



**CM** **CarbonMajors**

The Carbon Majors Database

Launch Report

April 2024



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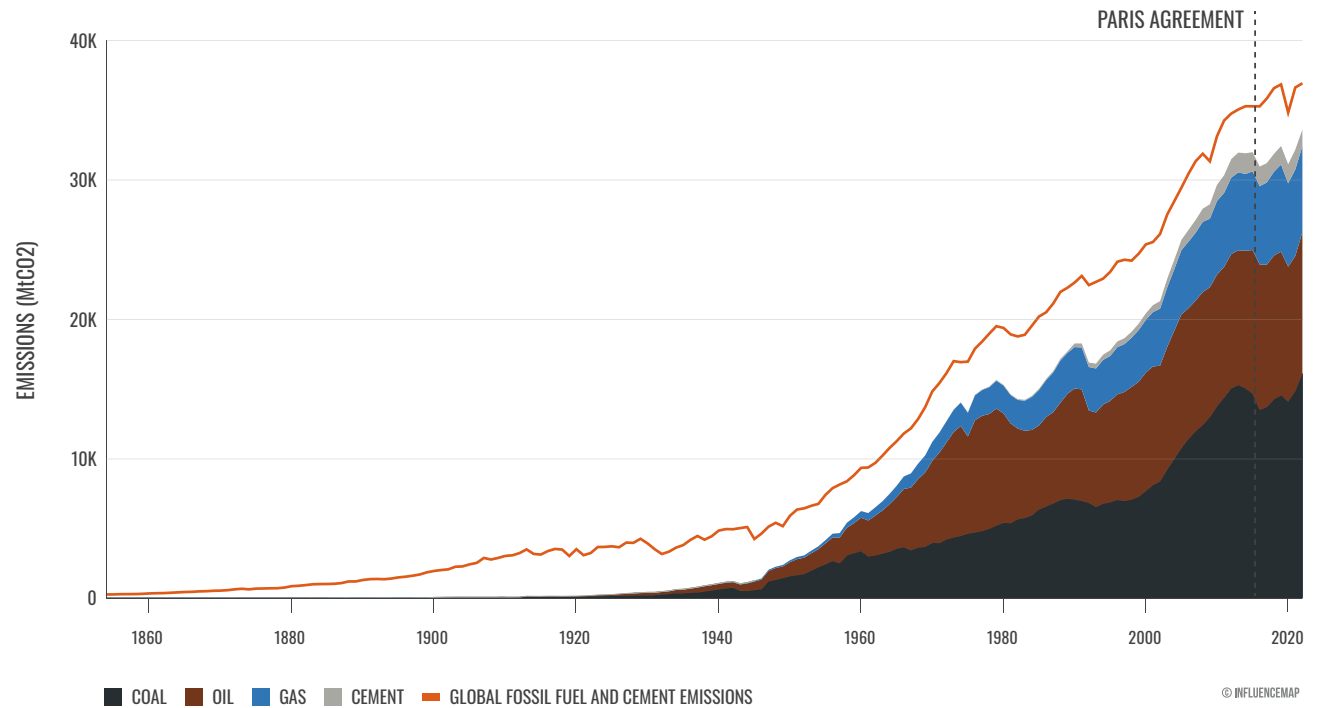
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## Executive Summary

- The Carbon Majors database traces 1,421 GtCO<sub>2</sub>e of cumulative historical emissions from 1854 through 2022 to 122 industrial producers, the CO<sub>2</sub> portion of which is equivalent to 72% of global fossil fuel and cement CO<sub>2</sub> emissions since 1751. Over 70% of these global CO<sub>2</sub> emissions historically can be attributed to just 78 corporate and state producing entities.
- Carbon Majors is a database of historic production data from 122 of the world's largest oil, gas, coal, and cement producers. This data is used to quantify the direct production-linked operational emissions and emissions from the combustion of marketed products that can be attributed to these entities. Carbon Majors was originally released in 2013 by Richard Heede of the Climate Accountability Institute (CAI)<sup>1</sup>. InfluenceMap has since updated and released the database on a new website: [carbonmajors.org](https://carbonmajors.org).

<sup>1</sup> Heede, R. *Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854–2010*. *Climatic Change* 122, 229–241 (2014).

Figure 1: Carbon Majors & Global CO<sub>2</sub> Emissions (1854–2022)

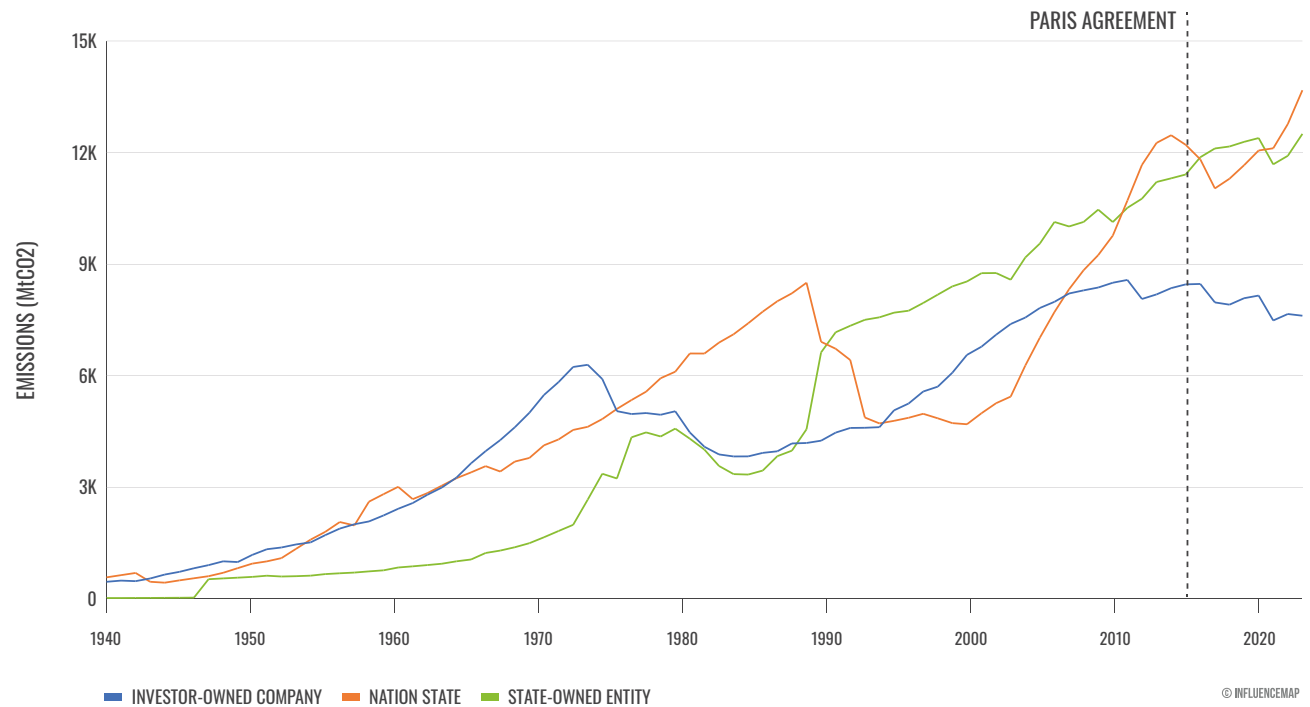


- The Carbon Majors dataset has played a pivotal role in holding fossil fuel producers to account for their climate-related impacts in academic, regulatory, and legal contexts. Examples include quantifying the contribution these entities have made to global surface temperature, sea level, and atmospheric CO<sub>2</sub> rise<sup>2</sup>; and establishing corporate accountability for climate change-related human rights violations<sup>3</sup>.
- The database categorizes entities into three types: investor-owned companies, state-owned companies, and nation-states. Historically, investor-owned companies account for 31% of all emissions tracked by the database (440 GtCO<sub>2</sub>e), with **Chevron, ExxonMobil, and BP** the three largest contributors respectively. State-owned companies are linked to 33% of the database total (465 GtCO<sub>2</sub>e), with **Saudi Aramco, Gazprom, and the National Iranian Oil Company** being the largest contributors. Nation-states account for the remaining 36% (516 GtCO<sub>2</sub>e), with **China's coal production and the Former Soviet Union** the largest contributors.

2 Ekwurzel, B., Boneham, J., Dalton, M.W. et al. *The rise in global atmospheric CO<sub>2</sub>, surface temperature, and sea level from emissions traced to major carbon producers*. *Climatic Change* 144, 579–590 (2017).

3 Commission on Human Rights of the Philippines (2022). *National Inquiry on Climate Change Report*.

**Figure 2: Emissions by Entity Type (1940–2022)**



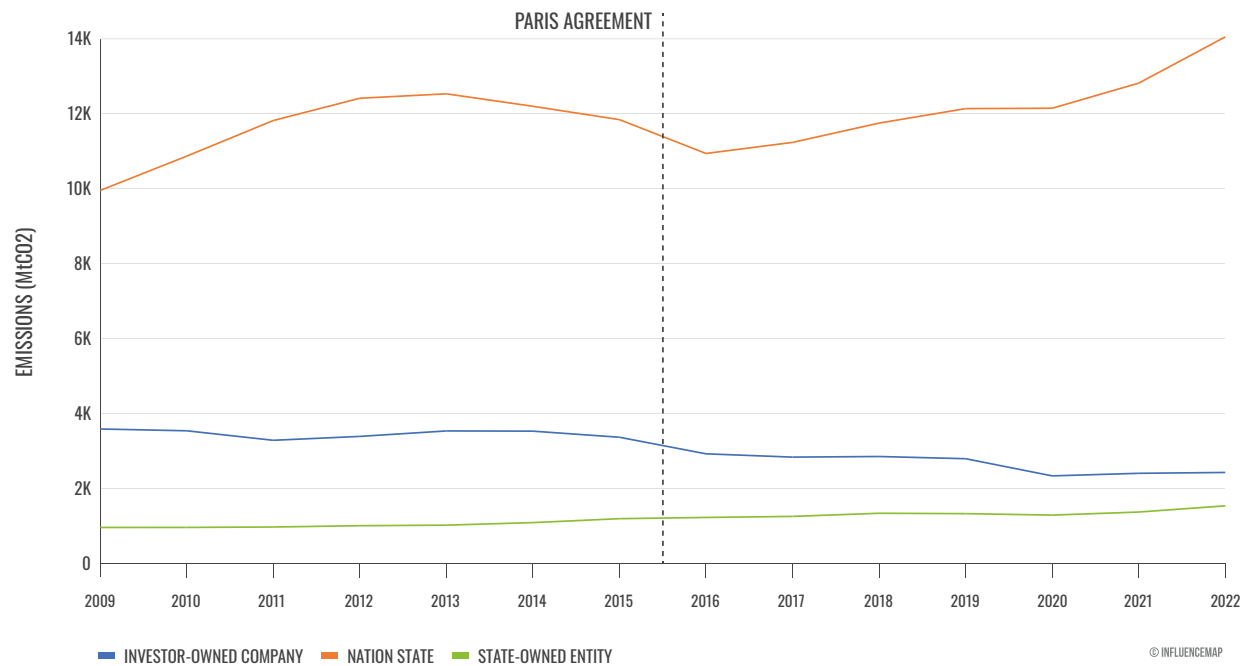
- In the seven years after the Paris Agreement was adopted at the end of 2015, 251 GtCO<sub>2</sub>e of emissions are linked to the 117 extant entities in the database, the CO<sub>2</sub> portion of which is over 88% of total fossil fuel and cement emissions in this time. 80% of these global emissions from

2016 through 2022 can be traced to just 57 corporate and state producing entities. During this period, nation-state producers account for 38% of emissions in the database, while state-owned entities account for 37% and investor-owned companies for 25%.

- The Carbon Majors database finds that most state- and investor-owned companies have expanded their production operations since the Paris Agreement. 58 out of the 100 companies were linked to higher emissions in the seven years after the Paris Agreement than in the same period before. This increase is most pronounced in Asia, where 13 out of 15 (87%) assessed companies are connected to higher emissions in 2016–2022 than in 2009–2015, and in the Middle East, where this number is 7 out of 10 companies (70%). In Europe, 13 of 23 companies (57%), in South America, 3 of 5 (60%) companies, and in Australia, 3 out of 4 (75%) companies were linked to increased emissions, as were 3 of 6 (50%) African companies. North America is the only region where a minority of companies, 16 of 37 (43%), were linked to rising emissions.
- Analysis of the Carbon Majors data shows that there was a shift in coal supply in the seven-year period after the Paris Agreement between investor-owned companies and state-controlled entities. According to the IEA, global coal consumption increased by almost 8% from 2015 to 2022, reaching an all-time high of 8.3 billion tonnes in 2022<sup>4</sup>. This research finds that from 2015 to 2022, CO<sub>2</sub>e emissions linked to investor-owned coal production decreased by 28%, while CO<sub>2</sub>e emissions linked to state-owned companies' and nation-states' coal production increased by 29% and 19%, respectively.

<sup>4</sup> IEA (2023). *Coal Market Update – July 2023*.

**Figure 3: Coal Emissions by Entity Type (2009–2022)**



# Introduction

## Background

In its 2023 [AR6 Synthesis Report](#), the International Panel on Climate Change (IPCC) makes clear the need for a swift phaseout of coal, oil, and gas to stand a chance of keeping global warming below 1.5°C. Meanwhile, the International Energy Agency's (IEA) [Net Zero by 2050](#) report quantifies significant, immediate declines in the use of coal, oil, and gas to give the world an even chance of limiting the global temperature rise to 1.5°C. Despite the landmark Paris Agreement treaty in 2015, the fossil fuel industry continues to expand, while global CO<sub>2</sub> emissions from fossil fuels reached a record high of 37.1 GtCO<sub>2</sub> in 2022, almost 5% higher than in 2015<sup>5</sup>. Current projections estimate that 16% of CO<sub>2</sub> emissions since the start of the Industrial Revolution in 1751 were released in the eight years after the Paris Agreement was adopted at the end of 2015<sup>6</sup>.

Based on current climate policies worldwide, the IEA predicts a path to 2.4°C in its [Energy Outlook 2023](#). The UN revised this figure to 2.8°C, based on the same data, in its [Production Gap Report 2023](#), which tracks the discrepancy between planned fossil-fuel production and what would be consistent with a 1.5°C or 2°C outcome. This year's key observation is that fossil fuel producers are intensifying their production efforts. By 2030, these producers are projected to produce 110% more fossil fuels than they should in a 1.5°C pathway and 69% more than in a 2°C pathway. If carbon dioxide emissions stay at 2022 levels, the carbon budget is projected to be depleted before 2030<sup>7</sup>, even without accounting for emissions from these planned expansions.

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<sup>5</sup> Friedlingstein, P., O'Sullivan, M., Jones, M. W. et al. [Global Carbon Budget 2023](#). *Earth System Science Data*, 15, 5301–5369 (2023).

<sup>6</sup> *Ibid.*

<sup>7</sup> Lamboll, R.D., Nicholls, Z.R.J., Smith, C.J. et al. [Assessing the size and uncertainty of remaining carbon budgets](#). *Nature Climate Change* 13, 1360–1367 (2023).

## Carbon Majors

The Carbon Majors Database was originally released in 2013<sup>8</sup> by Richard Heede of the Climate Accountability Institute (CAI) to show how emissions from the production of fossil fuels and cement can be traced to the companies that produced them. InfluenceMap, in collaboration with the Climate Accountability Institute, has updated and released the Carbon Majors database on a new website, [carbonmajors.org](#), where the database will be updated regularly and remain accessible to users.

The primary focus of the original Carbon Majors project was the accountability of hydrocarbon producers, specifically corporations that consistently generate substantial profits from the extraction and manufacturing of products recognized as the foremost contributors to climate change. Historically, emissions databases at this scale were exclusively established at the national level. Carbon Majors is the first and still the only database to aggregate emissions data on a global scale at the company level. As a result, Carbon Majors added a crucial link in the causal chain, connecting the actions of identifiable defendants to the climate change-related harms suffered by identifiable plaintiffs. The database attributes responsibility to a small group of companies and entities that have made a measurable, demonstrable, and historically important contribution to global warming.

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<sup>8</sup> Heede, R. [Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854–2010](#). *Climatic Change* 122, 229–241 (2014).

Since Carbon Majors' original release in 2013, the database has been used widely and frequently in climate litigation all over the world. Examples include:

- The Commission on Human Rights of the Philippines (CHRP) conducted an inquiry on corporate accountability for human rights violations including the loss of life, livelihood and property in the Philippines associated with the impacts of climate change. The Carbon Majors database played a pivotal role as the crucial piece of evidence in this inquiry. [CHRP's 2022 ruling](#) stated that the Carbon Majors entities were aware of the impacts of their products on the environment, engaged in 'willful obfuscation and obstruction' to prevent meaningful climate action, and are responsible to undertake human rights due diligence and provide remediation. It further recommends that the Carbon Majors entities desist from all activities that undermine climate science; cease exploration of new oil fields, keeping fossil fuels underground and leading a just transition to clean energy; and contribute to finance the implementation of mitigation and adaptation measures; among others.
- Residents of the Indonesian island Pari submitted a [complaint](#) in a Swiss court against Holcim, the Swiss cement corporation. The complainants demanded compensation for climate damages they have suffered, a financial contribution to flood-protection measures, and the rapid reduction of Holcim's emissions.
- The database has been cited in multiple climate lawsuits across the United States, including in [Baltimore](#), [Oregon](#), and [San Francisco and Oakland](#).

The number of new climate litigation cases continues to grow, and the Carbon Majors database will likely continue to play a significant role in this area.

As historical cumulative emissions are the primary driver of climate change, historical source attribution is also critical for a wide range of stakeholders outside of environmental law. The database serves as a key piece of research across various academic and research fields. Examples include:

- [Schleussner et al. \(2023\)](#) determine dollar estimates for climate damages from the 25 biggest oil and gas companies from 1985 to 2018.
- [Grasso and Heede \(2023\)](#) quantify proposed reparations for climate damage by oil, gas, and coal producers.
- [Ekwurzel et al. \(2017\)](#) found that emissions traced to 90 Carbon Majors entities contributed ~57% of the observed rise in atmospheric CO<sub>2</sub>, ~42–50% of the rise in global mean surface temperature, and ~26–32% of global sea level rise from 1880 to 2010.
- [Dahl et al. \(2023\)](#) found that 19.8 million acres or 37% of the total area burned by forest fires across western North America since 1986 can be attributed to 88 of the largest fossil fuel and cement producers.
- [Licker et al. \(2019\)](#) found that emissions traced to the 88 largest industrial carbon producers from 1880 to 2015 contributed ~55% of the historical decline in surface ocean pH values.
- The [Arctic Risk Platform](#) uses the database to investigate and highlight the global risk of Arctic change.

Outside of academia, the Carbon Majors database has also been cited as a source by the [European Banking Authority](#) in its Pillar 3 disclosure requirements on ESG risks, requiring financial institutions to disclose their exposure to the top 20 most polluting companies in the world.

## Methodology

The Carbon Majors database aims to trace greenhouse gas emissions from fossil fuels and cement produced by companies, historically from as early as 1854 to the present. This section gives an overview of the methodology that Carbon Majors uses to achieve this. For a more detailed description of this methodology, including discussion around the accounting protocol, calculation of emissions factors, historical attribution, uncertainties, etc., please refer to Rick Heede's 2014 paper, [Carbon Majors: Methods & Results Report](#)<sup>9</sup>.

### Entity Selection

Greenhouse gas emissions data has historically primarily been collected at the country level. The Carbon Majors database was created to instead link these emissions to fossil fuel production companies, or “carbon majors”: Carbon Majors originally selected extant companies from a variety of sources that met an 8 MtCO<sub>2</sub> per year emissions threshold. Some entities in the database do not meet this threshold, for example, companies that met the threshold when the Carbon Majors project was started but have since shrunk, or smaller companies acquired by larger ones. However, this guideline still applies to ensure a manageable number of entities. The number of entities assessed may vary over time due to mergers and acquisitions, as well as additions to the database.

The assessed entities are divided into three entity types: investor-owned companies, state-owned companies, and nation-state producers. Investor-owned companies include both publicly listed and privately held producers. Nation-state producers

are used primarily in the coal sector and are included only when investor-owned or state-owned companies haven't been established or played a minor role in the relevant country. Examples include North Korea and former Soviet states (the former Soviet Union and separately the Russian Federation, Kazakhstan, Ukraine, etc.). While current production is available for some Chinese coal entities, historic production data is unavailable and it has not been possible to verify the ownership structure of these entities, many of which are reportedly operated or directed by provincial government. Hence, China's coal production has been aggregated and reported as a nation-state. State-owned companies are often partially owned by institutional or individual shareholders. These are considered state owned if more than fifty percent of shares are controlled by the state.

The database also tracks mergers and acquisitions. In such cases, the acquired companies' emissions are attributed to the surviving company. Divestitures are inherently accounted for, as the production from divested assets will not be included in subsequent company disclosures (see Production Data below for further explanation). Assets that have been nationalized or expropriated are also monitored to the extent that equity-owned production is reported accurately by the relevant entities. Breakups of companies are also accounted for. For example, the multiple smaller companies into which the Standard Oil Trust was broken up have evolved to become some of the most recognizable companies in the database today. Some are direct descendants of Standard Oil, like ExxonMobil, with both Exxon and Mobil as descendants separately, and Chevron. Others have resulted from mergers with descendants of Standard Oil, such as BP and ConocoPhillips.

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<sup>9</sup> The data storage and processing methods as well as the output formats have changed. The new data structure is accessible and is explained on the [website](#).



## Production Data

Carbon Majors obtains production data for each entity for each year. Due to the importance of transparency in the Carbon Majors approach, self-reported production data by the producing entity is always preferred to and used instead of any other sources. This includes annual reports, company histories, SEC filings, operation reviews, online datasets on production, etc. However, in some cases, reputable third-party sources are used when self-reported data is unavailable, particularly for national companies that irregularly, inaccurately, or do not publish production data. Alternative, third-party sources include the U.S. Energy Information Administration (EIA), the Keystone Coal Industry Manual, the Oil & Gas Journal (especially the annual OGJ100/150 issues), and others.

For historical data, complete production records are sought and used where applicable. However, for some entities, production data is unavailable from the establishment of the entity, resulting in minor cases of underreporting, as early production is often overshadowed by later company expansions. In such cases, the entity's missing early production data are left empty. This is especially true before the U.S. Securities Act of 1933, which required companies to provide full and accurate financial and operational information. Other data gaps sometimes occur, often due to missing annual reports. In the absence of alternative available data, such gaps are filled through interpolation of surrounding data.

Net production data is preferred to gross, as gross production often includes output from joint ventures, production-sharing partnerships, or a state resource owner. While reporting gross production was common in the 1960s and early 1970s, it tends to overestimate emissions. In such cases, net production is estimated by applying a net-to-gross ratio. State-owned oil and gas companies typically report total production rather than their equity share. This practice can lead to a potential issue of double counting, where production is recorded both as overseas equity production by multinational oil and gas companies and as production by state-owned entities. To

address this, collating data from third-party sources is utilized to adjust self-attributed production. This involves reducing total national production by a percentage corresponding to the portion of production owned by the state.

Due to variations in how companies report production, the reported production data is standardized to a common commodity type, each with a standard unit: Oil & Natural Gas Liquids (million barrels), Natural Gas (billion cubic feet), and Coal (million tonnes).

To improve data accuracy, coal production is further categorized by rank, such as bituminous or anthracite, or by utilization, such as thermal or metallurgical. Preferably, coal rank data reported by the producing entity is used. However, coal rank is frequently reported in generic terms, but often with data on heat content. Using this information, along with the geographical locations of coal mines, enables coal rank categorization when entities fail to do so themselves. If this information is only available for specific years, this coal rank split may be applied to production data outside these years as an estimation.

## Emissions Calculations

### Fossil Fuel Emissions

Emission factors for each fuel type are used to estimate the carbon content released when these fossil fuels are combusted. These emissions factors were mostly derived from Tier 1 defaults from the Intergovernmental Panel on Climate Change's (IPCC) [Guidelines for National Greenhouse Gas Inventories](#). Other sources, including the International Energy Agency (IEA), United Nations, EIA, US Environmental Protection Agency (EPA), and Carbon Dioxide Information Analysis Center (CDIAC), were also consulted.

These emissions factors are then modified by deducting net non-energy uses of each fuel. This is due to some proportion of the fuel produced being refined into products that effectively store carbon, such as various petrochemicals. Non-energy uses vary by a wide variety of factors, however, like other global emissions databases, a common factor must be applied for non-energy uses associated with each fuel type. While this factor is likely reasonably accurate on a global scale, it may not always precisely represent each specific entity's non-energy uses.

Applying this factor to the standardized production results in the emissions from the combustion of marketed products, comprising nearly 90% of total emissions tracked by the database. These are Scope 3 Category 11 emissions, corresponding to "use of sold products", however this has been modified to quantify emissions from each fossil fuel company's net production of oil, gas, or coal as opposed to sold products. This was done to avoid double counting, and deliberately excludes emissions from crude oil purchased from other producers, natural gas purchased for resale, or coal sold on behalf of other producers.

**Table 1: Emission factors for the combustion of oil & natural gas liquids, natural gas, and coal<sup>10</sup>**

Fuel type	Carbon factor	CO <sub>2</sub> factor
Oil & Natural Gas Liquids	101.4 kgC/bbl	371.4 kgCO <sub>2</sub> /bbl
Natural Gas	14.6 kgC/kcf	53.4 kgCO <sub>2</sub> /kcf
Lignite Coal	328.4 kgC/tonne	1,203.2 kgCO <sub>2</sub> /tonne
Sub-Bituminous Coal	495.1 kgC/tonne	1,814.1 kgCO <sub>2</sub> /tonne
Bituminous Coal	665.5 kgC/tonne	2,438.6 kgCO <sub>2</sub> /tonne
Anthracite Coal	715.4 kgC/tonne	2,621.5 kgCO <sub>2</sub> /tonne
Metallurgical Coal	727.4 kgC/tonne	2,665.4 kgCO <sub>2</sub> /tonne
Thermal Coal	581.0 kgC/tonne	2,128.9 kgCO <sub>2</sub> /tonne

Four further direct operational Scope 1 emission types are then estimated:

- Flaring of CO<sub>2</sub> at oil and gas facilities, including various upstream and midstream facilities, relevant to oil and gas production.
- Venting of CO<sub>2</sub> from natural gas processing plants, also relevant to oil and gas production.
- Fugitive methane emissions from coal mines, oil extraction and storage, and gas production, processing, and transportation systems, applicable to oil, gas, and coal production.
- CO<sub>2</sub> emissions resulting from entity's use of their own fuel, limited to gas production, primarily the difference between total gas produced and "gas available for sale".

<sup>10</sup> Emissions factors include deduction for non-energy uses.

Table 2: Emission factors for the vented, flared, and fugitive carbon dioxide and methane, and use of own fuel<sup>11</sup>

Fuel type	Combustion (kgCO <sub>2</sub> /tCO <sub>2</sub> )	Flaring (kgCO <sub>2</sub> /tCO <sub>2</sub> )	Venting (kgCO <sub>2</sub> /tCO <sub>2</sub> )	Fugitive methane (kgCH <sub>4</sub> /tCO <sub>2</sub> )	Fugitive methane (kgCO <sub>2</sub> e/tCO <sub>2</sub> )	Own fuel use (kgCO <sub>2</sub> /tCO <sub>2</sub> )
Oil & Natural Gas Liquids	1,000	15.94	3.83	1.92	53.86	-
Natural Gas	1,000	1.74	28.53	9.88	276.59	57.26
Coal	1,000	-	-	4.03	112.97	-

<sup>11</sup> This analysis uses the IPCC AR5 100-year global warming potential of 28 x CO<sub>2</sub> for methane.

### Cement Emissions

Estimation of CO<sub>2</sub> emissions for cement production differs from that for fossil fuel production. Cement-related emissions are estimated as a proportion of gross emissions reported by the major cement companies to the Cement Sustainability Initiative. This proportion of gross emissions estimates the process emissions from the calcining of limestone into clinker or portland cement and excludes the emissions from fuel and electricity inputs, thus avoiding the double counting of fuels from fossil fuels producers already accounted for in Carbon Majors. From all these calculations, the database tracks the total emissions value in CO<sub>2</sub> equivalent units generated by each entity each year.

### Global Fossil Fuel & Cement Emissions

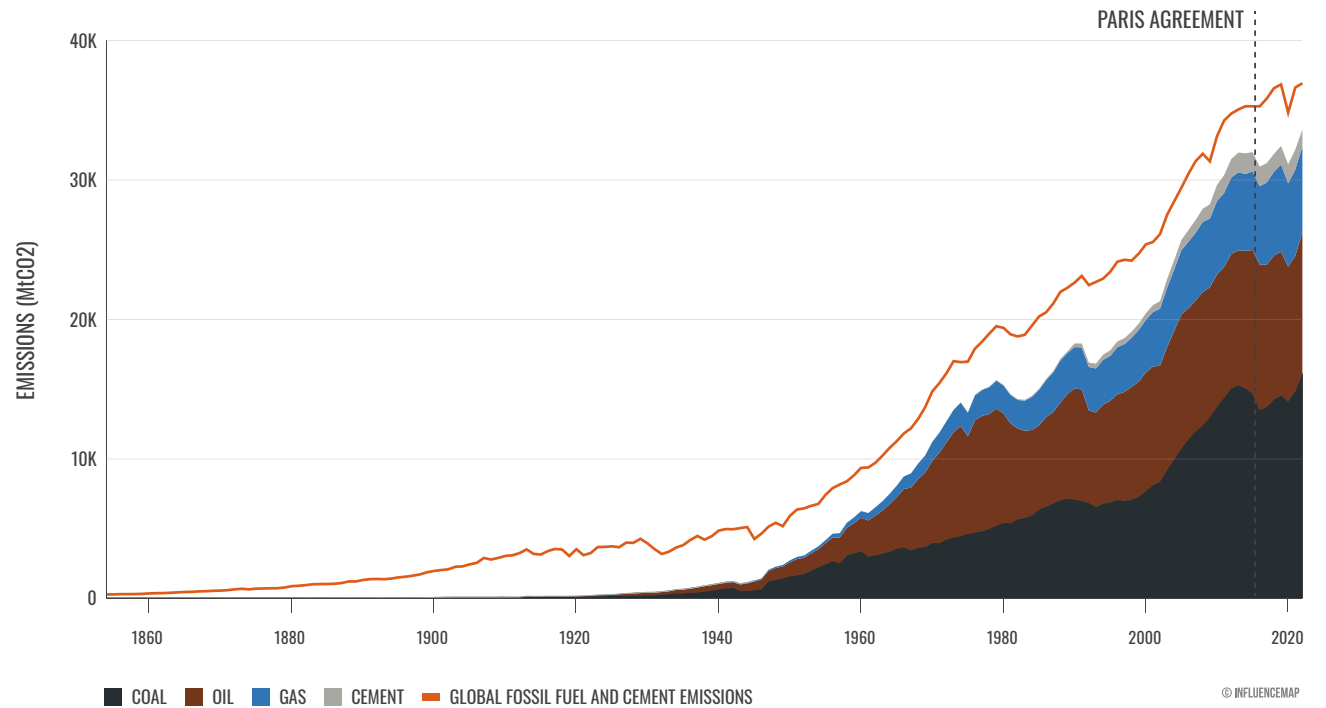
This research compares the emissions tracked by the Carbon Majors database to total fossil fuel and cement emissions since the beginning of the Industrial Revolution in 1751. Data from the Carbon Dioxide Information Analysis Center (CDIAC), and more recently the [Global Carbon Project](#), provides this total, amounting to 1,773 GtCO<sub>2</sub> from 1751 to 2022. The CO<sub>2</sub> emissions figures obtained from the above calculations (excluding fugitive methane CO<sub>2</sub> equivalent emissions) are compared to this total to calculate entities' relative contributions to total global fossil fuel and cement emissions.

## Findings

This section presents analysis of the Carbon Majors database, starting with a historical overview of the data. Entity emissions are then analyzed by the three entity types: investor-owned companies, state-owned companies, and nation-state producers. This section also sets out analysis of global emissions after the Paris Agreement. The final sections focus on emissions by fuel type and by entity region, respectively.

Figure 4 shows the annual CO<sub>2</sub> emissions traced to the carbon fuels and cement produced by the Carbon Majors entities from the beginning of the data records in 1854 to 2022, and compares them to global fossil fuel and cement emissions of CO<sub>2</sub>.

**Figure 4: Carbon Majors & Global CO<sub>2</sub> Emissions (1854–2022)**



## Database Emissions

The Carbon Majors database has quantified and traced cumulative emissions totalling 1,421 GtCO<sub>2</sub>e to the 122 entities within the database. The data spans from 1854 to 2022, with the CO<sub>2</sub> proportion of the database covering over 72% of fossil fuel and cement CO<sub>2</sub> emissions since the start of the Industrial Revolution in 1751. Over 70% of this global total can be traced to just 78 corporate and state producing entities. Table 3 shows the top 20 highest carbon producing entities in the database.

Table 3: Top 20 Carbon Majors entities by emissions (1854–2022)<sup>12</sup>

Entity	Total emissions (MtCO <sub>2</sub> e)	CO <sub>2</sub> emissions (MtCO <sub>2</sub> )	Percentage of global CO <sub>2</sub> emissions
China (Coal)	276,458	248,397	14.0%
Former Soviet Union	135,113	120,875	6.8%
Saudi Aramco	68,832	64,352	3.6%
Chevron	57,898	52,797	3.0%
ExxonMobil	55,105	49,537	2.8%
Gazprom	50,687	41,031	2.3%
National Iranian Oil Co.	43,112	39,282	2.2%
BP	42,530	38,788	2.2%
Shell	40,674	36,528	2.1%
Coal India	29,391	26,408	1.5%
Poland	28,750	25,832	1.5%
Pemex	25,497	23,384	1.3%
Russian Federation	23,412	21,036	1.2%
China (Cement)	23,161	23,161	1.3%
ConocoPhillips	20,222	17,916	1.0%
British Coal Corporation	19,745	17,741	1.0%
CNPC	18,951	17,194	1.0%
Peabody Coal Group	17,735	15,935	0.9%
TotalEnergies	17,584	15,935	0.9%
Abu Dhabi National Oil Co (ADNOC)	17,383	15,929	0.9%

<sup>12</sup> The total emissions values in the table above include fugitive methane emissions in MtCO<sub>2</sub> equivalent units, however only total CO<sub>2</sub> figures are factored into the calculation of an entity's percentage of global fossil fuel and cement emissions.

Carbon Majors has also traced 251 GtCO<sub>2</sub>e to the entities in the database in the seven years after the Paris Agreement, from 2016 until the end of 2022. The total Carbon Majors-tracked CO<sub>2</sub> emissions in this period are equivalent to 88% of global fossil fuel and cement CO<sub>2</sub> emissions. According to the Global Carbon Budget, these seven years contain 12.2% of global fossil CO<sub>2</sub> emissions since 1751 in 2.6% of the time, while 6 of the 10 highest emission years on record have occurred after the Paris Agreement<sup>13</sup>. Of all fossil fuel and cement CO<sub>2</sub> emissions in this time, 80% can be traced to just 57 corporate and state producing entities. Table 4 shows the top 20 carbon producing entities in the seven years after the Paris Agreement was adopted at the end of 2015.

**Table 4: Top 20 Carbon Majors entities by emissions (2016–2022)<sup>14</sup>**

Entity	Total emissions (MtCO <sub>2</sub> e)	CO <sub>2</sub> emissions (MtCO <sub>2</sub> )	Percentage of global CO <sub>2</sub> emissions
China (Coal)	72,993	65,584	25.8%
Saudi Aramco	13,256	12,313	4.8%
Gazprom	10,127	8,297	3.3%
Coal India	8,509	7,645	3.0%
National Iranian Oil Co.	8,176	7,123	2.8%
China (Cement)	8,155	8,155	3.2%
Russian Federation	7,174	6,445	2.5%
Rosneft	5,734	5,262	2.1%
CNPC	4,966	4,359	1.7%
Abu Dhabi National Oil Company	4,746	4,316	1.7%
ExxonMobil	4,086	3,619	1.4%
Iraq National Oil Company	3,695	3,488	1.4%
Shell	3,621	3,162	1.2%
BP	3,513	3,111	1.2%
Sonatrach	3,408	2,901	1.1%
Chevron	3,326	2,946	1.2%
Kuwait Petroleum Corp.	3,046	2,852	1.1%
TotalEnergies	2,877	2,535	1.0%
Petrobras	2,839	2,608	1.0%
Pemex	2,648	2,432	1.0%

<sup>13</sup> Friedlingstein, P., O'Sullivan, M., Jones, M. W. et al. *Global Carbon Budget 2023*. *Earth System Science Data*, 15, 5301–5369 (2023).

<sup>14</sup> The total emissions values in the table above include fugitive methane emissions in MtCO<sub>2</sub> equivalent units, however only total CO<sub>2</sub> figures are factored into the calculation of an entity's percentage of global fossil fuel and cement emissions.

## Emissions by Entity Type

Emissions from the assessed entities are traced to three entity types: investor-owned companies, state-owned companies, and nation-state producers. Nation-state producers are used primarily in the coal sector and are included only when investor-owned or state-owned companies haven't been established or play a minor role in the country. Figure 5 shows how the emissions from each entity type have evolved from 1940 to 2022.

### Investor-owned Companies

Investor-owned companies have played a substantial role in contributing to historical fossil fuel and cement emissions. This analysis has traced 440 GtCO<sub>2</sub>e to the 75 investor-owned companies in the database. The top 5 investor-owned companies, Chevron, ExxonMobil, BP, Shell, and ConocoPhillips are cumulatively linked to 11.1% of all fossil fuel and cement CO<sub>2</sub> emissions since 1751. Just 75 investor-owned companies are linked to 22.3% of these global emissions.

Figure 5: Emissions by Entity Type (1940–2022)

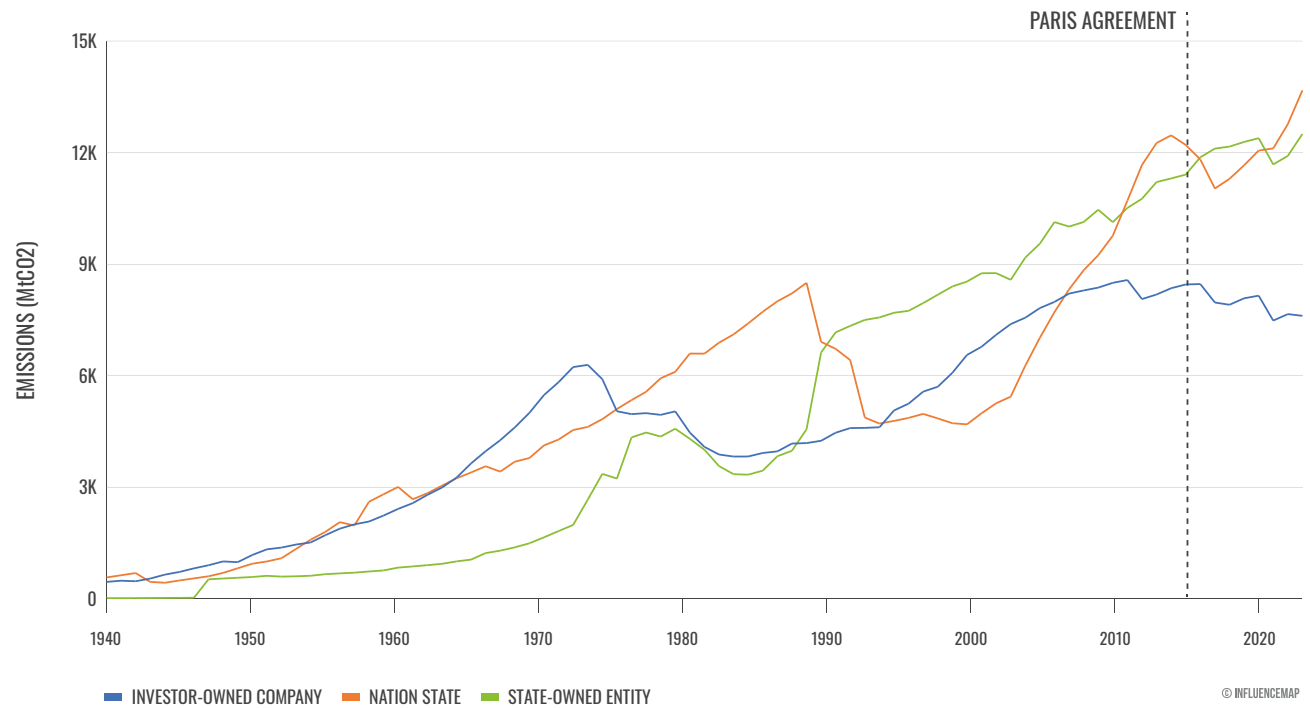


Table 5: Top 10 investor-owned companies by emissions (1854–2022)<sup>15</sup>

Investor-owned company	Total emissions (MtCO <sub>2</sub> e)	CO <sub>2</sub> emissions (MtCO <sub>2</sub> )	Percentage of global CO <sub>2</sub> emissions
Chevron	57,898	52,797	3.0%
ExxonMobil	55,105	49,537	2.8%
BP	42,530	38,788	2.2%
Shell	40,674	36,528	2.1%
ConocoPhillips	20,222	17,916	1.0%
Peabody Coal Group	17,735	15,935	0.9%
TotalEnergies	17,584	15,935	0.9%
Occidental Petroleum	12,907	11,591	0.7%
BHP	11,042	9,903	0.6%
CONSOL Energy	10,490	9,413	0.5%

In the seven years after the Paris Agreement, 62 GtCO<sub>2</sub>e of emissions were traced to investor-owned companies, the CO<sub>2</sub> proportion of which is equal to 21.6% of total fossil fuel and cement CO<sub>2</sub> emissions. While not playing as large a role after the Paris Agreement as historically, these companies are still linked to significant emissions, with each of the top 5 companies by emissions linked to at least 1% of these global CO<sub>2</sub> emissions in this time frame.

<sup>15</sup> Note: The total emissions values in the table above include fugitive methane emissions in MtCO<sub>2</sub> equivalent units, however only total CO<sub>2</sub> figures are factored into the calculation of an entity's percentage of global fossil fuel and cement emissions.

Table 6: Top 10 investor-owned companies by emissions (2016–2022)<sup>16</sup>

Investor-owned company	Total emissions (MtCO <sub>2</sub> e)	CO <sub>2</sub> emissions (MtCO <sub>2</sub> )	Percentage of global CO <sub>2</sub> emissions
ExxonMobil	4,086	3,619	1.4%
Shell	3,621	3,162	1.2%
BP	3,513	3,111	1.2%
Chevron	3,326	2,946	1.2%
TotalEnergies	2,877	2,535	1.0%
Peabody Coal Group	2,394	2,151	0.8%
Glencore	2,313	2,079	0.8%
Lukoil	2,310	2,111	0.8%
Eni	1,752	1,528	0.6%
BHP	1,709	1,545	0.6%

Most investor-owned companies also expanded production in the seven-year period after the Paris Agreement compared to the seven years before its adoption, despite the IPCC making clear the necessity of a rapid shift away from fossil fuels. Of the 66 companies active from 2009 through 2022, 36 (55%) are linked to increased emissions. Despite most of these companies increasing emissions, total investor-owned company emissions decreased from 2016 through 2022. This was driven by a few coal producers significantly reducing emissions.

<sup>16</sup> Note: The total emissions values in the table above include fugitive methane emissions in MtCO<sub>2</sub> equivalent units, however only total CO<sub>2</sub> figures are factored into the calculation of an entity's percentage of global fossil fuel and cement emissions.



## State-owned Companies

Carbon Majors has traced 465 GtCO<sub>2</sub>e of historical emissions to 36 state-owned companies, including Saudi Aramco, Gazprom, Coal India, National Iranian Oil, and others. The CO<sub>2</sub> proportion of this total is equivalent to 23.6% of global fossil fuel and cement emissions. The contribution of the world's largest state-owned companies to total historical emissions is substantial, with 15.5% of global fossil fuel and cement emissions attributable to just the top 10 state-owned producers in the database.

**Table 7: Top 10 state-owned entities by emissions (1854–2022)<sup>17</sup>**

State-owned entity	Total emissions (MtCO <sub>2</sub> e)	CO <sub>2</sub> emissions (MtCO <sub>2</sub> )	Percentage of global CO <sub>2</sub> emissions
Saudi Aramco	68,832	64,352	3.6%
Gazprom	50,687	41,031	2.3%
National Iranian Oil Co.	43,112	39,282	2.2%
Coal India	29,391	26,408	1.5%
Pemex	25,497	23,284	1.3%
British Coal Corporation	19,745	17,741	1.0%
CNPC (PetroChina)	18,951	17,194	1.0%
Abu Dhabi National Oil Co (ADNOC)	17,383	15,929	0.9%
Petroleos de Venezuela	16,901	15,654	0.9%
Kuwait Petroleum Corp.	15,922	14,945	0.8%

<sup>17</sup> The total emissions values in the table above include fugitive methane emissions in MtCO<sub>2</sub> equivalent units, however only total CO<sub>2</sub> figures are factored into the calculation of an entity's percentage of global fossil fuel and cement emissions.

In the seven years after the Paris Agreement, 2016 through 2022, state-owned entities were linked to 95 GtCO<sub>2</sub>e, the CO<sub>2</sub> proportion of which is equivalent to 33.4% of the fossil fuel and cement total in that time. This is a 10% increase from the 86 GtCO<sub>2</sub>e linked to these entities in the seven years preceding the Paris Agreement, 2009 through 2015. This is evidence of expanded extraction activities, with 65% of these entities showing increased production.

**Table 8: Top 10 state-owned entities by emissions (2016–2022)<sup>18</sup>**

State-owned entity	Total emissions (MtCO <sub>2</sub> e)	CO <sub>2</sub> emissions (MtCO <sub>2</sub> )	Percentage of global CO <sub>2</sub> emissions
Saudi Aramco	13,256	12,313	4.8%
Gazprom	10,127	8,297	3.3%
Coal India	8,509	7,645	3.0%
National Iranian Oil Co.	8,176	7,123	2.8%
Rosneft	5,734	5,262	2.1%
CNPC (Petro China)	4,966	4,359	1.7%
Abu Dhabi National Oil Co (ADNOC)	4,746	4,316	1.7%
Iraq National Oil Company	3,695	3,488	1.4%
Sonatrach	3,408	2,901	1.1%
Kuwait Petroleum Corp.	3,046	2,852	1.1%

<sup>18</sup> The total emissions values in the table above include fugitive methane emissions in MtCO<sub>2</sub> equivalent units, however only total CO<sub>2</sub> figures are factored into the calculation of an entity's percentage of global fossil fuel and cement emissions.

## Nation-state Producers

Carbon Majors has tracked 516 GtCO<sub>2</sub>e to 11 nation-state producers contained within the database. The CO<sub>2</sub> emissions from these entities account for 26.3% of the global fossil fuel and cement CO<sub>2</sub> emissions. After the Paris Agreement, from 2016 through 2022, state producers were linked to 93 GtCO<sub>2</sub>e, the CO<sub>2</sub> proportion of which is equal to 33.3% of the global total in that time. This is a 5% increase from the 89 GtCO<sub>2</sub>e linked to these same producers in the seven years prior to the Paris Agreement, 2009 through 2022.

This change has been almost entirely driven by rising Chinese and Russian coal production. Emissions traced to Chinese coal production rose by 3 GtCO<sub>2</sub>e in 2016–2022 compared to 2009–2015, a 4.4% increase. Emissions from Russian production increased by 1.6 GtCO<sub>2</sub>e between the two periods, a 31% increase. A 0.6 GtCO<sub>2</sub> increase was linked to China’s cement production in this period, an 8% increase. Emissions traced to all other producers decreased between these two periods.

**Table 9: Carbon Majors nation-state entities ranked by emissions (2016–2022)<sup>19</sup>**

Nation-state	Emissions (2016–2022, MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions (2016–2022)	Emissions (1854–2022, MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions (1854–2022)
China (Coal)	72,993	25.8%	276,458	14.0%
China (Cement)	8,155	3.2%	23,161	1.3%
Russian Federation	7,174	2.5%	23,412	1.2%
Kazakhstan	1,901	0.7%	7,769	0.4%
Poland	1,686	0.6%	28,750	1.5%
Ukraine	487	0.2%	4,969	0.3%
North Korea	425	0.2%	4,104	0.2%
Czech Republic	406	0.1%	2,737	0.1%
Slovakia	13	<0.1%	104	<0.1%
Former Soviet Union	-	-	135,113	6.8%
Czechoslovakia	-	-	9,618	0.5%

<sup>19</sup> The total emissions values in the table above include fugitive methane emissions in MtCO<sub>2</sub> equivalent units, however only total CO<sub>2</sub> figures are factored into the calculation of an entity’s percentage of global fossil fuel and cement emissions

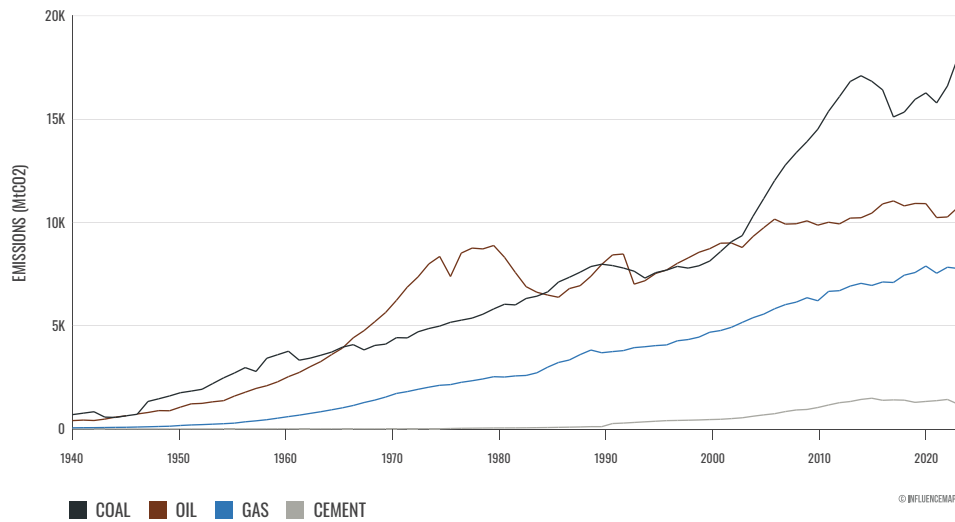
## Emissions by Fuel Type

The Carbon Majors database tracks emissions from the production of four different commodity types: oil & natural gas liquids, natural gas, coal, and cement. As can be seen in Figure 6, cement has played a substantially smaller role than the other fuels. As a result, the analysis in this section is limited to the three carbon fuels.

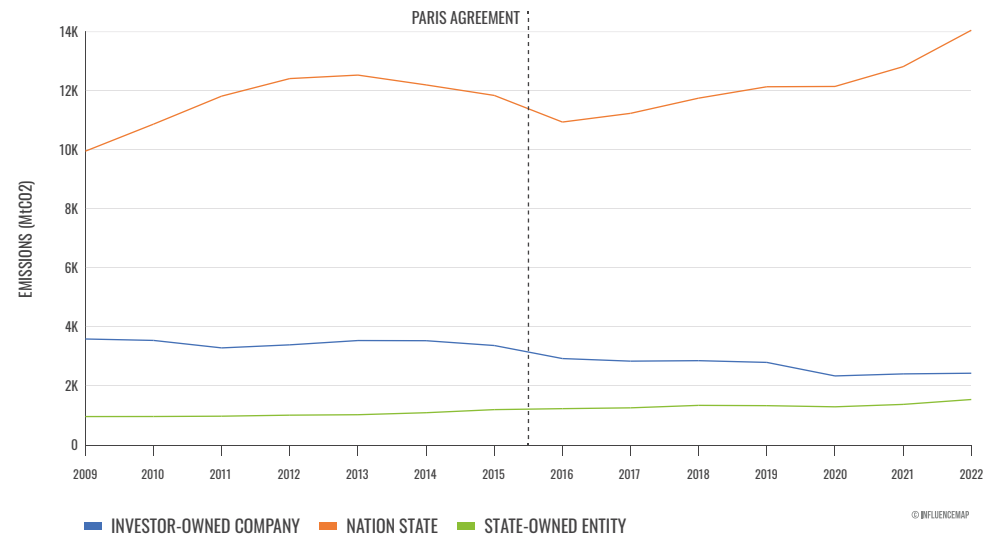
As can be seen in Figure 7, emissions from investor-owned coal production decreased by 939 MtCO<sub>2</sub>e or 27.9% from 2015 to 2022. However, in the same period, emissions from state-owned coal production increased by 343 MtCO<sub>2</sub>e (29%), while emissions from nation-state coal production increased by 2,208 MtCO<sub>2</sub>e (19%). According to the IEA, global coal consumption rose almost 8% from 7.6 billion tonnes in 2015 to an all-time high of 8.3 billion tonnes in 2022. These findings indicate a shift in coal supply from investor-owned companies to state entities.

Emissions associated with oil production remained steady from 2015 to 2022, for both investor-owned and state-owned oil producers. While oil production emissions from state-owned entities experienced a decline in 2020 and 2021, they rebounded in 2022, nearly reaching 2015 levels again. Emissions linked to natural gas production, however, increased from 2016 through 2022, driven by both state-owned and investor-owned gas producers.

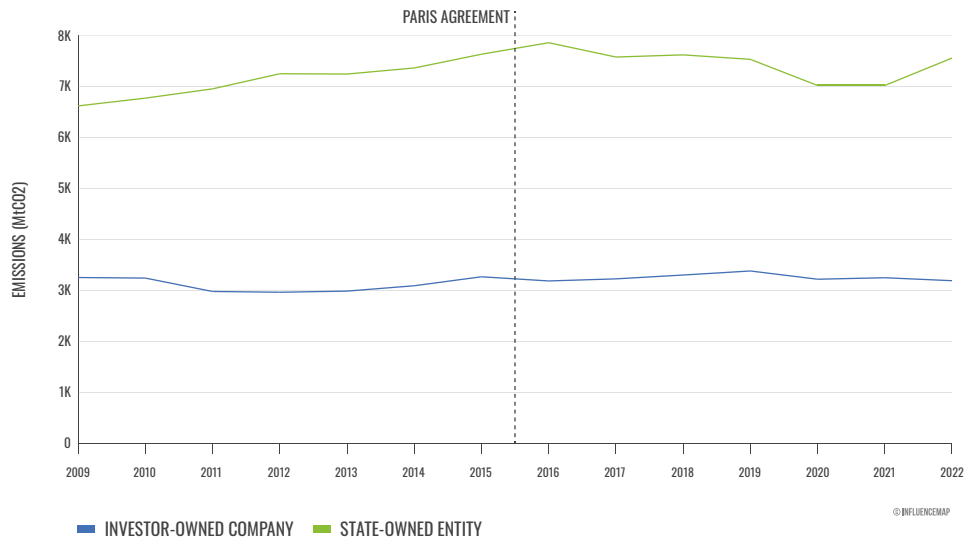
**Figure 6: Emissions by Commodity Type (1940–2022)**



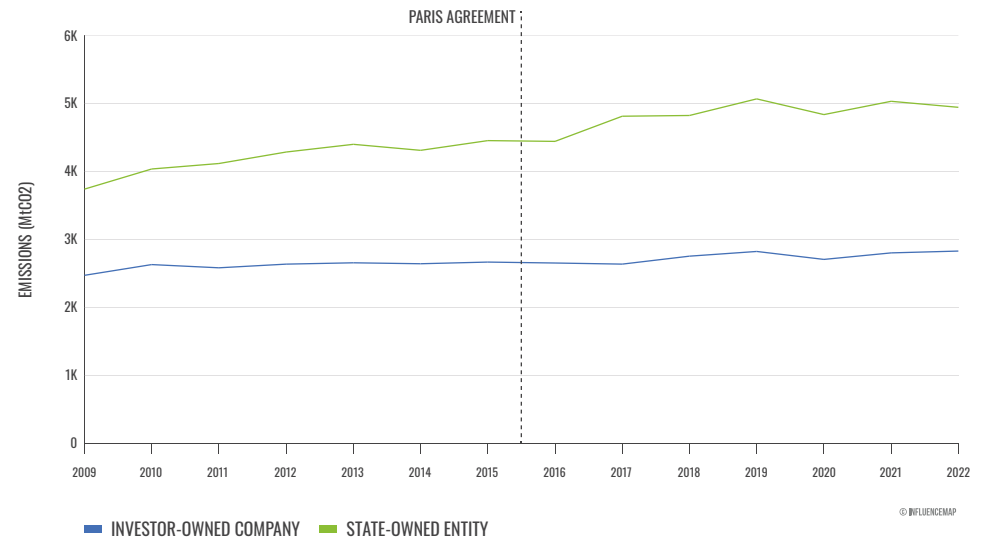
**Figure 7: Coal Emissions by Entity Type (2009–2022)**



**Figure 8: Oil Emissions by Entity Type (2009–2022)**



**Figure 9: Gas Emissions by Entity Type (2009–2022)**



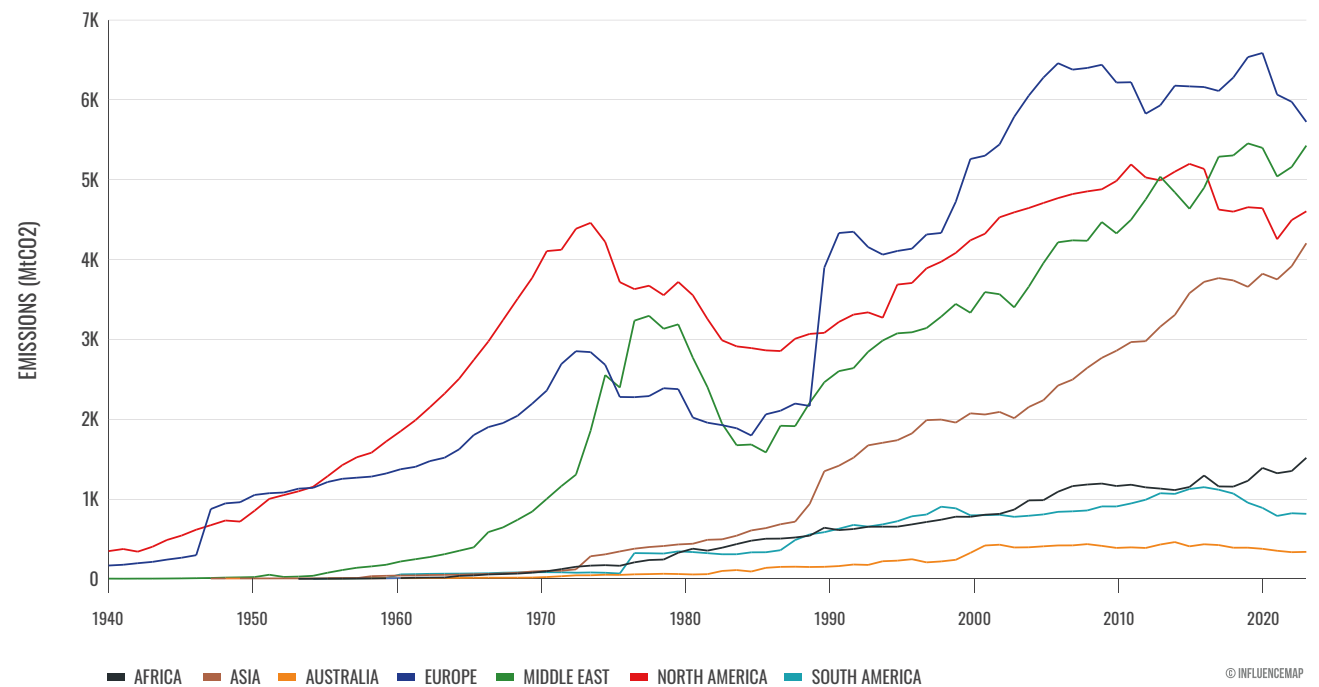
## Company Emissions by Region

This section analyzes the emissions of both investor-owned and state-owned companies by region, categorizing these entities based on the location of their headquarters: Africa, Asia, Australia, Europe, the Middle East, North America, and South America. Figure 10 illustrates emissions from companies in these regions spanning from 1940 to the present.

In the seven years after the Paris Agreement, 2016 through 2022, 58% of investor-owned and state-owned companies have been linked to increased emissions compared with the same period before the Paris Agreement, 2009 through 2015. This trend is most prevalent in Asia, with all 5 Asian investor-owned companies and 8 out of 10 state-owned entities linked to increased emissions. This development has been primarily shaped by rising emissions from Asian coal production, as can be seen in Figure 11. Asian companies have seen a 7.4% overall increase in emissions in the seven years after the Paris Agreement compared to the same period before the agreement.

Expansion after the Paris Agreement is also prominent in Middle Eastern companies, with increased emissions traced to 7 out of the 10 companies in this region, a 12.4% overall increase regionally between the two periods. In Europe, 13 out of 23 companies, and in Africa, 3 out of 6 companies were linked to increased emissions, with an average increase of 4.1% and 7.1%

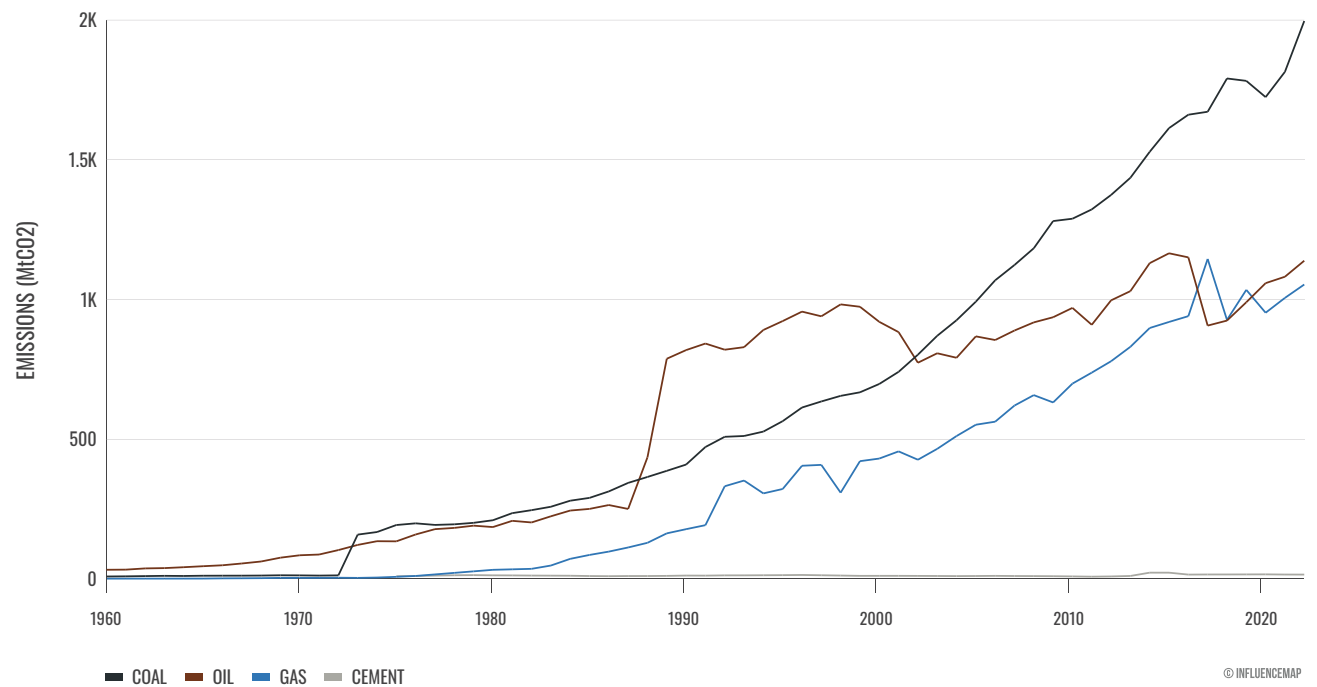
**Figure 10: Company Emissions by Region (1940–2022)**



respectively. 3 out of 4 Australian companies were linked to higher emissions, although BHP's significant decrease in emissions led to an overall decrease in emissions of 10.2%. Similarly, while 3 out of 5 entities in South America increased emissions, Petroleos de Venezuela's large drop pushes the total change in emissions regionally to a 14.4% decrease.

North America was the only region where most companies decreased emissions, with rising emissions traced to only 16 out of 37 companies, for a total decrease in emissions of 11.6% in 2016–2022 compared to 2009–2015. This decrease has primarily been driven by the reduction in production from North American coal companies, with 9 out of 14 North American coal companies linked to lower emissions in 2016–2022 compared to 2009–2015, for a total decrease in emissions of 35.1%.

**Figure 11: Asian Company Emissions by Commodity Type (1960–2022)**



## Policy Engagement

Many of the companies tracked by Carbon Majors are among the most oppositional companies to climate regulation globally, as shown by InfluenceMap’s *LobbyMap* database. The LobbyMap database scores and ranks over 500 companies and 250 industry associations on their activities influencing climate change policy using an A+ to F scale.

### Investor-owned Companies

As shown in Table 10, half of the 10 highest emissions investor-owned companies in the Carbon Majors database score a D- or below, indicating unsupportive positions on climate policy. The other half score only slightly higher at C or C-. Every company in the top 10 has an engagement intensity score above 12%, indicating active engagement with climate policy. 8 out of 10 have intensity scores above 36%, indicating highly active or strategic engagement with climate policy. For example, *Chevron* scores an E+ with an engagement intensity of 51%, and *ExxonMobil* scores a D with an engagement intensity of 53%, indicating that both companies are highly engaged with and hold unsupportive or oppositional positions on climate-related policy.

**Table 10: Top 10 investor-owned companies: LobbyMap policy engagement scores**

Investor-owned company	Performance band	Engagement intensity
<i>ExxonMobil</i>	D	53%
<i>Shell</i>	C	66%
<i>BP</i>	C	64%
<i>Chevron</i>	E+	51%
<i>TotalEnergies</i>	C	55%
<i>Peabody Coal Group</i>	E-	19%
<i>Glencore</i>	D	36%
<i>Lukoil</i>	D-	13%
<i>Eni</i>	C-	42%
<i>BHP</i>	C-	45%



## State-owned Companies

State-owned companies are even more oppositional to climate regulation globally according to [LobbyMap research](#). LobbyMap assesses 6 of the top 10 state-owned Carbon Majors companies by emissions. Of these, none scores higher than a D+, while only 2 receive scores higher than an E+, where D to F indicates increasingly obstructive climate policy engagement.

State-owned companies are also not as transparently engaged as investor-owned companies. The 6 assessed state-owned companies average a 15% engagement intensity compared to 44% for investor-owned companies.

[Saudi Aramco's](#) E+ score with an engagement intensity of 14% is representative of these companies, indicating oppositional positions on climate policy with active engagement.

**Table 11: Top 10 state-owned companies: LobbyMap policy engagement scores**

State-owned company	Performance band	Engagement intensity
Saudi Aramco	E+	14%
Gazprom	E	20%
Coal India	E	9%
National Iranian Oil Co.	-	-
Rosneft	E-	13%
CNPC (Petro China)	D+	26%
Abu Dhabi National Oil Co (ADNOC)	D-	10%
Iraq National Oil Company	-	-
Sonatrach	-	-
Kuwait Petroleum Corp.	-	-

## Conclusion

This analysis of the emissions traced to the world's largest carbon producing entities, or Carbon Majors, provides insights into the responsibility for historical and post-Paris Agreement industrial emissions. The historical overview, spanning from 1854 through 2022, reveals that 70% of fossil fuel and cement CO<sub>2</sub> emissions since the Industrial Revolution can be traced to 78 entities.

Analysis of the post-Paris Agreement period, covering seven years from 2016 until the end of 2022, further demonstrates the outsized impact of a small group of producers that are expanding production. Just 57 entities are linked to 80% of post-Paris Agreement fossil fuel and cement CO<sub>2</sub> emissions, underlining the increasing concentration of carbon contributions. This analysis also highlights the persistent increase in production by the majority of producers within all entity types after the Paris Agreement, despite the urgent need for a transition away from fossil fuels. InfluenceMap's research on policy engagement reveals a clear connection between these high-emitting entities and some of the most globally oppositional positions on critical climate regulation necessary to steer the real economy towards the transition.

The analysis of emissions by fuel type reveals a shift in coal supply dynamics, with emissions from investor-owned coal production decreasing from 2015 to 2022, while state-owned and nation-state coal production has increased. This increase comes despite the IPCC's warning that curbing coal consumption is essential to meeting international climate targets<sup>20</sup>. Likewise, emissions linked to natural gas production increased in the seven years after the Paris Agreement, most substantially by state-owned entities, while oil production emissions remained constant.

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<sup>20</sup> IPCC (2022). *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*

Lastly, regional company analysis highlights companies' lack of emissions reductions globally. The research shows that there are no leading regions when it comes to emissions reductions. Asia and the Middle East stand out as the regions associated with the highest emissions increases, alongside companies from Africa, Europe, and South America. North America is the only region to buck this trend, with a slim majority of companies linked to decreasing emissions.

In summary, the Carbon Majors database offers a comprehensive understanding of the world's largest fossil fuel and cement producers' role in shaping industrial greenhouse gas emissions. In doing so, Carbon Majors provides evidence for the attribution of responsibility for substantial climate impacts to a small group of companies and entities that have made a measurable and demonstrable contribution to global warming.

## Appendix 1: Historical Emissions (1854–2022)

The emissions column in Table 12 includes four direct production-linked operational emission types and emissions from the combustion of marketed products. One of the four direct emission types is fugitive methane (see the Methodology for more information), given in CO<sub>2</sub> equivalent units. In the final column, *Percentage of global CO<sub>2</sub> emissions*, the value for fugitive methane is not considered when comparing an entity's total CO<sub>2</sub> emissions to total fossil fuel and cement CO<sub>2</sub> emissions.

**Table 12: Carbon Majors entities ranked by emissions (1854–2022)**

	Entity	Emissions (MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions
1	China (Coal)	276,458	14.01%
2	Former Soviet Union	135,113	6.82%
3	Saudi Aramco	68,832	3.63%
4	Chevron	57,898	2.98%
5	ExxonMobil	55,105	2.79%
6	Gazprom	50,687	2.31%
7	National Iranian Oil Co.	43,112	2.22%
8	BP	42,530	2.19%
9	Shell	40,674	2.06%
10	Coal India	29,391	1.49%
11	Poland	28,750	1.46%
12	Pemex	25,497	1.32%
13	Russian Federation	23,412	1.19%

	Entity	Emissions (MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions
14	China (Cement)	23,161	1.31%
15	ConocoPhillips	20,222	1.01%
16	British Coal Corporation	19,745	1.00%
17	CNPC (PetroChina)	18,951	0.97%
18	Peabody Coal Group	17,735	0.90%
19	TotalEnergies	17,584	0.90%
20	Abu Dhabi National Oil Company	17,383	0.90%
21	Petroleos de Venezuela	16,901	0.88%
22	Kuwait Petroleum Corp.	15,922	0.84%
23	Iraq National Oil Company	15,188	0.81%
24	Sonatrach	14,955	0.735
25	Rosneft	14,295	0.75%

	Entity	Emissions (MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions
26	Occidental Petroleum	12,907	0.65%
27	BHP	11,042	0.56%
28	Petrobras	10,799	0.56%
29	CONSOL Energy	10,490	0.53%
30	Nigerian National Petroleum Corp.	10,243	0.53%
31	Czechoslovakia	9,618	0.49%
32	Petronas	9,130	0.45%
33	Eni	9,075	0.45%
34	QatarEnergy	8,405	0.42%
35	Pertamina	8,270	0.42%
36	Anglo American	8,163	0.41%
37	Libya National Oil Corp.	8,146	0.43%
38	Arch Resources	7,969	0.40%
39	Lukoil	7,835	0.41%
40	Kazakhstan	7,769	0.39%
41	Equinor	7,739	0.39%
42	RWE	7,585	0.38%
43	Rio Tinto	6,767	0.34%
44	Glencore	6,329	0.32%

	Entity	Emissions (MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions
45	Alpha Metallurgical Resources	6,127	0.31%
46	ONGC India	5,917	0.30%
47	Sasol	4,992	0.25%
48	Ukraine	4,969	0.25%
49	Surgutneftegas	4,735	0.25%
50	Repsol	4,584	0.23%
51	Petroleum Development Oman	4,387	0.22%
52	Sinopec	4,374	0.23%
53	Egyptian General Petroleum	4,318	0.22%
54	TurkmenGaz	4,223	0.19%
55	Petoro	4,174	0.21%
56	CNOOC	4,147	0.22%
57	North Korea	4,104	0.21%
58	Marathon Oil	3,804	0.19%
59	Bumi Resources	3,762	0.19%
60	Devon Energy	3,297	0.16%
61	Singareni Collieries	3,291	0.17%
62	Sonangol	3,281	0.18%
63	Holcim Group	3,173	0.18%
64	Novatek	3,096	0.14%
65	Ecopetrol	3,096	0.16%

	Entity	Emissions (MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions
66	Suncor Energy	3,072	0.16%
67	Hess Corporation	3,026	0.15%
68	Ovintiv	2,993	0.14%
69	Czech Republic	2,737	0.14%
70	Canadian Natural Resources	2,640	0.13%
71	Cyprus AMAX Minerals	2,569	0.13%
72	Westmoreland Mining	2,339	0.12%
73	BASF (Wintershall Dea)	2,313	0.11%
74	American Consolidated Natural Resources	2,240	0.11%
75	Exxaro Resources Ltd	2,160	0.11%
76	Bapco Energies	2,127	0.10%
77	Adaro Energy	2,068	0.10%
78	YPF	2,039	0.10%
79	Cenovus Energy	1,965	0.10%
80	APA Corporation	1,964	0.10%
81	Banpu	1,943	0.10%
82	PetroEcuador	1,922	0.10%
83	EOG Resources	1,806	0.09%
84	Alliance Resource Partners	1,777	0.09%

	Entity	Emissions (MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions
85	Kiewit Mining Group	1,689	0.09%
86	Heidelberg Materials	1,684	0.09%
87	North American Coal	1,644	0.08%
88	Chesapeake Energy	1,609	0.07%
89	Syrian Petroleum	1,578	0.08%
90	Cloud Peak	1,476	0.07%
91	Vistra	1,394	0.07%
92	Teck Resources	1,308	0.07%
93	Inpex	1,256	0.06%
94	Naftogaz	1,252	0.06%
95	Coterra Energy	1,184	0.06%
96	PTTEP	1,080	0.05%
97	OMV Group	1,014	0.05%
98	EQT Corporation	1,001	0.05%
99	Southwestern Energy	982	0.04%
100	Woodside Energy	918	0.04%
101	UK Coal	882	0.04%
102	Cemex	867	0.05%
103	Santos	837	0.04%
104	Pioneer Natural Resources	826	0.04%

	Entity	Emissions (MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions
105	Murphy Oil	765	0.04%
106	Orlen	720	0.04%
107	Antero	606	0.03%
108	Taiheiyo Cement	580	0.03%
109	Continental Resources	455	0.02%
110	Tourmaline Oil	450	0.02%
111	Whitehaven Coal	428	0.02%
112	Navajo Transitional Energy Company	390	0.02%
113	Wolverine Fuels	385	0.02%
114	Seriti Resources	361	0.02%
115	Obsidian Energy	356	0.02%
116	Vale	317	0.02%
117	SM Energy	316	0.02%
118	Adani Enterprises	316	0.02%
119	CNX Resources	227	0.01%
120	CRH	217	0.01%
121	Tullow Oil	211	0.01%
122	Slovakia	104	0.01%

## Appendix 2: Emissions After the Paris Agreement (2016–2022)

The emissions column in Table 13 includes four direct production-linked operational emission types and emissions from the combustion of marketed products. One of the four direct emission types is fugitive methane (see the Methodology for more information), given in CO<sub>2</sub> equivalent units. In the final column, *Percentage of global CO<sub>2</sub> emissions*, the value for fugitive methane is not considered when comparing an entity's total CO<sub>2</sub> emissions to total fossil fuel and cement CO<sub>2</sub> emissions.

**Table 13: Carbon Majors entities ranked by emissions (2016–2022)**

	Entity	Emissions (MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions
1	China (Coal)	72,993	25.79%
2	Saudi Aramco	13,256	4.84%
3	Gazprom	10,127	3.26%
4	Coal India	8,509	3.01%
5	National Iranian Oil Co.	8,176	2.80%
6	China (Cement)	8,155	3.21%
7	Russian Federation	7,174	2.53%
8	Rosneft	5,734	2.07%
9	CNPC	4,966	1.71%
10	Abu Dhabi National Oil Company	4,746	1.70%
11	ExxonMobil	4,086	1.42%
12	Iraq National Oil Company	3,695	1.37%
13	Shell	3,621	1.24%

	Entity	Emissions (MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions
14	BP	3,513	1.22%
15	Sonatrach	3,408	1.14%
16	Chevron	3,326	1.16%
17	Kuwait Petroleum Corp.	3,046	1.12%
18	TotalEnergies	2,877	1.00%
19	Petrobras	2,839	1.03%
20	Pemex	2,648	0.96%
21	Peabody Coal Group	2,394	0.85%
22	Glencore	2,313	0.82%
23	Lukoil	2,310	0.83%
24	Petronas	2,223	0.76%
25	Nigerian National Petroleum Corp.	2,107	0.74%
26	Equinor	1,979	0.68%

	Entity	Emissions (MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions
27	Kazakhstan	1,901	0.67%
28	Eni	1,752	0.60%
29	BHP	1,738	0.61%
30	Petroleos de Venezuela	1,710	0.61%
31	ConocoPhillips	1,709	0.60%
32	Poland	1,686	0.60%
33	QatarEnergy	1,652	0.56%
34	Novatek	1,570	0.51%
35	CNOOC	1,467	0.53%
36	Sinopec	1,441	0.51%
37	Surgutneftegas	1,373	0.50%
38	Bumi Resources	1,355	0.48%
39	TurkmenGaz	1,315	0.42%
40	Occidental Petroleum	1,283	0.46%
41	Canadian Natural Resources	1,137	0.41%
42	Arch Resources	1,129	0.40%
43	Petoro	1,073	0.36%
44	Petroleum Development Oman	1,033	0.36%
45	ONGC India	920	0.32%
46	Pertamina	884	0.30%
47	Anglo American	883	0.31%

	Entity	Emissions (MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions
48	Egyptian General Petroleum	877	0.29%
49	Singareni Collieries	869	0.31%
50	Libya National Oil Corp.	841	0.30%
51	American Consolidated Natural Resources	835	0.29%
52	Sonangol	813	0.30%
53	Adaro Energy	802	0.28%
54	Exxaro Resources Ltd	779	0.28%
55	EOG Resources	778	0.28%
56	Sasol	776	0.27%
57	Cenovus Energy	762	0.27%
58	EQT Corporation	742	0.24%
59	Ecopetrol	728	0.26%
60	Suncor Energy	726	0.27%
61	Repsol	708	0.24%
62	Banpu	707	0.25%
63	RWE	686	0.24%
64	Coterra Energy	675	0.22%
65	Chesapeake Energy	658	0.21%
66	BASF (Wintershall Dea)	654	0.22%
67	Alliance Resource Partners	613	0.22%
68	Devon Energy	608	0.21%



	Entity	Emissions (MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions
69	Southwestern Energy	606	0.19%
70	Bapco Energies	576	0.19%
71	Inpex	553	0.19%
72	Ovintiv	533	0.18%
73	Teck Resources	533	0.19%
74	Holcim Group	526	0.21%
75	PetroEcuador	524	0.20%
76	Antero	520	0.17%
77	YPF	495	0.17%
78	Ukraine	487	0.17%
79	PTTEP	481	0.16%
80	APA Corporation	472	0.17%
81	CONSOL Energy	470	0.17%
82	OMV Group	438	0.15%
83	North Korea	425	0.15%
84	Pioneer Natural Resources	416	0.15%
85	Czech Republic	406	0.14%
86	Marathon Oil	405	0.14%
87	Navajo Transitional Energy Company	379	0.13%
88	Tourmaline Oil	371	0.12%
89	Seriti Resources	361	0.13%

	Entity	Emissions (MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions
90	Cloud Peak	344	0.12%
91	Heidelberg Materials	339	0.13%
92	Hess Corporation	330	0.12%
93	Continental Resources	324	0.11%
94	Westmoreland Mining	308	0.11%
95	Whitehaven Coal	299	0.11%
96	Woodside Energy	291	0.09%
97	Naftogaz	282	0.09%
98	Santos	276	0.09%
99	Alpha Metallurgical Resources	265	0.09%
100	Adani Enterprises	263	0.09%
101	North American Coal	255	0.09%
102	CNX Resources	227	0.07%
103	Kiewit Mining Group	192	0.07%
104	Murphy Oil	183	0.06%
105	Cemex	181	0.07%
106	Rio Tinto	169	0.06%
107	Orlen	162	0.05%
108	Vale	157	0.06%
109	Wolverine Fuels	150	0.05%
110	SM Energy	142	0.05%

	Entity	Emissions (MtCO <sub>2</sub> e)	Percentage of global CO <sub>2</sub> emissions
111	Vistra	133	0.05%
112	CRH	119	0.05%
113	Taiheiyo Cement	109	0.04%
114	Tullow Oil	79	0.03%
115	Syrian Petroleum	60	0.02%
116	Obsidian Energy	34	0.01%
117	Slovakia	13	<0.01%