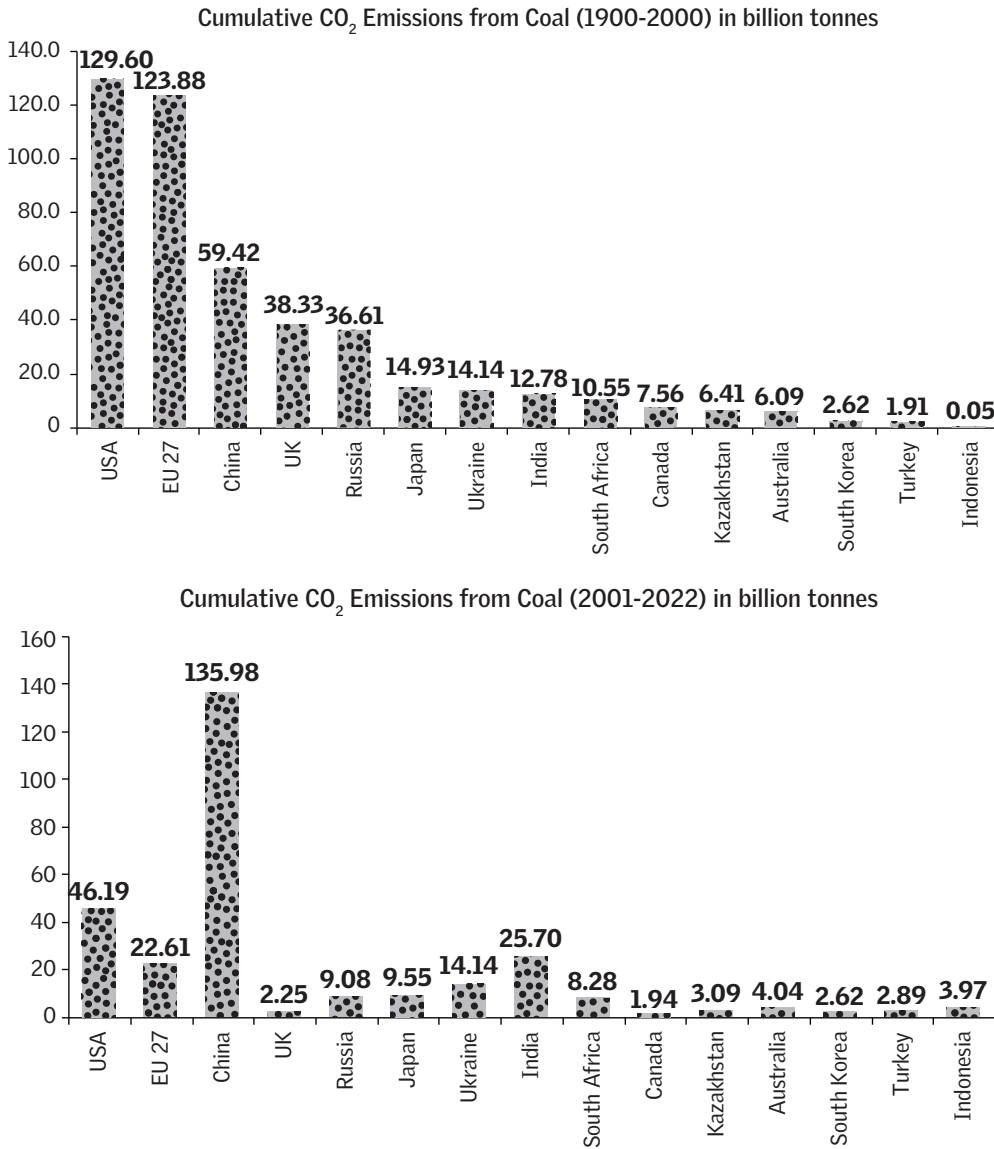
electricity generation, and driving various industrial sectors. Throughout history, the Global North has derived the greatest benefits from coal use. However, increased scrutiny of its polluting nature has altered its perception—from being a dominant energy source to now being seen as a climate culprit. Today, coal finds its most vociferous opponents not only amongst activists, scientists and policymakers focused on climate action, but also among oil and gas conglomerates who use the polluting image of coal to push other fuels, particularly natural gas, as the 'friendlier' alternative.¹²

It is true that coal is the most carbon-intensive of all fossil fuels—it emits between 88.6 kilograms of CO₂ per gigajoule (for Bituminous coal) and 98.3 kilograms of CO₂ per gigajoule (for Anthracite), compared to 69.4 kilograms for oil and 50.7 kilograms for natural gas.¹³ This means that coal releases a greater number of carbon molecules that bond with oxygen when burned. Consequently, among the three fossil fuels, coal emits the highest concentrations of CO₂. We analyzed CO₂ emissions from coal for the top 15 countries, comparing data from 1900–2000 with that from 2001–2022 (see *Graph 2: Cumulative CO₂ emissions of countries from coal, 1900–2000 vs. Cumulative CO₂ emissions of countries from coal, 2001–2022*). The graphs below clearly illustrate that historically, EU, Russia, UK and USA have been significant coal-based emitters. It is only in the past two decades that China, India and South Africa have started showing up on the map in a significant way.

Coal is known for its bulkiness and lower energy yield per unit compared to oil and gas, making it less favoured for trade. However, countries such as Japan rely heavily on imported fossil fuels, including coal. Within the EU 27 context, Poland and Germany show the highest concentrations of coal usage and related emissions. Australia exports nearly 70 per cent of its coal, mostly to countries in Asia. The dynamics of coal exports and imports, therefore, offer valuable insights into the characteristics and trends of both major producers and consumers of the fuel.

It is important to highlight the political dynamics and enduring incumbency of coal. Take, for example, the fact that imported coal is

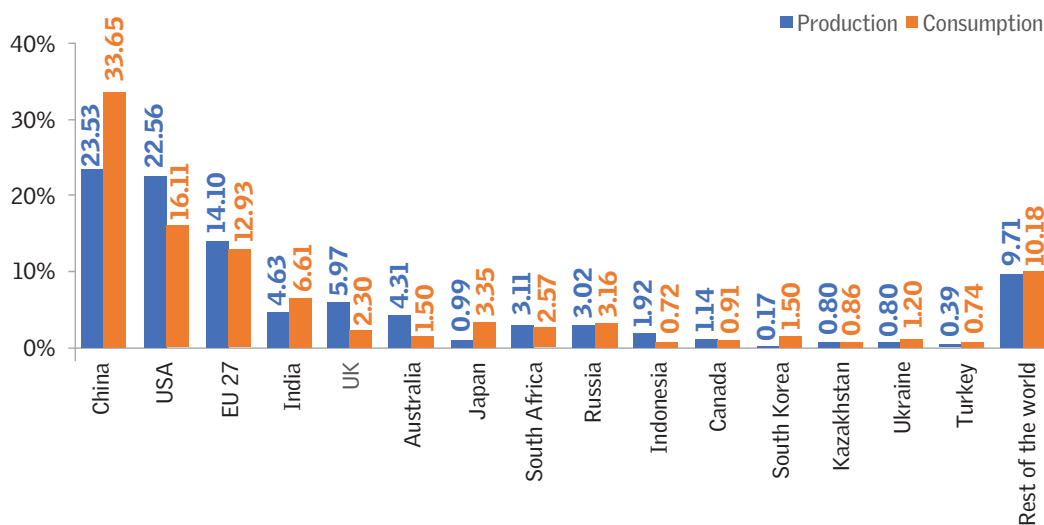
Graph 2: Cumulative CO₂ emissions of countries from coal between 1900–2000, and CO₂ emissions of countries from coal between 2001–2022



Source: Global Carbon Budget, Our World in Data, CSE Analysis

much more expensive than domestic coal. This, in turn, means that exporting coal provides revenue. Or that coal is much more labour-intensive than oil and gas, thus creating more job opportunities in developing and densely populated countries. These nuances are often overlooked in multilateral discussions around coal. Even at the conclusion of the Global Stocktake, coal was the one fossil fuel that was specifically singled out as a major carbon emitter.

Graph 3: Shares of global historical coal production and consumption of countries between 1900–2022



Source: Statistical Review of World Energy, CSE analysis.

Graph 3 illustrates the 15 countries responsible for the largest shares of global coal emissions between 1900–2022 compared to the rest of the world. The graph confirms that coal consumption is geographically concentrated and typically consumed in the same countries where it is produced. Aside from the top 15 coal users shown, the rest of the world collectively accounts for about 10 per cent of both consumption and production.

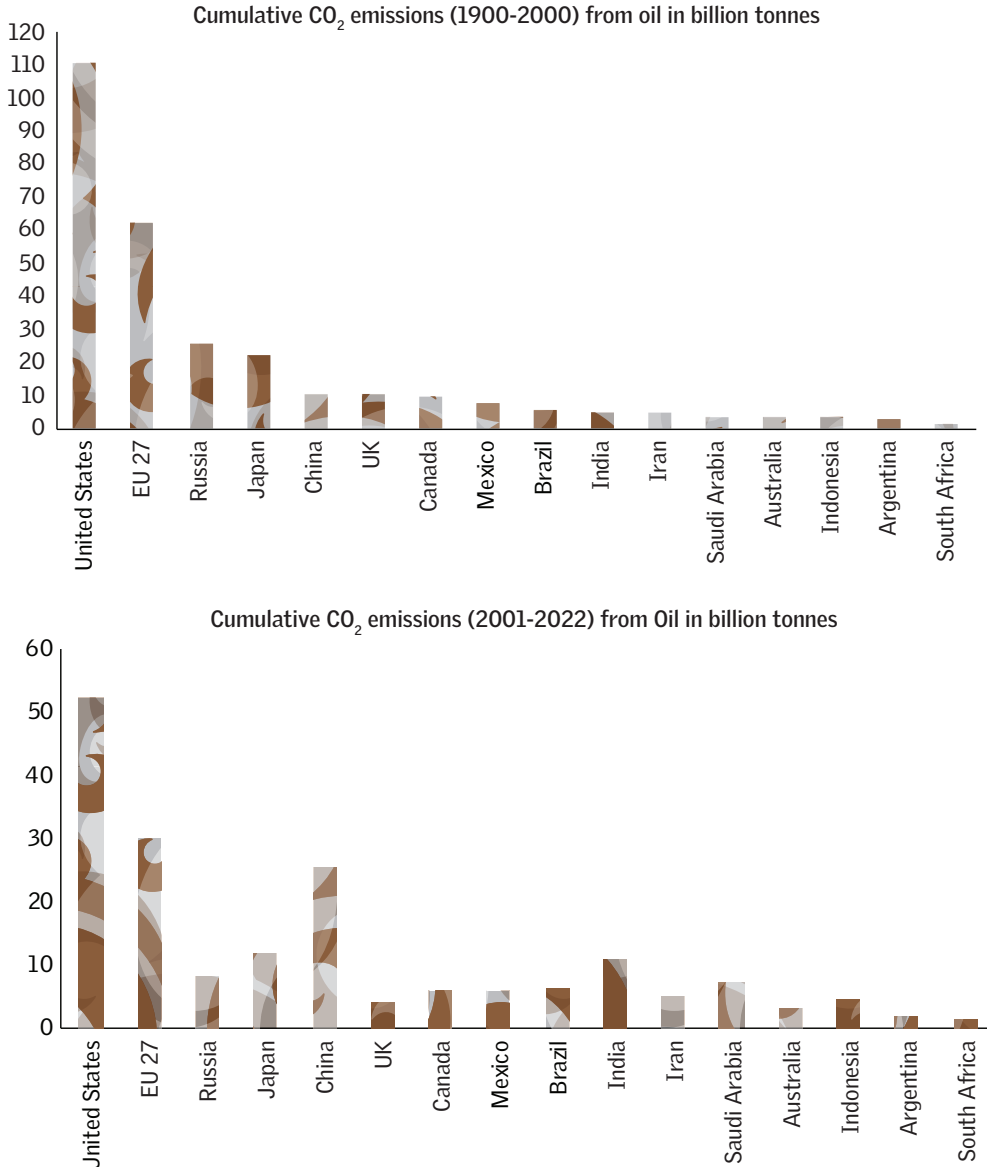
2.2 OIL

The modern oil industry is widely recognized to have begun with the discovery of oil in Pennsylvania in 1859. Subsequent discoveries in the early 1900s led to the gradual takeover of oil, which was viewed as relatively cheaper and more flexible than the bulky coal. The coal to oil transition was powered by a growing demand for kerosene to light homes and gasoline to fuel motor cars. During this time, the discovery of oil in the Middle East, and the subsequent World Wars led to a race for oil extraction, not just for consumption but for strategic geopolitical power.

Another surge in oil extraction came with the discovery of fracking in the USA in the late 1990s. Fracking is the process of pumping

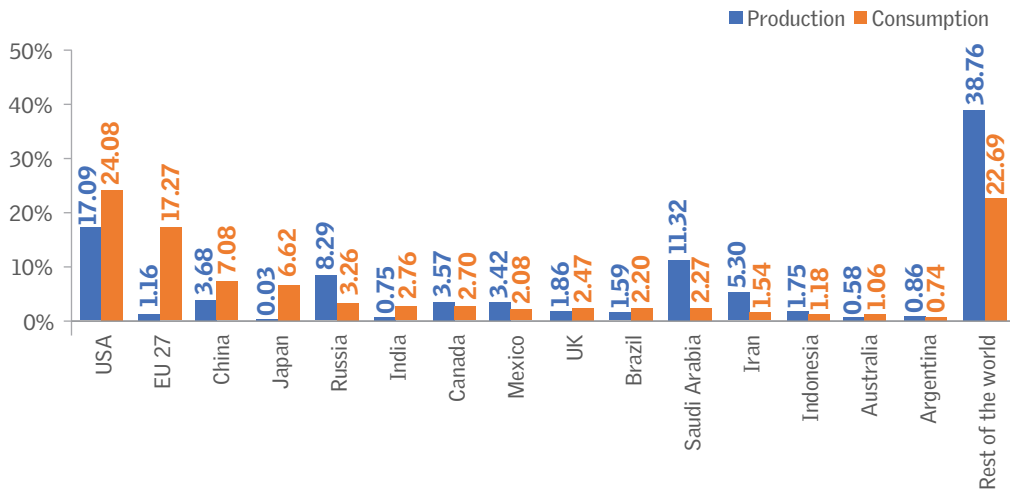
high pressure liquids into the cracks and pores of oil-bearing rocks to extract hydrocarbon. The success of the method led to its adoption by other countries, further reducing their dependence on coal. Spurring oil’s popularity was its liquid nature, making it easier to transport, quicker to power large vessels such as ships, and ultimately, easier to trade as a commodity.

Graph 4: Cumulative CO₂ emissions of countries from oil between 1900–2000, and CO₂ emissions of countries from oil between 2001–2022



Source: Global Carbon Budget, Our World in Data, CSE Analysis

Graph 5: Shares of global historical oil production and consumption of countries between 1900–2022



Source: Statistical Review of World Energy, CSE analysis.

Graph 5 depicts the 15 countries that have contributed the largest shares of global CO₂ emissions from oil between 1900 and 2022, in comparison to the rest of the world. Our assessment indicates that countries typically fall into either major producer or consumer roles in the oil industry. This contrasts with our findings for coal in Section 2.1, where consumption and production levels were roughly the same for countries. It seems that oil is more dispersed around globally than coal. This may possibly be due to the relative ease with which oil can be traded.

The International Energy Agency (IEA) expects global oil demand to peak by 2030 as countries move towards clean energy sources. However, the Organisation of The Petroleum Exporting Countries (OPEC) projects that the oil demand will continue to increase until 2045.¹⁴

It is crucial for petroleum-dependent economies, which have accumulated considerable wealth from fossil fuel production, to begin diversifying their economies.

2.3 NATURAL GAS

Natural gas emits nearly 50 per cent less CO₂ than coal and has a higher energy content per kg.¹⁵ According to a study by the University of Texas, natural gas is also cheaper to extract, making it a more affordable fuel option. It has, therefore, been referred to as a 'bridge fuel' in recent years. In the final Global Stocktake document, the term used was 'transitional fuel'.

Table 1: Carbon content of fossil fuels

Fossil fuel	Carbon content (in kgCO ₂ per gigajoule)
Anthracite coal	98.3
Bituminous coal	88.6
Subbituminous	92.5
Lignite	93.6
Coke	108.2
Oil	69.4
Gas	50.7

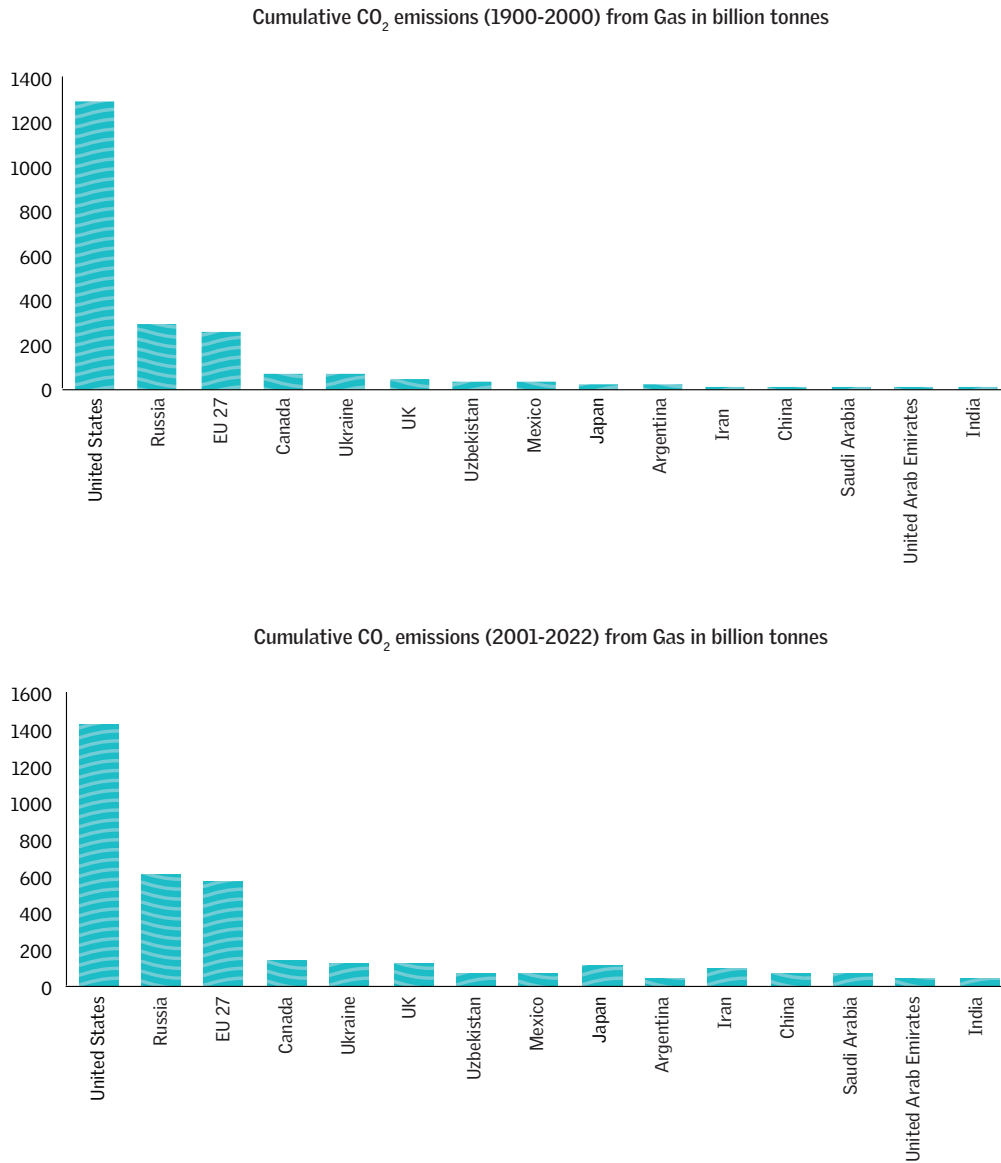
Source: US Energy Information Administration

The narrative of natural gas as a 'bridge fuel' emphasizes its necessity as the world transitions to a low-carbon future. Oil and gas economies argue that thinking of a net zero future without some need for natural gas is unrealistic. In fact, it was Russia that advocated for and successfully included language on transitional fuels in the GST text.

Graph 7 shows the 15 countries responsible for the largest shares of CO₂ emissions from natural gas between 1900–2022 compared to the rest of the world. The overall use of gas has been dominated by the USA, Russia, EU 27 and Canada. This is different from the pattern of oil which was more diverse and equally distributed. This can be attributed to the high costs of infrastructure for gas pipelines and export terminals.

While developed countries do not directly vouch for natural gas, especially in multilateral fora, their export and import deals speak

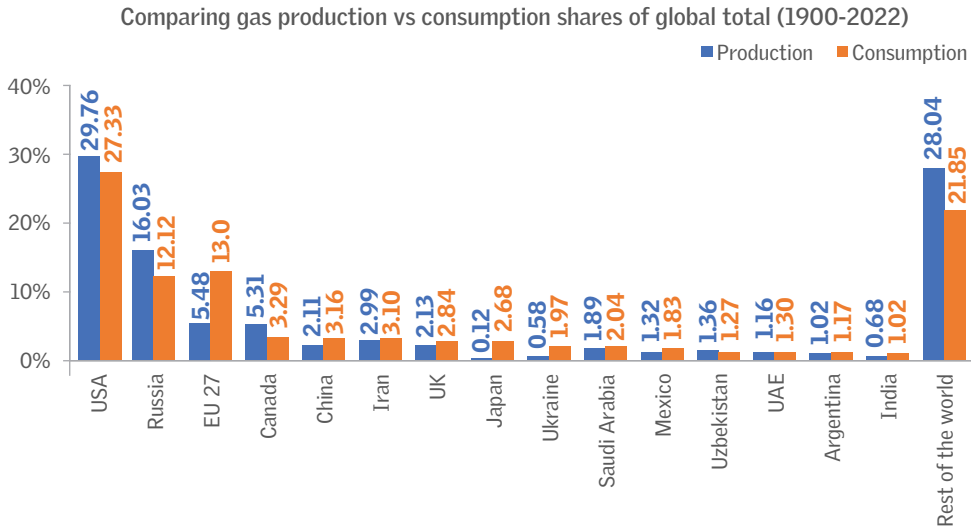
Graph 6: Cumulative CO₂ emissions of countries from gas between 1900–2000, and CO₂ emissions of countries from gas between 2001–2022



Source: Global Carbon Budget, Our World in Data, CSE Analysis

for themselves. As of 2023, the USA has been the largest supplier of natural gas to Europe for three consecutive years. Reuters reported that in 2023, Qatar, a leading exporter of liquefied natural gas (LNG), entered into a 27-year agreement with Italy to supply gas. Qatar also has an existing agreement to supply gas to the UK.

Graph 7: Shares of global historical natural gas production and consumption of countries, 1900–2022



Source: Statistical Review of World Energy, CSE analysis.

Countries are also opening up fields to extract natural gas, setting up LNG pipelines and import terminals. As of 2024, the Global Energy Monitor reports that overall, the planned gas infrastructure amounts to about USD 910 million.¹⁶ North America tops this list with planned projects estimated at about USD 106 million. While developed nations argue that the use of coal in the Global South has a risk of carbon lock-in, it must be remembered that vast expansions of natural gas pose the same risk. Moreover, a key pollutant from natural gas is methane which is about 28 times more potent in warming the planet than CO₂.

Therefore, while replacing coal with natural gas may reduce CO₂ emissions, it does not guarantee a reduction in the increase in global temperature.

3. A budget for fossil fuels

3.1 WHAT IS A CARBON BUDGET?

The concept of a carbon budget in climate policy aims to quantify the amount of emissions that is permissible to stay on track towards meeting global targets. Following a series of publications in the 2000s, the Global Carbon Budget (GCB) was first quantified in the IPCC's Fifth Assessment Report (AR5). Due to difficulties in accurately quantifying the GCB, the IPCC determines the estimated GCB available to meet the 1.5°C target, with a 50 per cent accuracy being the most common. In 2018, the AR5 estimated that to have a 50 per cent chance of achieving the 1.5°C target, the GCB was 268 GtCO₂. Due to improvements in climate models and better and more expansive data, the budget was revised in the next cycle. In the Sixth Assessment Report (AR6) released in 2021, the available budget was revised to 500 GtCO₂ to have a 50 per cent chance of meeting the 1.5°C target.

Up until 2015, the year of the Paris Agreement, the focus had been on ascertaining a global limit to temperature rise rather than on carbon emissions. This was largely due to the fact that the few approximations of the GCB were even more scientifically deficient at that time and were largely regarded as an oversimplification. It is only in the past decade that the discourse around the GCB and efforts to improve its estimation have increased. Even today, the accuracy of the GCB remains a topic of debate within climate policy discussions. While some experts say it is the simplest way to connect geophysical elements to robust climate policy development, others argue that it is an oversimplification that glosses over key factors and can lead to misinterpretation in the policy space.

Global South countries push the GCB to further highlight how the Global North oversteps permissible emission levels. According to these countries, the UNFCCC principles of equity and common but differentiated responsibility (CBDR) must also extend to reserving

the shrinking GCB for those who have not been historical polluters. To illustrate the global participation in the GCB if it was implemented, we examine which countries have historically held the largest shares of the estimated GCB.

3.2 WHO HAS HISTORICALLY OCCUPIED THE CARBON BUDGET SPACE?

In the previous section, we examined historical shares in relation to the total CO₂ emissions produced up to this point. In this section, using the methodology highlighted in the Box below, we represent historical shares in the context of the total available GCB to meet the 1.5°C target with a 50 per cent chance (see *Graph 8: A representation of the consumed vs remaining GCB for a 50 per cent chance to meet the 1.5°C target*).

Countries with two per cent or greater shares have been represented individually while the rest have been clubbed under the 'rest of the world'. Australia has found a place due to its status as a historical polluter. We see that the USA has taken up slightly more GCB space than the rest of the countries. If we set aside China and India's shares, the seven highest polluters, who also happen to be rich, developed countries, have constituted 45.52 per cent of the GCB space since 1900. Today, China's swift rise in emissions places it at the same level of historical polluters. Together, these polluters and China have consumed 56.22 per cent of the GCB. Not only has this left a fraction of the GCB for the others, but these countries have also continued to expand fossil fuel dependency and emissions in the 21st century.

Altogether, our analysis shows that by 2019, the world has collectively utilized 76.43 per cent of the GCB between 1900–2019. This aligns with a similar analysis by Carbon Brief, which concluded that 86 per cent of the GCB has been burned through since 1850.¹⁷

METHODOLOGY

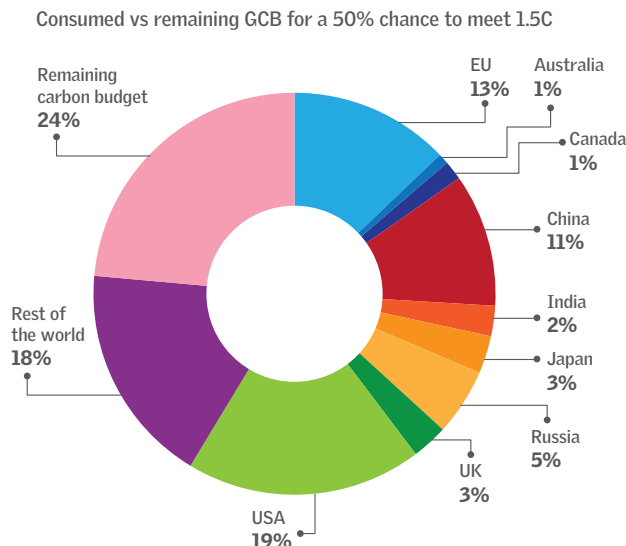
According to the IPCC Sixth Assessment Report's Working Group I, the Global Carbon Budget (GCB) available at the beginning of 2020, with a 50 per cent chance of meeting the 1.5°C target, was 500 Gigatonnes of CO₂ (GtCO₂). For the purpose of this analysis, we assume that the GCB available since 1900 to ensure a 50 per cent chance of meeting the 1.5°C target was the sum total of emissions from 1900 to 2019, plus the remaining 500 GtCO₂ from 2020.

The total global CO₂ emissions from 1900 to 2019 was calculated to be 1620.96 GtCO₂. Adding the IPCC numbers, we estimate that the total GCB available for the world to meet the 1.5C target at the start of 1900 was 2120.96 GtCO₂. The

total CO₂ emissions of countries from 1900 to 2019 was then represented as a share of the total budget. This reveals the share of the GCB utilized by each country until 2019, as illustrated in the pie chart.

It must be noted that it is only since AR5 in 2014, that the GCB that remains available to meet the 1.5C target has officially been published by the IPCC. The methodologies to evaluate the remaining GCB are still evolving. This method, therefore, relies on the assumption that the estimated remaining budget can be retroactively applied to historical emissions. It is a simplification meant to aid an illustrative representation of equitable shares of the budget. Accounting for uncertainties and limitations are out of the scope of this paper.

Graph 8: A representation of the consumed vs remaining GCB for a 50 per cent chance to meet the 1.5°C target



Source: Global Carbon Project, IPCC AR6, CSE Analysis

While the GCB is used to advocate for the carbon emissions deemed necessary to aid a transition, it is critical to ensure that it is not misused to continue an inequitable sharing in the process. A recent analysis by the Centre for Science and Environment (CSE) analyzed shares in the future if the current rate of emissions continued without major interventions.¹⁸ They found that the distribution of historical emissions between 1870–2030 would be nearly the same as that between 1870–2021. This means that in the nine years (now six) left until 2030, which is the target year in most Nationally Determined Contributions (NDC), climate actions are not enough to bring down the emissions share of the top polluters. The flip side of this scenario implies that, with the exception of a few countries, the rest of the world is projected to maintain their current emission levels. This implies that unless they achieve rapid decarbonization, their industrialization, or level of social and economic wellbeing remains stunted.

Developing nations now show stronger condemnation of the Global North and their polluting history. However, the operationalization of equity in distributing carbon space and guiding a fossil fuel phase out remains theoretical. For it to materialize practically, many factors and their political feasibility have to be considered.

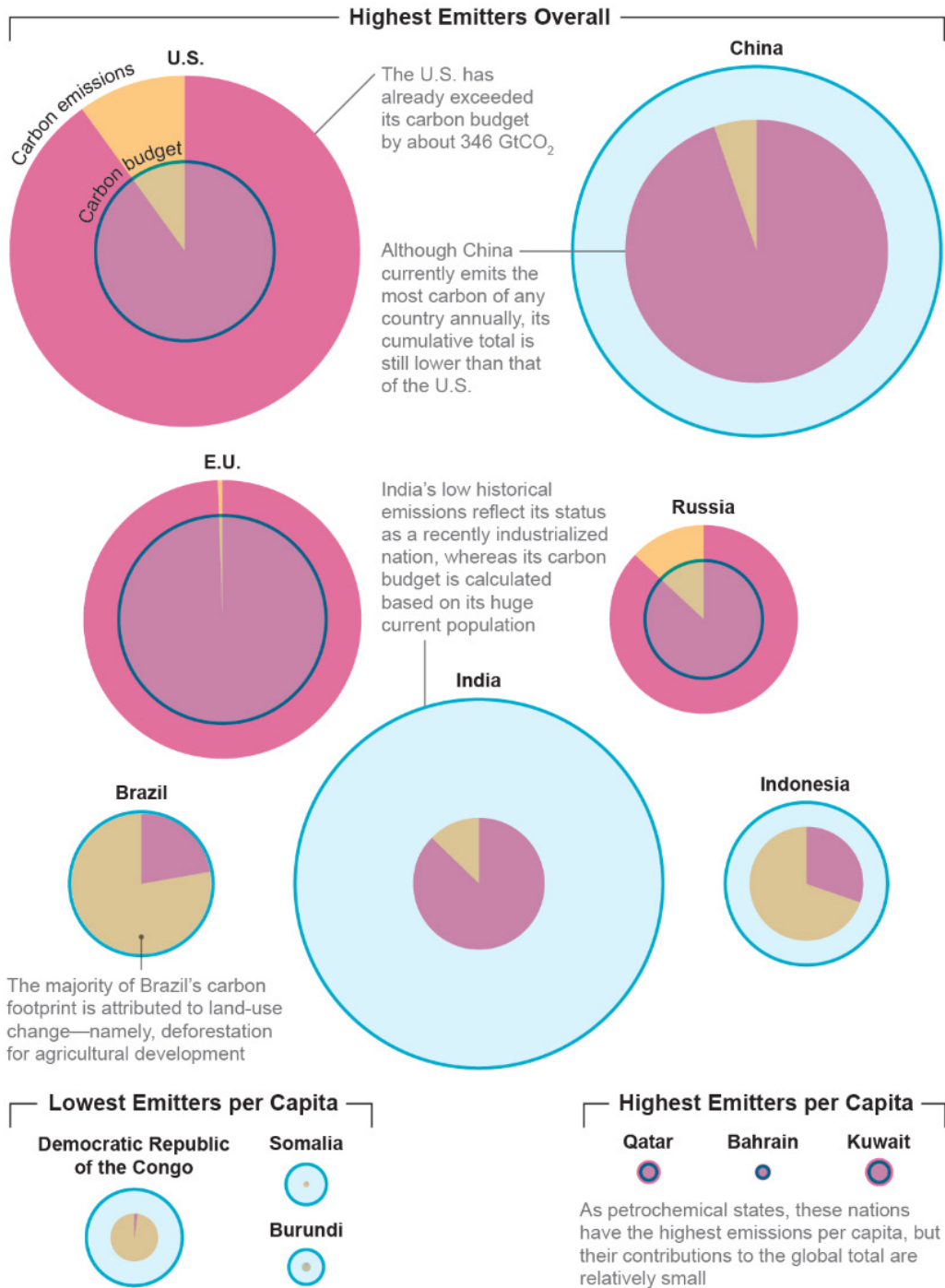
4. Who receives the remaining carbon budget?

Deciding on an equitable allocation of the remaining GCB is still a theoretical concept. This is due to both the fallacies of the GCB estimation and the lack of political feasibility. Moreover, no country has managed to completely phase out fossil fuels yet, and they contribute significantly to economic development and geopolitical influence. Finally, the benefits and costs of fossil fuel use are layered and dependent on multiple factors and feedback loops. Every country will therefore, have a justification as to why they deserve to have access to the GCB.

Attempts have been made by scholars to find ways of allocating the remaining budget. For example, in the journal *Scientific American*, it was found that wealthy countries and heavy oil-and gas-dependent economies had blown way past their budgets.¹⁹ The study hinged on population and per capita emissions as the central factor. As a result, countries with high emissions and small populations (developed countries) and those with fossil fuel-intensive economies and small populations (Gulf countries) had overshot their budgets while India, China and Indonesia still had a significant portion of their shares of GCB left (See *Figure 1: Representation of remaining carbon budget space for countries*).

Similarly, in another publication, Sven Teske of the University of Technology Sydney attempted to determine responsibility by modelling sectoral and economic factors and historical emissions of G20 countries.²⁰ This was supplemented by an analysis of a Per Capita Carbon Index to come to an allocation of the carbon budget between the countries.²¹ In its results, the paper states that for the rightful determination of GCB allowances, a number of factors including, economic capacity, status of industry decarbonization, per capita and historical emissions are necessary. While this resonates with conclusions in other more theoretical papers, the

Figure 1: Representation of remaining carbon budget space for countries



Source: Scientific American

focus on G20 countries eclipses countries in the rest of the world and their right to the GCB.

Researchers Renaud Gignac and H Damon Matthews of Concordia University propose a slightly different method of contraction and convergence (C&C) where cumulative and per capita emission allowances are adjusted across regions through credits and debits.²² This adjustment aims to equalize emissions allowances globally. While the researchers describe this method as relatively straightforward, a gap that emerges in their method is that of non-CO₂ gases.

The GCB has a central connection only to CO₂, but the potential impact of other GHG emissions and aerosols remain unaddressed. The researchers suggest grouping non-CO₂ gases together, while treating CO₂ emissions separately from other short-or long-lived emissions.

A review paper by Felipe Sanchez and Linus Linde of the Stockholm Environmental Institute in 2021 compiled metrics and factors used in various publications to decide on indicators for the fossil fuel phaseout.²³ The complete list showed a number of metrics that had easily accessible data sources and factors that had simple methods of quantification. On the other hand, there were few that had mostly private sources or were important but difficult to quantify. The resulting assessment showed that it is not merely the choice of factors but also the sequence in which they are used that makes a difference in the suggested phaseout order. Different sequences or weights to factors overlooked different layers and uncertainties. While the focus of this paper is on the phaseout and not on GCB, the findings are pertinent to the latter as well.

Yet more literature has focused on equitable allocation of the GCB or the 'right to emit' as a more theoretical concept rooted in values and principles. One common stumbling block across all of them is the lack of political viability and feasibility in enacting this at the multilateral policy level, not to mention that the 'non-policy

prescriptive' nature of the Paris Agreement makes it difficult for the UNFCCC to impose responsibility on countries without touching on national sovereignty. This is perhaps the reason why, despite climate commitments in the form of NDCs, countries across the world are continuing to license and sign off on new fossil fuel explorations, plants and international deals. Particularly, where the GCB allowance has clearly run out.

5. Is the phaseout occurring in countries that have exhausted their carbon budget?

5.1 COUNTRIES PLANNING TO EXPAND FOSSIL FUEL PRODUCTION

According to a recent analysis by Oil Change International using data from Rystad Energy,²⁴ planned oil and gas extraction between 2023–2050 in 20 countries will lead to additional emissions of nearly 175 GtCO₂ (see *Map 2: CO₂ emissions in GtCO₂ based on planned oil and gas extractions in 20 countries*). Taking into account the global total, this would leave 22.7 GtCO₂ emitted by extractions in the rest of the world.

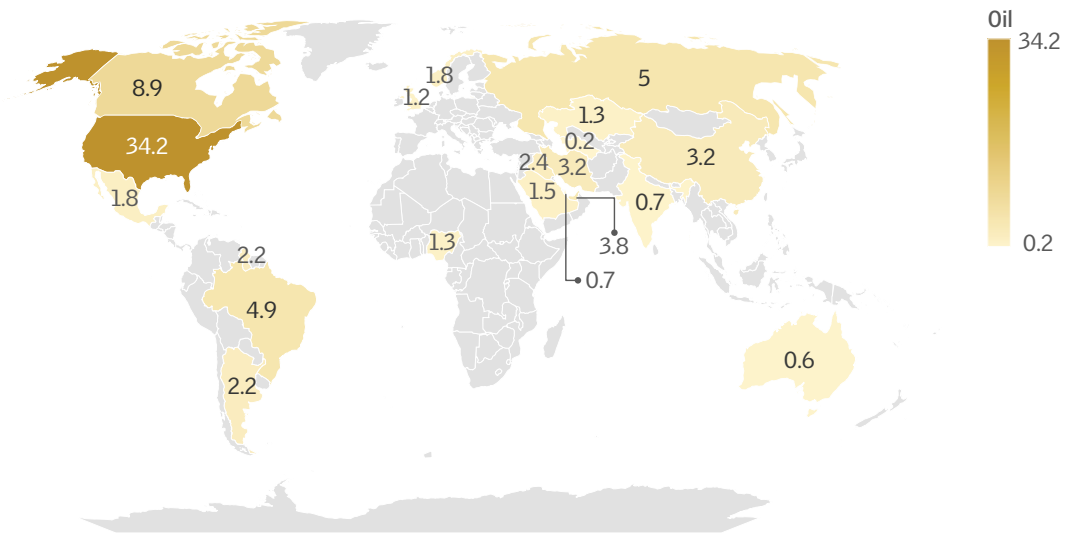
While it is concerning that emissions are set to rise at all, it is much more worrisome that USA, Canada, Russia, Norway, Australia and UK are responsible for nearly 68 per cent of these emissions.²⁵ These are all rich, developed countries who also happen to be historical polluters. These countries have either long overshot their budget or have diversified economies and the ability to withstand the impacts of a fossil fuel phaseout. Some of their plans are detailed in the Table 1: Fossil fuel extraction plans of select countries.

5.2 ROLE OF FOSSIL FUEL RESERVES

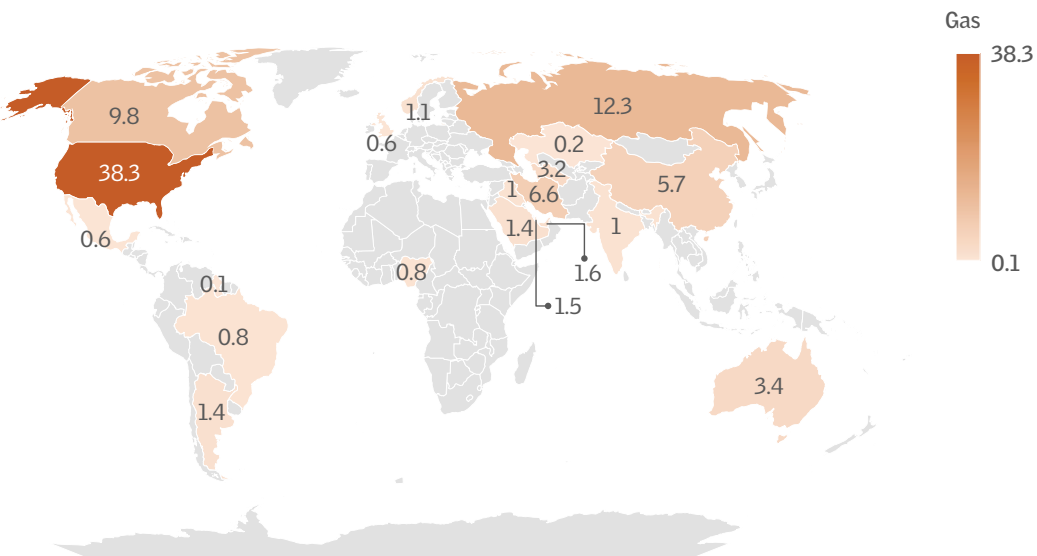
Fossil fuel reserves, although difficult to account for in determining future extractions and emissions, provide some information on the resources available in a country. Reserves are often not used as key metrics in the fossil fuel phaseout question, largely due to the uncertainties around their calculations and the fact that these are under sovereign control. The fossil fuel policy experts we spoke to explained that it is easy for countries to stake claim on their reserves and demand compensation to avoid extracting from them. For example, Saudi Arabia, which hosts nearly 17 per cent of the

Map 2: Expected CO₂ emissions in GtCO₂ based on planned oil and gas extractions in 20 countries

Emissions from planned oil extractions 2023-2050



Emissions from planned gas extractions 2023-2050



Source: Oil Change International

Table 2: Fossil fuel extraction plans of select countries

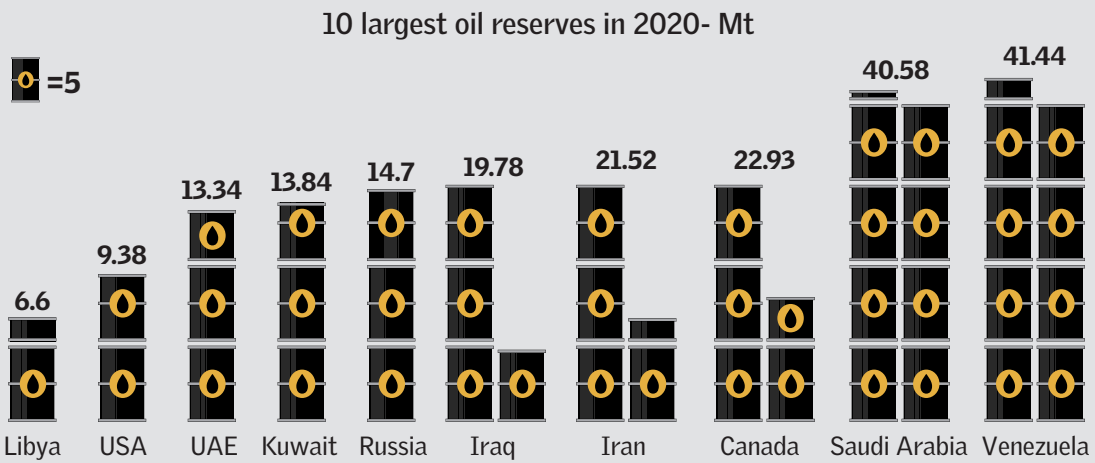
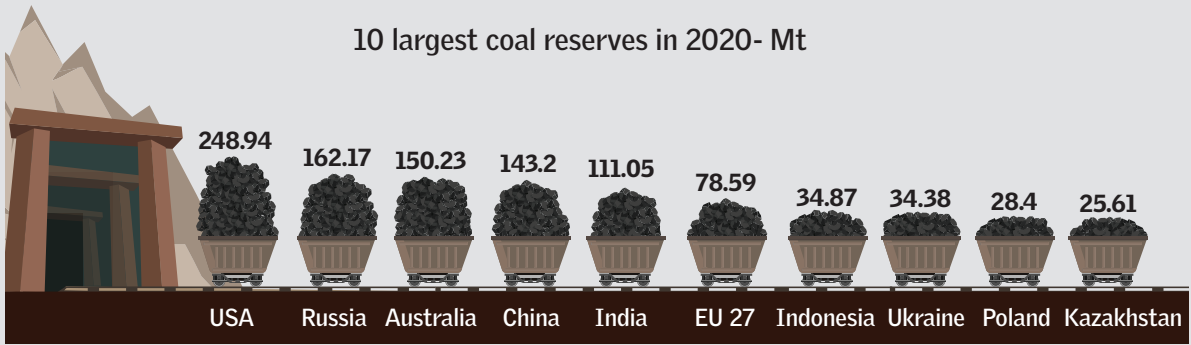
Country	Planned extractions
USA	In March 2023, the government approved the largest single oil project on federal lands, the ConocoPhillips Willow project in Alaska, which is projected to produce up to 180,000 barrels of oil a day as early as the late 2020s
	Projections determine that oil production will reach 19–21 Mb/d from 2024 to 2050, while gas production will reach 1.2 trillion cubic meters in 2050
Canada	Approved new pipelines and LNG export projects like Coastal GasLink, Trans Mountain, and LNG Canada, while also permitting new oil and gas fields such as Bay du Nord.
	In 2022, the federal government provided a USD 7.6 billion loan guarantee for the Trans Mountain Expansion Project
Saudi Arabia	In early 2023, Aramco indicated that it will expand its maximum capacity from 12 Mb/d in 2022 to 13 Mb/d by 2027 as well as growing its gas production capacity
	Projections indicate that gas production will increase by 40 per cent between 2019 and 2030, primarily driven by domestic demand
Norway	In 2023, the Norwegian Government awarded 47 new licenses to 25 different oil and gas companies on the Norwegian shelf. Norway's temporary COVID-19 tax break has led to 35 projects estimated to hold a total of 2.5 billion barrels of oil equivalent (boe).
Qatar	Qatar is planning an 85 per cent increase in LNG output from 77 to 142 metric tons per annum by 2030. The country has recently sealed decades-long gas deals with the UK and France, and is also initiating offshore explorations in Namibia.
Australia	In 2024, the Australian government announced that it would ramp up the use of gas till 2050 and beyond. The country is planning more than 100 fossil fuel expansions, at a cost of AUD 200 billion.

world's proven petroleum reserves, had earlier raised the prospect of demanding compensation for losses incurred by a global fossil fuel phaseout along with other petrostates.²⁷ It was also noted that fossil fuel reserves cannot be directly correlated with social well-being factors, making them an inadequate metric for evaluating a fossil fuel phaseout.

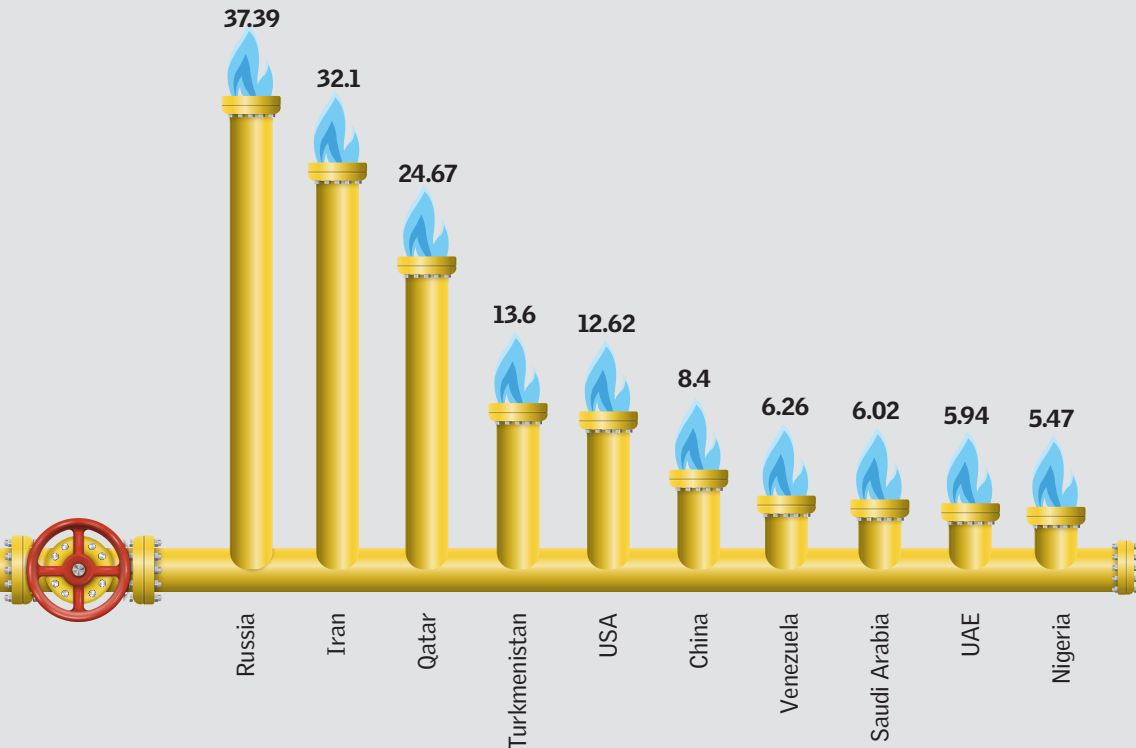
Nevertheless, data on reserves can provide information on who has the potential to tap into fossil fuel reserves in the future (see *Graph 9: Countries with the highest proven coal, oil and gas reserves as of 2020*). Similarly, as we are looking at countries that have the responsibility and means to phase out, such as USA which has high amounts of coal, oil and gas; we should simultaneously direct attention towards countries that should stop exploring and extracting further.

The first Annual GST Dialogue took place in the 60th meeting of the Subsidiary Bodies to the UNFCCC held in Bonn in 2024. In its

Graph 9: Countries with the highest proven coal, oil and gas reserves as of 2020



10 Largest natural gas reserves in 2020 - trillion metre cube



Source: Statistical Review of World Energy, Our World in Data, CSE Analysis.

intervention, Ghana, on behalf of the African Group of Negotiators, stated that developed countries must stop producing oil and gas in order to move towards a fossil fuel transition.²⁸ It was argued that the gap in the energy market following such a move would be filled by developing nations. If such a system were to be implemented, who would ideally be required to phase out first?

6. Who must lead an equitable fossil fuel phaseout?

Based on a review of the literature and expert consultations, we arrived at a set of indicators to determine what a roadmap to an equitable fossil fuel phaseout (EFFPO) would look like.

35 countries were selected to represent a diversity in historical responsibility, economic dependence on fossil fuels and population wellbeing.

These include:

- Developed countries who are also historical polluters,
- Lower middle-income countries who are emerging emitters,
- Petrostates with economies heavily dependent on fossil fuels,
- Least developed countries with low historical emissions and low economic reliance on fossil fuels, and
- Island states to represent both those dependent on fossil fuels for their economy and those who are not.

Figure 2: 35 countries chosen to represent a diverse group based on criteria listed above



This method is centered around determining the historical responsibility of a country to lead a fossil fuel phaseout. It then determines the capacity of a country to withstand the potential

economic and social impacts of a phaseout. The method is ultimately rooted in equity and CBDR to highlight which countries should and can lead the transition.

In this paper, we assume that historical responsibility is accounted for by both production and consumption of fossil fuels. The principle of leading the phaseout based on historical burdens applies to both producers and consumers. In this paper we have not distinguished between producers and consumers in terms of who should be considered more responsible to lead. This requires a deeper analysis that can be followed up in subsequent work.

6.1 CALCULATING HISTORICAL RESPONSIBILITY

The indicators used to calculate the historical responsibility score are:

Table 3: Indicators of calculating historical responsibility

Historical Responsibility Composite Score	
Cumulative Fossil Fuel Production (1965–2022) ²⁹	Who has produced the most fossil fuels.
Average Fossil Fuel Consumption Per Capita (1965–2022) ³⁰	Who has consumed the most fossil fuels based on population size.
Average Historical Per Capita CO ₂ Emissions (1965–2022) ³¹	Who has emitted the most fossil fuels based on population.

To combine the three metrics and arrive at a standard score representing the overall responsibility of a country, we carry out data normalization. The goal of normalization is to bring different metrics onto the same scale to allow unit-less values that can be compared with each other.³²

For this paper we adopted minimum-maximum normalization, wherein the data is normalized on a scale between 0–1.³³ Upon achieving the minimum-maximum scores for each of the three metrics, the average was calculated to determine a country’s overall historical responsibility. A similar method is utilized by composite scoring indices such as the United Nations Human Development Index.³⁴

A detailed description of the methodology and reasoning for the chosen metrics is provided in the Appendix.

6.2 CALCULATING CAPACITY TO PHASE OUT

While the responsibility of a country can be estimated by its production and consumption of fossil fuels, the capacity for a country to phase out can vary based on individual realities.

For example, a petrostate may have a higher responsibility to phase out compared to a developed country, but its economy may be heavily dependent on fossil fuels along with a population that has a lower quality of life. This would mean that a rapid phaseout without the necessary precautions in such a country can adversely affect its people.

Therefore, we include another step of assessing a country's potential to withstand the impact of a phase out on its economy and population wellbeing. Four factors were selected for this:

Table 4: Factors indicating a country's resilience to a fossil fuel phaseout

Economic factors	
GDP Dependence on Fossil Fuels: Fossil Fuel Rents as a % of GDP ³⁵	This is inferred as the dependency of a country's economy on fossil fuels for wealth. Higher the number, higher the dependency and lower the capacity to phaseout.
Economic Diversification Index ³⁶	Inferred as the diversity in a country's sources of income. Higher the number, higher the diversity and higher the capacity to phaseout.
Social factors	
GDP Per Capita in Purchasing Power Parity ³⁷	Inferred as a proxy for the income per person in a country. Higher the number, higher the income, higher the capacity to withstand impacts of a phaseout.
UN Inequality Adjusted Human Development Index ³⁸	Inferred as the overall social development in a country. Higher the number, higher the development, higher the capacity to withstand the impacts of a phaseout.

In order to better compare the capacity of a country with its responsibility, we arrive at a composite score for capacity, combining the four economic and social indicators selected. The methodology to do so is min-max normalization, the same as that used for the responsibility score.

The methodology is further detailed in the Appendix. The Appendix also details the individual positions of countries for the four capacity metrics, to depict how the countries compare to each other.

6.3 WHO MUST LEAD THE PHASEOUT?

The range of composite scores for responsibility and capacity were each divided into three groups denoting the higher, moderate and lower values. The final results are displayed in Table 6, showcasing the countries sequenced in order of their responsibility alongside their capacity to withstand a phaseout.

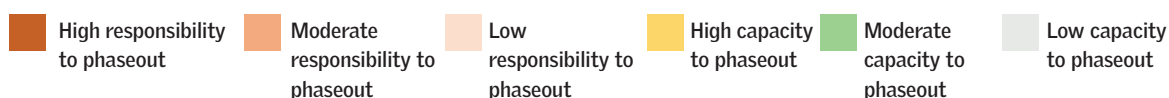
Finally, we summarize Table 6 into a more visually effective representation of the overall urgency with which each of the countries in our dataset are expected to transition away from fossil fuels. The composite scores for responsibility and capacity were divided as per 30th percentile to determine the high-moderate-low categories. Table 5 shows this result as a matrix.

Table 5: Who must lead the phaseout?

	High capacity	Moderate capacity	Low capacity
High responsibility	<ul style="list-style-type: none"> • USA • Canada 	<ul style="list-style-type: none"> • Qatar • UAE • Russia • Saudi Arabia • China • Trinidad and Tobago 	<ul style="list-style-type: none"> • Kuwait
Moderate responsibility	<ul style="list-style-type: none"> • Australia • Germany • UK • Norway • Japan • France 	<ul style="list-style-type: none"> • Brunei • Kazakhstan • Poland • Mexico • Argentina • Indonesia 	<ul style="list-style-type: none"> • Iran • South Africa • Iraq • Algeria • India
Low responsibility		<ul style="list-style-type: none"> • Barbados • Brazil • Thailand • Colombia • Vietnam 	<ul style="list-style-type: none"> • Nigeria • Egypt • Bangladesh • Mozambique

Table 6: The sequence of countries listed from highest to lowest responsibility to lead a fossil fuel phaseout, with their corresponding capacity to phaseout

COUNTRY	RESPONSIBILITY TO PHASEOUT	CAPACITY TO PHASEOUT
Qatar	0.688	0.61
USA	0.600	0.86
United Arab Emirates	0.470	0.62
Kuwait	0.413	0.37
Russia	0.366	0.53
Saudi Arabia	0.320	0.47
Canada	0.300	0.70
China	0.294	0.67
Trinidad and Tobago	0.277	0.64
Australia	0.251	0.67
Brunei	0.232	0.63
Kazakhstan	0.175	0.44
Germany	0.168	0.83
UK	0.161	0.76
Norway	0.141	0.70
Poland	0.132	0.63
Iran	0.129	0.30
Japan	0.116	0.73
South Africa	0.116	0.41
France	0.097	0.74
Mexico	0.084	0.53
Iraq	0.066	0.16
Argentina	0.064	0.55
Algeria	0.061	0.40
Indonesia	0.057	0.44
India	0.053	0.42
Nigeria	0.044	0.26
Barbados	0.041	0.56
Brazil	0.038	0.47
Thailand	0.035	0.54
Colombia	0.033	0.43
Egypt	0.032	0.40
Vietnam	0.014	0.53
Bangladesh	0.002	0.37
Mozambique	0.000	0.24



Source: CSE Analysis

6.4 WHAT DO OUR RESULTS SAY ABOUT THE COUNTRY GROUPS?

6.4.1 DEVELOPED COUNTRIES MUST LEAD THE PHASEOUT IN THE SHORT-TERM

Our analysis makes it clear that if there is any country that absolutely needs to phase out fossil fuels based on historical responsibility and can afford to do so with little to no consequences, it is the USA and Canada. Other developed nations—Australia, Norway, Germany, UK, France—have reduced their historical responsibility due to uptake of clean energy in their domestic requirements and possess enough capacity to transition completely. These countries however, continue to benefit financially and socially from the use of fossil fuels and do not push for an immediate phaseout in the Global North.

In fact, the G7 countries, which include Australia, Norway, Germany, UK, and France among others and represent some of the world's wealthiest nations, have not yet committed to a collective date for phasing out coal.³⁹ Instead, these countries are some of the loudest voices in favour of technologies like carbon capture and storage.⁴⁰ They also push for more scrutiny on the emissions of emerging economies, demanding stronger mitigation targets from all. All this, while their own emissions have fallen only negligibly compared to the reductions required based on their responsibility.

Another key point to note in light of equity is the provision of finance. According to Article 9 of the Paris Agreement, developed countries are required to provide means of implementation including, climate finance to developing countries.⁴¹ Not only did the allocation of USD 100 billion per year by 2020 remain unfulfilled till 2022, but most finance that they have provided to the Global South have largely been in the form of loans.⁴² In climate negotiations, developed countries demand that more countries be asked to contribute to climate finance, including emerging

emitters, instead of committing to a quantum and timeline.⁴³ As such, developed countries are fulfilling neither their responsibility to lead the fossil fuel transition nor the responsibility to financially enable the transition in developing nations.

The biggest defaulters:

USA: The USA remained the biggest historical emitter in 2022, simultaneously being the leading oil exporter in 2023 for the sixth consecutive year. At multilateral fora such as COP, the country is among those pushing for a cessation on coal use and production but does not support similar negotiations on oil and gas.

Canada: The country aims to be a net zero emitter by 2050 but has oil and gas expansions planned well into 2030 according to the UNEP Production Gap Report. According to an analysis by Environmental Defence Canada, the country also continues to invest public money into the fossil fuel industry, with USD 18.6 billion provided in 2023. At the multilateral fora, Canada specifically calls for a phaseout of 'unabated' fossil fuels and for stronger mitigation targets from emerging emitters.

Those who can phase out, but do not commit:

Australia: Australia is the second largest global exporter of thermal coal and liquefied natural gas and plans to support gas even beyond 2050. Recent reports suggested that the country exports three times more oil than UAE and earned about USD 300 billion from fossil fuels in the 2022–23 financial year.

Norway: Norway has systematically positioned itself as a climate leader, touting its renewable power system and scaling back fossil fuel consumption. Behind the smoke and mirrors, lies the bitter truth that the country is the fifth largest oil and third largest gas exporter worldwide. The country even benefitted from the Russia-Ukraine conflict, leading to fossil fuel income being predicted at USD 97 billion in 2022, nearly three times the 2021 number.⁴⁴ All this money goes into the country's Government Pension Fund, now worth about USD 250,000 per Norwegian citizen.

Germany, Japan, UK, France, Poland: Germany and Japan both continue to depend on coal for their energy demands. While Germany has proposed a conditional coal phaseout timeline of 2035, Japan is the only G7 country with no such phaseout year. In fact, Japan, which does not produce fossil fuels but is import-dependent, also endorses coal power plants fitted with ammonia co-firing as an 'abatement' measure. UK and France both have had more than 50 per cent of their energy requirements being met using low-carbon sources in recent years. Both countries, however, align with the narrative pushed by developed countries at multilateral fora for a coal phaseout and use of gas as a transitional fuel. Poland is a uniquely placed developed country in that it still derives nearly 70 per cent of its domestic power from coal. The country announced in 2024 that it is planning to set a coal phaseout date, marking a change in previous narratives from the government.

Russia: Russia has the world's largest natural gas reserves and is a key fossil fuel exporter. After its conflict with Ukraine, Russia faced sanctions that dropped its key importers like the EU. However, many developing countries have now made new gas deals with Russia at the same time, securing its position as a producer. Russia has vocally been against a fossil fuel phaseout and foresees a gas production growth to 1 trillion cubic meters per year by 2035.

6.4.2 PETROSTATES: KEY PLAYERS FOR A SUCCESSFUL PHASEOUT OF FOSSIL FUELS

Petrostates are economies that are heavily dependent on the production and export of oil and natural gas. They are key players for a successful fossil fuel transition. The wealth accrued by these countries from fossil fuels has also made them some of the wealthiest nations in the region. Their 'moderate capacity' status is primarily due to their extreme economic dependence on oil and gas, signaling the need to explore economic diversity and policies to support the same.

When discussing petrostates, some have sufficient access to economic well-being due to their reliance on fossil fuels, while others grapple with a dual challenge of economic dependence

on fossil fuels and lower levels of human development. The need to streamline economic and social systems in a just manner to be compatible with a low-carbon economy is a requirement for these countries.

Petrostates often argue against mentions of a fossil fuel phaseout, given that it can weaken producer countries. This is not completely wrong; recent findings indicate that a fossil fuel phaseout could cause losses of nearly USD 8 trillion.⁴⁵ This fiscal hit to economies would inevitably impact social wellbeing. A phaseout in these nations therefore has to be well managed and just, in the medium term.

At the same time, it is important for petrostates to reconsider lofty fossil fuel expansion plans and start incorporating more renewable energy into their domestic needs. The plan for a transition has to be immediate.

The biggest producers:

Qatar: Qatar hosts a huge amount of proven oil reserves and has become a more lucrative natural gas export partner for Europe, USA and Australia, especially since the Russia-Ukraine conflict. Qatar's greater wealth better positions it to develop oil and gas infrastructure and its massive reserves enable production at scale. Easy surface access to oil also makes their production less carbon-intensive, making them up one of the 'cleanest producers' as per the IEA. The country plans to expand gas production by one third by 2026.

UAE: The UAE, which hosted COP28 where the groundbreaking call for transitioning away from fossil fuels was made, has built its economy predominantly on fossil fuel wealth. In fact, the country has plans to continue expanding its oil and gas operations well into 2050. Earlier UAE has joined other OPEC countries to focus on phasing out 'emissions' from fossil fuels and not the fuel sources themselves, seemingly advocating for abatement technologies. A recent investigation by Global Witness revealed that state oil

company ADNOC had explored fossil fuel deals amounting to Euro 92 billion at COP28.

Saudi Arabia: Saudi Arabia is the second largest oil producing country and the government-owned Saudi Aramco produces one out of every ten barrels of oil globally. The country, along with OPEC, resists specific calls for a global fossil fuel phaseout and is also said to have invested in research projects focused on carbon capture and other abatement technologies. The country has referred to the COP28 call for a fossil fuel transition as a 'menu' of options and not a specific directive.

Kuwait: Kuwait opposed the proposal of a fossil fuel phaseout in the COP28 Global Stocktake text and aims to ramp up its current oil production from 2.9 million barrels per day to four billion barrels by 2035. Its sustained production makes it a good candidate to lead a phaseout. However, its exclusive economic dependence on oil and gas makes phaseout precarious.

Those who can phaseout with caution:

Brunei: Brunei has an economy that is historically dependent on fossil fuel exports. Overseas investments, income from domestic production and a smaller population has led to a higher GDP per capita for Brunei. As a result, Brunei has high levels of social development, including education, health and wellness, and quality of life for its people.

Kazakhstan: Despite targets to shift to renewable energy, Kazakhstan has plans to expand coal, oil and gas production. The earliest phaseout year for coal-fired thermal power plants mentioned by the government is 2050. Kazakhstan is described as one of the richest countries in Central Asia. However, due to extreme social and economic inequality among its population, it has moderate capacity to phaseout, according to our analysis.

Mexico: Reports state that since 2018, government officials in Mexico have actively promoted fossil fuel dependence in the

country while stalling penetration of renewable energy. Despite being one of the largest oil producers in the world and a member of OPEC+, poverty and lack of social wellbeing translates to Mexico having only moderate capacity to sustain a phaseout.

Iran, Iraq, Algeria, Nigeria: All four countries are heavily dependent on fossil fuels for income, with little economic diversification. A lower population income and low human development also puts their populations at risk without a planned transition.

6.4.3 EMERGING ECONOMIES: GROWING NATIONS WITH GROWING EMISSIONS

Emerging nations, a subset in the Global South most often represented by the Like-Minded Developing Countries (LMDC), include some of the fastest growing economies. As these countries develop with slow integration of clean energy sources, their fossil fuel use and emissions are bound to grow.

At multilateral negotiations, developed countries argue that it is time for 'emerging emitters' to share equal responsibility in meeting stringent mitigation targets and contributing to climate finance. In response, emerging economies point out that they have the right to develop and attain the economic and social wellbeing that the Global North has achieved historically.

Many emerging economies have built-in renewable energy targets as part of their NDCs and have installed renewable energy capacity at a remarkable pace. Despite this, the integration of renewable energy into the grid has been slow, with fossil fuels, primarily coal, dominating domestic sources. In terms of production, many have, in recent years, announced plans to expand coal, oil and gas.

While they point out that these expansions are justified, given the need for more reliable energy to sustain their population and economy, it is time to rethink the path to development. In a

decarbonized future, newly built fossil fuel infrastructure has a risk of carbon lock-in, stranded assets and associated financial loss.⁴⁶ It is important for these countries to strike a balance between fossil fuel and renewable energy. It is also of importance to specify that for these countries to successfully transition, highly concessional climate finance is a necessity. Along with this, transfer of technology is pertinent to renewable energy percolation.

The fastest growing emissions:

China: China is the world's largest coal producer and importer. In 2005, the country overtook USA in terms of highest annual emissions and has since been the top emitter every year. Much of its uptake in fossil fuels and resulting emissions is attributed to rapid industrial growth in the country, although its massive population pulls down the per capita numbers. In a positive trend, 50 per cent of the increase in global renewable installations in 2023 was driven by China alone. However actual usage has not kept pace and 70 per cent of the country's energy needs still comes from fossil fuels. At this point, the world cannot transition away from fossil fuels unless China makes rapid strides in reducing its use, due to its huge share in the carbon space.

Time to strike a balance:

Argentina: In 2019, Argentina became the first Latin American country to declare a climate emergency. However, following an economic crisis in 2021 and the Russia-Ukraine conflict's impact on global oil, the country opened up gas fields and began developing natural gas infrastructure.

Indonesia: Indonesia generates 60 per cent of its domestic power from coal. It is also emerging as a major industrial hub for the new green economy since 30 per cent of the world's nickel is hosted in the country. Processing nickel is energy-intensive and Indonesia's power grid being dominated by coal means an increase in fossil fuel emissions. Balancing a global rise in EVs with an uptake in

clean energy is key to maintaining the country's economic and social development needs.

South Africa: Nearly 85 per cent of South Africa's energy is generated from coal-fired power plants. However, long power cuts are frequent in the country, and its state-owned power utility Eskom, is cash strapped. South Africa hosts large reserves of important minerals like gold and platinum, and the mining industry demands a lot of energy. Although the country is fit to host wind and solar power, installing renewable capacity has not been a popular option. In recent years as costs of renewable energy have decreased, officials have opened up to increasing clean energy capacity. However, they stress on this happening alongside the use of coal and gas and not in place of them.

India: India still relies on coal for meeting almost 75 per cent of its power generation even as the country installs renewable energy capacity, particularly solar, for meeting its NDC targets. At the same time, to meet growing power demands and energy security needs, India has been expanding thermal power and coal production domestically. It has been instrumental in advocating language at COP that focuses on phasing down 'all fossil fuels' and not singling out coal. The country has also been at the forefront of demanding that developed countries take the lead in the transition.

Brazil: Hydropower is already responsible for more than 60 per cent of Brazil's electricity generation needs. However, the nation hosts a significant share of the world's oil reserves and is a net exporter of oil. In 2023 its decision to join OPEC+ was met with criticism from civil society even as the government assured that its participation in OPEC+ will be to promote the transition to clean energy. In the meantime, the country has announced plans to increase oil production to 5.4 million barrels per day by 2029.

Thailand, Colombia, Vietnam, Egypt: Thailand, Vietnam and Egypt have plans to expand fossil fuel production and use, particularly following the narrative of natural gas being a transition fuel.

Uptake of renewable energy has been slow but gradually rising. Colombia which signed the Fossil Fuel Non-Proliferation Treaty in 2023 has announced at the Bonn Climate Conference in 2024 that it has stopped all expansion projects.

6.4.4 LEAST DEVELOPED COUNTRIES AND ISLAND NATIONS: MINIMUM CONTRIBUTION, MAXIMUM IMPACT

The negotiation blocs representing the Least Developed Countries (LDCs) and the Alliance of Small Island States (AOSIS) include nations that have contributed minimally to global emissions yet face severe impacts of climate change. Due to their lower development status and reliance on fossil fuel imports, none of the LDCs showed up in our analysis as responsible for leading the phaseout.

Among the two island nations examined, Barbados showed low responsibility and moderate capacity to phase out fossil fuels. This is largely due to its small population and economic reliance on fossil fuel imports. In contrast, Trinidad and Tobago, an oil and gas exporter, was identified as having high responsibility due to its fossil fuel wealth. Despite its high social development, the nation also has moderate capacity to phase out fossil fuels.

Our analysis raises the question regarding island states—while it is true that disproportionately they face their minimal contribution to climate change and disproportionate vulnerability to its impacts (as seen with Barbados), how should we approach cases like Trinidad and Tobago in fossil fuel phaseout plans?

Trinidad and Tobago: The only country in this group to show up among the highly responsible, Trinidad and Tobago is the largest oil and natural gas producer in the Caribbean. The government spends nearly 3.8 per cent of its GDP on social assistance spending, much higher than its regional average. Its high production of fossil fuels and higher social development factors therefore make it a country with moderate capacity to phaseout.

Barbados: Barbados aims to phaseout all fossil fuels by 2030, and become the first 100 per cent fossil fuel-free island nation in the world. Although currently dependent on fossil fuel imports for energy needs, Barbados has remained at the forefront of demanding climate finance reforms and a global fossil fuel transition.

Mozambique, Bangladesh: The discovery of gas deposits in Mozambique sparked a rush of investments, positioning gas deals as a key development strategy for the country. However, reports indicate that the benefits from these investments will only materialize in the long term, while in the short term, Mozambique faces social vulnerability and economic debt due to unfavourable deals.

Meanwhile, Bangladesh, one of the most climate-vulnerable countries globally, heavily relies on fossil fuel imports. It advocates for a fossil fuel phaseout led by developed countries.

7. A rules-based system for the way forward

As of 2022, 760 million people worldwide did not have access to electricity.⁴⁷ This means that many people, particularly in developing countries, are yet to experience the advantages of social and economic progress that comes with reliable, affordable energy. Developed countries were able to get a jumpstart on fossil fuel-driven growth which is perceived to be more reliable and continues to be economically and geopolitically viable. It is not surprising then that countries in the Global South want to have their fair chance at a similar pace of development using the same blueprint. However, there is a need for this blueprint of economic growth to be reinvented so that it is low carbon and affordable. This reinvention must be led by the developed countries that are historically responsible for driving climate change. At the same time, as countries who have benefited immensely from fossil fuels, developed countries must finance the low-carbon transformation globally, enabling the change.

Our findings propose a potential sequence to hold countries accountable to leading the fossil fuel transition. Through this methodology, we propose a rules-based system for climate governance. In such a scenario, the countries who have benefited the most at the expense of others—developed countries—would be the first to phase out. Such a sequence was originally a part of the UNFCCC process, where Annex I countries were identified⁴⁸, with the intention of time-bound emission reduction targets to reflect their responsibility.

According to our results (see *Table 5: Who must lead the phaseout?*), it is these Annex I countries who not only have high to medium responsibility but are the only ones with the highest capacity to phase out.

A rules-based system would also hold countries accountable to phasing out polluting fuels once they reach a certain threshold. For example, the high responsibility, medium-to low-capacity countries in our list would be required to set up time-bound targets for economic diversification and transitioning to low carbon alternatives. This would include petrostates with fossil fuel dependent economies and even countries like China who have had massive emissions growth and reached the levels of historical polluters.

Similarly, it could mean that developing countries with medium-to-low responsibility and medium-to low-capacity should have access to the remaining carbon budget, while simultaneously receiving high quality finance from the developed countries to support their low carbon transition.

While the GST put forth the call for a transition away from fossil fuels, it is imperative that countries take steps towards the transformation in an equitable manner. Our results suggest a potentially viable mechanism to discern the order in which this must happen. Following constructive steps towards this transition will ensure the development of an actionable framework for the future.

Appendix: Detailed Methodology for Section 6

CALCULATING HISTORICAL RESPONSIBILITY

Table 7: Indicators used to calculate the historical responsibility score

Historical Responsibility Composite Score	
Cumulative Fossil Fuels Production (1965–2022)	Who has produced the most fossil fuels.
Average Fossil Fuels Consumption Per Capita (1965–2022)	Who has consumed the most fossil fuels based on population size.
Average Historical Per Capita CO ₂ Emissions (1965–2022)	Who has emitted the most fossil fuels based on population.

Fossil fuel production data was acquired from the 2023 Statistical Review of World Energy. The sum total of production values of coal, oil and gas between 1965–2022 was obtained for each country in the dataset. Since produced fossil fuels can be traded and not all the fuel produced is used by the population in a country, we have not taken a per capita value for this indicator.

Fossil fuel consumption data was acquired from the 2023 Statistical Review of World Energy and divided by population data acquired from the World Bank to arrive at per capita values. The average consumption per capita of coal, oil and gas between 1965–2022 was derived for each country in the dataset. Since consumption implies the usage of fossil fuels within a country, we have distributed the value across its population to achieve a more equitable representation based on different population sizes.

Per capita emissions are derived by dividing the total emissions of a country (obtained from Global Carbon Project) by its population (obtained from World Bank). To avoid double counting in the data, we have considered only per capita and not total emissions. The

decision to omit total emissions as a metric is based on achieving a more equitable representation of a country emissions based on the differences in population sizes.

To combine the three metrics and arrive at a standard score representing the overall responsibility of a country, we carry out data normalization. The goal of normalization is to bring different metrics onto the same scale to allow unit-less values that can be compared with each other. For this paper we adopted minimum-maximum normalization, wherein the data is normalized on a scale between 0 to 1. A similar method is utilized by composite scoring indices such as the United Nations Human Development Index.

Normalization was carried out for each of the three indicators separately, with the following formula:

$$\frac{(\text{country value} - \text{minimum value of range})}{(\text{maximum value of range} - \text{minimum value of range})}$$

Upon achieving the min-max normalization scores for each of the three metrics, the average of the three was calculated to determine a country's overall historical responsibility.

The results in decreasing order were as follows:

The median responsibility score of the range was considered as the midpoint, calculated to be 0.116. Countries scoring above this threshold were deemed highly responsible to lead a rapid phaseout, while those below were considered not responsible to initiate such a phaseout.

DETERMINING A COUNTRY’S CAPACITY TO PHASE OUT ALONGSIDE RESPONSIBILITY

The indicators used to calculate the phaseout capacity score are:

Table 8: Indicators used to calculate phaseout capacity

Economic Factors	
GDP Dependence on Fossil Fuels: Fossil Fuel Rents as a % of GDP	Inferred as the dependency of a country’s economy on fossil fuels for wealth. Higher the number, higher the dependency, and lower the capacity to phase out.
Economic Diversification Index	Inferred as the diversity in a country’s sources of income. Higher the number, higher the diversity and higher the capacity to phaseout.
Social Factors	
GDP Per Capita in Purchasing Power Parity	Inferred as a proxy for the income per person in a country. Higher the number, higher the income, higher the capacity to withstand the impacts of a phaseout.
UN Inequality Adjusted Human Development Index	Inferred as the overall social development in a country. Higher the number, higher the development and higher the capacity to withstand the impacts of a phaseout.

GDP dependence on fossil fuels data was obtained from the fossil fuel rents as a percentage of the GDP dataset as provided by the World Bank. The average of the last seven years (2015–2021) was taken as the dependence for each country. A shorter timeline was taken to represent recent trends.

The Economic Diversification Index for the 2022 was obtained from the Mohammed bin Rashid School of Government’s report. The numbers were picked up as represented in the report. The report did not provide numbers for the island nations of Barbados and Trinidad and Tobago.

GDP per capita in purchasing power parity (PPP) was obtained as a dataset from the World Bank. The average of the last seven years (2015–2021) was taken as the value for each country. A shorter timeline represents recent trends.

The UN IHDI score of 2022 for each country was obtained from the UNDP dataset. Inequality adjusted scores were selected over the aggregated HDI score to represent variability in income within the country’s populations.

COUNTRY	RESPONSIBILITY TO PHASEOUT	COUNTRY	RESPONSIBILITY TO PHASEOUT
Qatar	0.688	South Africa	0.116
USA	0.600	France	0.097
United Arab Emirates	0.470	Mexico	0.084
Kuwait	0.413	Iraq	0.066
Russia	0.366	Argentina	0.064
Saudi Arabia	0.320	Algeria	0.061
Canada	0.300	Indonesia	0.057
China	0.294	India	0.053
Trinidad and Tobago	0.277	Nigeria	0.044
Australia	0.251	Barbados	0.041
Brunei	0.232	Brazil	0.038
Kazakhstan	0.175	Thailand	0.035
Germany	0.168	Colombia	0.033
UK	0.161	Egypt	0.032
Norway	0.141	Vietnam	0.014
Poland	0.132	Bangladesh	0.002
Iran	0.129	Mozambique	0.000
Japan	0.116		

To combine the four metrics and arrive at a standard score representing the overall capacity to phaseout of a country, we carry out data normalization. The goal of normalization is to bring different metrics onto the same scale to allow unit-less values that can be compared with each other.

Normalization was carried out for each of the three indicators separately, with the following formula:

$$\frac{(\text{country value} - \text{minimum value of range})}{(\text{maximum value of range} - \text{minimum value of range})}$$

Upon achieving the min-max normalization scores for each of the four metrics, the average of the three was calculated to determine a country's overall phaseout capacity.

COUNTRY	CAPACITY TO PHASEOUT	COUNTRY	CAPACITY TO PHASEOUT
USA	0.86	Russia	0.53
Germany	0.83	Saudi Arabia	0.47
UK	0.76	Brazil	0.47
France	0.74	Kazakhstan	0.44
Japan	0.73	Indonesia	0.44
Canada	0.70	Colombia	0.43
Norway	0.70	India	0.42
Australia	0.67	South Africa	0.41
China	0.67	Egypt	0.40
Trinidad and Tobago	0.64	Algeria	0.40
Poland	0.63	Bangladesh	0.37
Brunei	0.63	Kuwait	0.37
United Arab Emirates	0.62	Iran	0.30
Qatar	0.61	Nigeria	0.26
Barbados	0.56	Mozambique	0.24
Argentina	0.55	Iraq	0.16
Thailand	0.54		
Vietnam	0.53		
Mexico	0.53		

The results in decreasing order were as follows:

Both composite scores were then categorized based on the 30th percentile to arrive at blocks of high-moderate-low numbers. The sequence of countries was determined based on historical responsibility while capacity denotes the ability of a country to phaseout based on current circumstances.

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The transition away from fossil fuels needs to be done in a differentiated manner, with developed countries taking the lead, in line with the principles of equity and common but differentiated responsibilities. However, the 2023 outcome of the first Global Stocktake of the Paris Agreement failed to recognize this. Creating a roadmap for an equitable fossil fuel phaseout must consider both, countries' historical responsibility and current capacities. In this report, we lay out a roadmap for who should lead the transition using key economic, social and energy indicators.



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