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# Coal 2023

Analysis and forecast to 2026

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# Abstract

The global coal market has experienced a turbulent three years. Demand dropped sharply during the Covid pandemic, only to leap during the post-Covid rebound and following Russia's invasion of Ukraine. In 2022, global coal demand reached its highest level ever. Today, coal remains the largest energy source for electricity generation, steelmaking and cement production – maintaining a central role in the world economy. At the same time, coal is the largest source of man-made carbon dioxide (CO<sub>2</sub>) emissions, and curbing consumption is essential to meeting international climate targets.

A historic turning point could arrive soon. The International Energy Agency's latest projections see coal demand peaking within this decade under today's policy settings, primarily as a result of the structural decline in coal use in developed economies and a weaker economic outlook for China, which has also pledged to reach a peak in CO<sub>2</sub> emissions before 2030. However, key questions remain, including when the peak in demand will occur, at what level, and how fast consumption will decline after that point.

Since its first publication in 2011, the IEA's annual Coal Report has served as the global benchmark for the medium-term forecast of coal supply, demand and trade. Its analysis also covers costs, prices and mining projects at regional and country level by coal grade. Given coal's impact on energy supply and CO<sub>2</sub> emissions, Coal 2023 is indispensable reading for those following energy and climate issues.

# Acknowledgements, contributors and credits

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The individuals and organisations that contributed to this report are not responsible for any opinion or judgement it contains. Any error or omission is the sole responsibility of the IEA.

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# Executive summary

## Global coal consumption reached an all-time high in 2022...

Global coal demand reached a record high in 2022 amid the global energy crisis, rising by 4% year-on-year to 8.42 billion tonnes (Bt). The growth engine for coal demand, which increased in both power and non-power sectors, was once again Asia. In China, demand rose by 4.6%, or 200 million tonnes (Mt). In India, it increased by 9%, or 97 Mt; and in Indonesia, where nickel smelters became a significant source of demand growth, it shot up by 32%, or 49 Mt. The United States saw coal demand fall by 8%, or 37 Mt, more than any other market, while a 4.3% increase in consumption in Europe was more muted than many had feared. Despite subdued hydropower and nuclear electricity generation in some European countries, a weak economy and mild winter in Europe restrained the impact of natural gas price spikes, which encouraged some switching to coal.

## ... and the world is heading towards a new record in 2023

In 2023 we expect coal demand to fall in almost all advanced economies. The biggest drops in consumption will occur in the European Union and the United States, where record annual declines of around 20% are expected. Other advanced economies – such as Korea, Japan, Canada and Australia – are set to see lower rates of decline. Nevertheless, the growth in China (around 5%) and India (over 8%), as well as in Indonesia, Viet Nam and the Philippines – which together represent more than 70% of global coal demand – will more than offset these decreases on a global level. In China and India, in particular, rising coal consumption is driven by robust growth in demand for electricity and low hydropower output. Overall, we expect global coal demand to grow slightly (by 1.4%) both in power and non-power sectors in 2023 to around 8.54 Bt, a new record.

## Global coal demand is set to decline to 2026 – but China will have the last word

We forecast that China's coal consumption will fall in 2024 and plateau through 2026, with hydropower output set to recover while electricity generation from solar PV and wind increases significantly. However, the pace of economic growth in China and its coal use in the coming years is subject to uncertainty. The country's economy is undergoing major structural changes as it reaches the end of infrastructure-led, energy-intensive growth, but the speed at which it changes

gears and continues to expand clean energy capacity will have a significant influence on the outlook for coal. The availability of hydropower is a key variable in the short term, since coal is used as a substitute when hydro underperforms in China.

India, Indonesia and other emerging and developing economies are expected to rely on coal to power strong economic growth, despite commitments to accelerate the deployment of renewables and other low-emissions technologies. By contrast, due to their different economic and energy context, we do not see a major risk of coal use rising again among advanced economies. Coal power plants are being regularly shuttered in these economies, and industrial coal consumption is set to decline due to weak industrial output, improved efficiency, and increased switching to other fuels. Overall, we expect global coal demand to drop in 2024 and plateau through 2026, even in the absence of governments announcing and implementing stronger clean energy and climate policies. As a result, global coal consumption in 2026 is set to be 2.3% lower than in 2023 – although China will have the last word.

## Coal's shift to Asia is accelerating

The dominance of China in coal markets is stronger than any other country for any other fuel. It consumes more than half of the world's coal and produces half of it, and it is the largest importer, accounting for close to one-third of the global coal trade. But India and ASEAN also exert a growing influence – helping further shift the focus of the coal market towards Asia. In 2000, advanced economies accounted for almost half of global coal consumption (48%), while China and India together accounted for 35%. Coal consumption has declined in the European Union since the 1980s and in the United States since the 2000s, whereas it has grown strongly in China, India and ASEAN. As a result, in 2026, we expect China and India to account for more than 70% of global coal consumption. By contrast, the European Union and United States are expected to each account for around 3% of global coal consumption. This increasing gap in reliance on coal between countries could present challenges for future international dialogue on the need for rapid decline in global coal use to reach climate goals.

## Major coal producers are increasing their output

Energy security has moved further up the political agenda after the market disruptions sparked by the Covid-19 pandemic and Russia's invasion of Ukraine. For China and India, domestic coal production has long been the cornerstone of energy security policy. In recent years, both countries have struggled to keep the lights on during periods of high electricity demand even before these shocks owing to coal shortages and high prices. As a result, both governments have intensified efforts to increase coal production since October 2021.

Output from the three largest producers continue to reach new highs. In China, production in both Shanxi and Inner Mongolia surpassed 1 Bt in recent years. India is also projected to cross this threshold in 2024. And in Indonesia, which has significantly boosted coal output in recent years amid elevated international prices and increasing regional demand, production is expected to reach 700 Mt in 2023 for the first time.

Meanwhile, lignite production in Europe, while still significant, will fall in line with regional demand through 2026. Hard coal production in Poland, which has committed to shut down its coal mines by 2049, is set to continue its slow but inevitable decline. Production dropped in the United States, though the decline was not as steep as the collapse in demand, given higher exports and stock building. US production is set to decline further through 2026 to below 400 Mt, which would be the lowest level in six decades.

In Australia, production is set to decline through 2026, driven by both lower domestic demand and exports.

## **Coal trade has expanded to an all-time high in 2023 but will decline afterwards**

The volume of coal trade has increased almost every year this century with very few exceptions. In 2015, China's measures to protect its domestic coal industry, coupled with a slowing economy that weighed on consumption, led to the first contraction in coal trade since the 1990s. In 2020, the economic downturn driven by the Covid-19 pandemic triggered the second drop. Now, after a recovery in 2021 and 2022, global coal trade volumes are set to rise again in 2023, reaching record levels for seaborne and total trade – though declines are expected in the coming years.

European imports collapsed in 2023 amid low demand and plentiful stocks, while Japan, Korea and Chinese Taipei reduced their imports in line with lower coal demand. However, growth in China, which will record its highest imports ever in 2023, will more than offset these declines. Despite strong domestic production in China, exporters have benefitted from robust demand and massive stock building due to energy security concerns.

On the supply side, Indonesia once again proved to be the most flexible exporter and will export close to 500 Mt in 2023, a level that has never been reached by any country before. Australia will increase exports by 10 Mt as disruptions induced by La Niña in the past few years recede. Russia's efforts to replace its former European energy customers continue, with about half of exports in 2023 directed to China, up from less than one-quarter in 2021.

## **In 2023, thermal coal prices are retreating from their 2021 and 2022 highs**

In October 2021, thermal coal prices reached unprecedented levels when supply was insufficient to meet a sudden rise in demand after Covid restrictions were eased in many countries. After Russia's invasion of Ukraine in 2022, high gas prices, supply-side constraints, and energy security concerns drove coal prices to all-time highs. Yet after summer 2022, lower gas prices and greater coal supply led to a pullback in coal prices.

In 2023, prices have further receded globally, although they are still higher than pre-Covid levels. Regional disparities are evident, with prices steadier in China owing to strong domestic supply, while weather disruptions jolted prices in Australia. Russian coal has traded at a variable discount, sometimes on the order of USD 200 per tonne, though more recently it has been just a few dollars per tonne cheaper. Coal producers have seen significant cost inflation in the past few years, which has stemmed from increased royalties owed to governments in some parts of the world and surging costs for fuel, explosives, tyres and labour.

## **Two years of unprecedented profits have left coal producers flush with cash**

Coal prices during the past two years have been much higher than expected. Consumers have struggled to cope as energy bills have jumped. Some countries intervened to provide support through regulatory measures and subsidies, especially in the electricity sector. Meanwhile, producers have enjoyed strong margins even as their costs have risen, and generous royalties have made significant contributions to the public budgets of many producer countries.

Coal mining companies have paid back debts, increased dividends and buybacks, and retained some cash. Diversified miners have often channelled coal profits towards other commodities as growing demand tied to the energy transition is expected to drive up their prices. However, Glencore, the largest thermal coal exporter, will also become a major producer of coking coal after it completes its acquisition of Elk Valley Resources, which was announced earlier this year. Given the difficulty of receiving regulatory approvals and public pushback against new projects, pure coal players are generally opting to acquire existing mines rather than develop projects from scratch.

# Demand

## Global coal demand is expected to peak in 2023 and decrease thereafter

In 2022, coal demand reached a new record high of 8 415 Mt, increasing by 4%. The increase was mainly backed by growth in countries that rely heavily on coal, such as China and India. Furthermore, extraordinarily high gas prices and generally weaker nuclear power and hydropower production drove growth in demand for coal to generate power. Coal demand for power generation rose by 4% to 5 687 Mt. Coal use for non-power purposes rose by 3.7% to 2 728 Mt.

Accounting for more than half of global coal demand, China is by far the world's largest coal consumer. In 2022, the country's overall coal demand rose by 4.6% to a total of 4 520 Mt, with coal taking a share of more than 60% in power generation. India, the world's second-largest coal consumer comprising about 14% of global coal demand, recorded an increase of 9%, totalling 1 162 Mt.

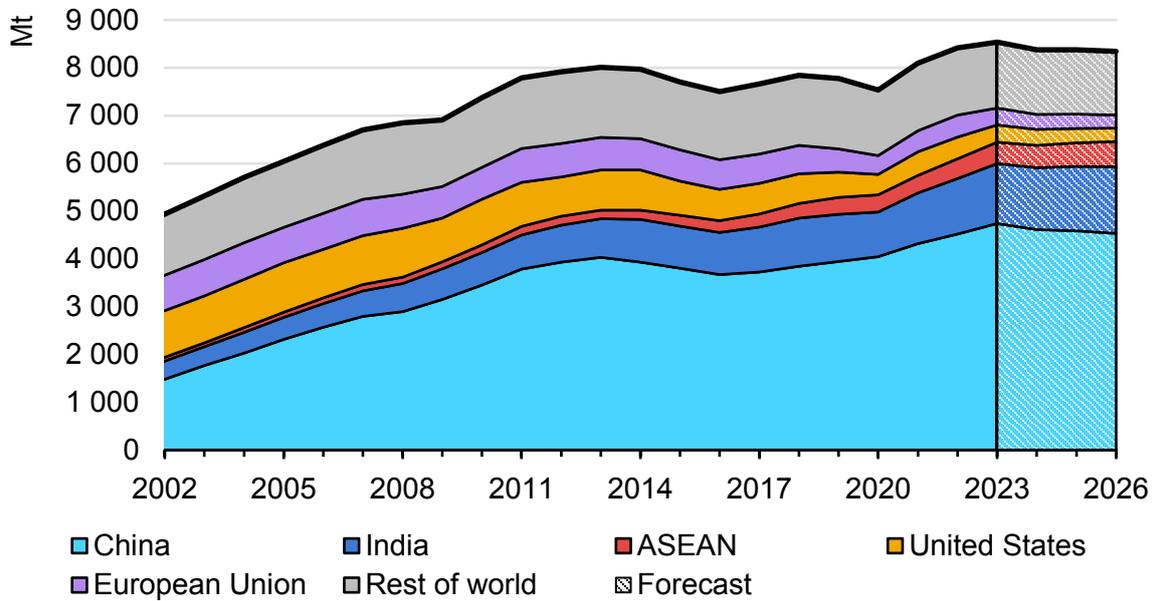
In 2023 global coal demand is expected to have increased only marginally by 1.4%, albeit reaching a new all-time high of about 8 536 Mt. Coal demand growth is losing momentum due to lukewarm economic prospects paired with the weakening of the factors that pushed coal-fired power generation in 2022. Meanwhile, global coal demand is expected to continue moving eastwards, with China, India, and ASEAN countries combined consuming three-quarters of global demand. At the start of the century, that share was around 35%, lower than the combined share of the European Union and the United States at that time.

In absolute terms, coal demand in 2023 is estimated to have increased most strongly in China (up 220 Mt, or 4.9%), followed by India (up 98 Mt, or 8%) and Indonesia (up 23 Mt, or 11%). The largest declines are expected in the European Union (down 107 Mt, or 23%) and the United States (down 95 Mt, or 21%), driven mainly by the electricity sector, but also by weak industrial activity. Data and forecasts for Russia, currently the fourth largest coal consumer, are difficult to estimate, given ongoing war against Ukraine. Likewise, Ukraine's forecast is quite uncertain.

For our forecast period until 2026 we expect to see a trend emerging of declining worldwide coal demand, starting in 2024. With growth in India and ASEAN offsetting declines in the European Union and the United States, China remains the decisive player for setting the trend of global coal demand. Higher renewable

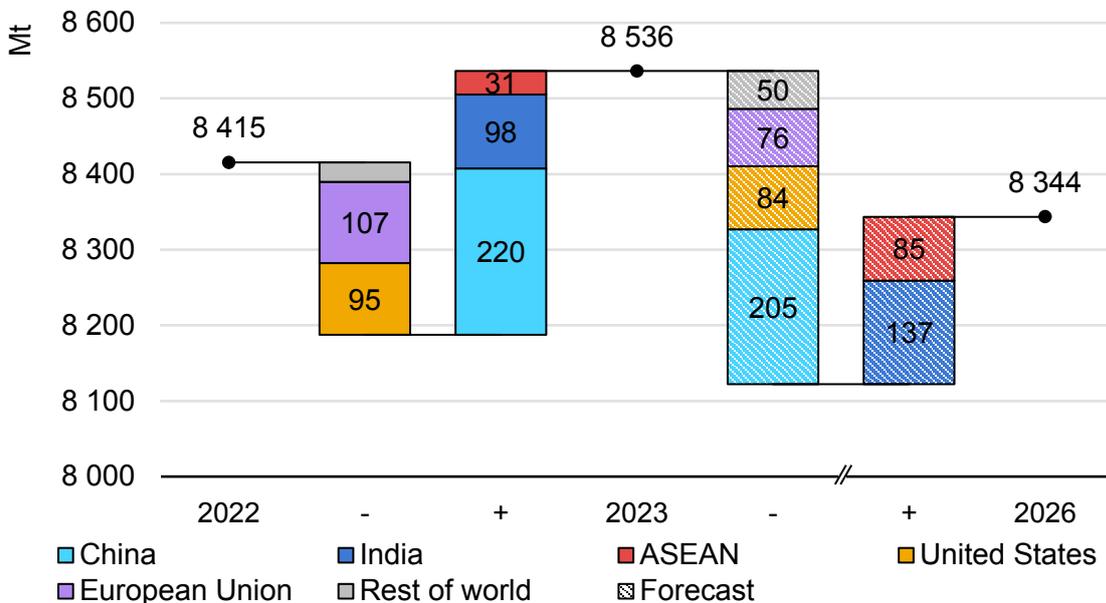
growth than overall electricity demand growth is likely to push global coal consumption on a downward trajectory. This would imply that coal is likely to peak in 2023.

### Global coal consumption, 2002-2026



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### Change in global coal consumption, 2022-2026



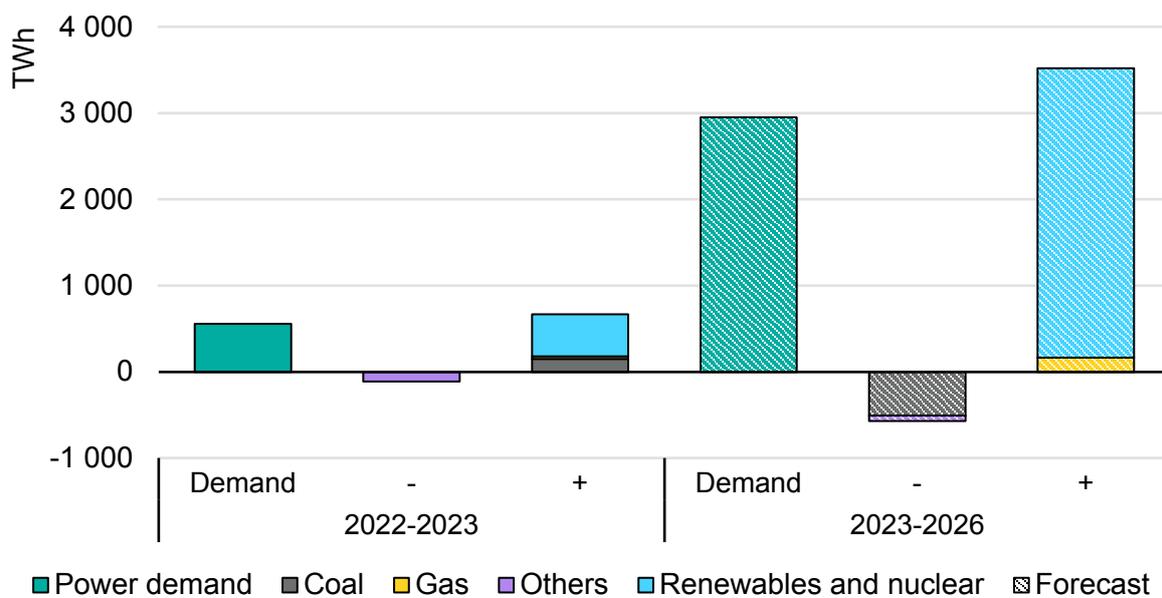
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## Coal in power generation is set to decline through to 2026

In 2022, global electricity production grew by about 2.3% to a total of 29 074 TWh. Coal-fired power generation made up about 36% of the total, remaining the largest source. Driven by growing electricity demand in Asia, high gas prices pushing up coal use for power generation in some parts of the world, and a weak performance overall from nuclear (down 141 TWh), coal-fired power generation grew by about 1.4% (up 141 TWh) resulting in an increase in coal demand from the power sector of about 4% (up 220 Mt). The difference in growth rates is accounted for by a decrease in the calorific value of coal used for power generation, mainly in China.

Lower gas prices in 2023, falling close to pre-crisis levels, have led to a partial reverse of the gas-to-coal switch in the European Union. In contrast, the power mix in China and India is less exposed to global gas price developments, and therefore the development of renewables and growth in electricity demand are the main determinants of coal-fired generation. Global power demand growth is expected to have slowed to 2% in 2023, curbed, among other factors, by weak economic growth in mature economies in the aftermath of the energy crisis. We anticipate coal-fired power generation to have grown by 1.5% (up 158 TWh), increasing coal use in the power sector by 1.4% (up 81 Mt). We expect renewable additions to have accounted for the largest share of electricity demand growth in 2023, gaining 5% (or 443 TWh).

**Change in global power demand and generation by source, 2022-2026**



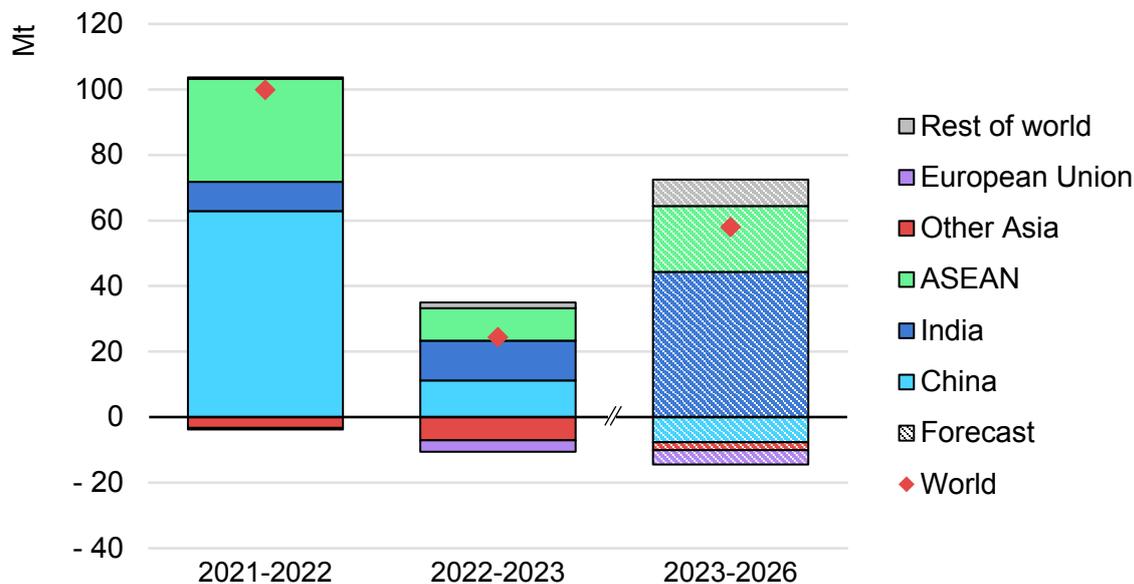
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For our forecast period 2024-2026, this development is about to become even more pronounced, with renewables growth exceeding growth in electricity demand initiating a downturn in coal-fired power generation. After recent years of low rainfall, we assume that the change in weather pattern from La Niña to El Niño will improve hydro availability in China and India. In addition, a steep upward trend in low-cost solar PV deployment supports the rise in renewable generation. Further to that, nuclear generation is set to see moderate increases, especially in China, India and the European Union. Against this background, coal-fired generation is likely to be pushed into a downward trajectory from 2024. In the three-year period, we expect a decrease of 5%, falling to 10 067 TWh in 2026. By then, coal's share of the global electricity mix would have dropped to just over 30%, the lowest share in IEA records.

## **Non-power thermal coal and lignite demand grows slightly through to 2026**

Besides power generation, thermal coal and lignite find applications in a range of other activities, including but not limited to the manufacture of cement and providing heat for industrial and residential purposes. In 2022, overall non-power thermal coal and lignite consumption rose by 7% to 1 642 Mt. On this basis, non-power uses accounted for 22% of overall thermal coal and lignite consumption in that year. The major share of this growth in 2022 is accounted for by Chinese consumption rising to 973 Mt, where the coal conversion sector to replace costly oil and gas products played a significant role. An even stronger increase in relative terms was observed in ASEAN countries, where consumption increased by 51% from 65 Mt to 98 Mt. This exceptional increase was predominantly fuelled by Indonesian growth (up 31 Mt). Indonesia is strategically ramping up its nickel production, to serve globally rising demands for this critical mineral used in the manufacture of batteries. As production processes in Indonesia often use coal as a direct (reductant) or indirect (captive power generation) constituent, nickel production has become an important driver of coal demand. Indeed, this has implications for the carbon footprint of that nickel.

### Change in thermal coal and lignite consumption for non-power purposes by region, 2021-2026



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We expect aggregated non-power use of thermal coal and lignite to have slightly increased in 2023, as gains in ASEAN, India and China are likely to overcompensate for declines in the European Union and other Asian countries. In China, ongoing efforts to decrease coal consumption for residential heating and small industry, and the stagnation of infrastructure-related investment dampening cement demand, weigh on the outlook for non-power coal consumption. Conversely, the coal conversion sector (coal-to-liquids, coal-to-gas and coal-to-chemicals; see further detail in the section below) exhibits huge potential for coal use and finds itself on the rise amid China's endeavour to reduce energy import dependency. Overall, we expect a slight decline in China's thermal non-power coal demand through to 2026.

India's non-power thermal coal and lignite consumption is likely to continue its upward trajectory, as industrial activity is expected to increase by almost 6% annually in the next three years. Accordingly, we estimate consumption to rise by 44 Mt by 2026. Together with ASEAN (up 20 Mt), India is expected to serve as the engine behind thermal non-power coal consumption in the next three years.

Summarising these developments, we forecast global thermal coal and lignite consumption for non-power use to increase by 58 Mt, or 1.1% annually, until 2026.

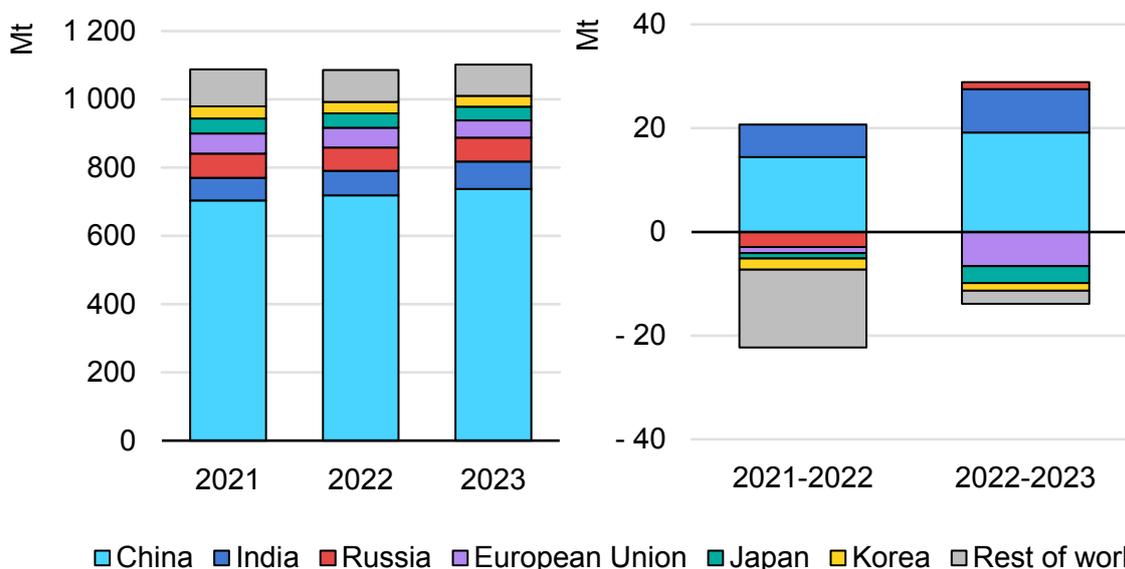
## Met coal demand plateaus, but uncertainty in China increases

Metallurgical (met) coal, which includes coking coal (hard, medium, and semi-soft) and coal for pulverised coal injection (PCI) is a primary ingredient in steelmaking. Coke, which is generated from the heating of coking coal in a coke oven without oxygen, is also employed in the manufacture of carbides, ferroalloys and other chemical compounds. Accordingly, our projections for met coal demand are primarily based on the steel production forecasts of organisations such as the [World Steel Association](#), as well as GDP growth and industrial production.

Preliminary data for 2022 show a slight decline in global met coal consumption, down by 2 Mt to 1 086 Mt. Amid that year’s energy market rollercoaster, Russia (down 3 Mt, or 4.1%), Korea (down 2 Mt, or 6%), and the rest of the world (down 10 Mt, or 12%) accounted for the greatest reductions. In light of a weak economic performance and high energy prices in 2022, Chinese met coal demand rose by only 2% to 718 Mt.

Our estimate for 2023 shows an overall surge in met coal consumption of 1.4% to 1 101 Mt. This comes hand in hand with energy prices declining almost to pre-crisis levels and higher steel production in some countries. The increase is fuelled by growth in China and India, which more than offset declines in the European Union and other world regions.

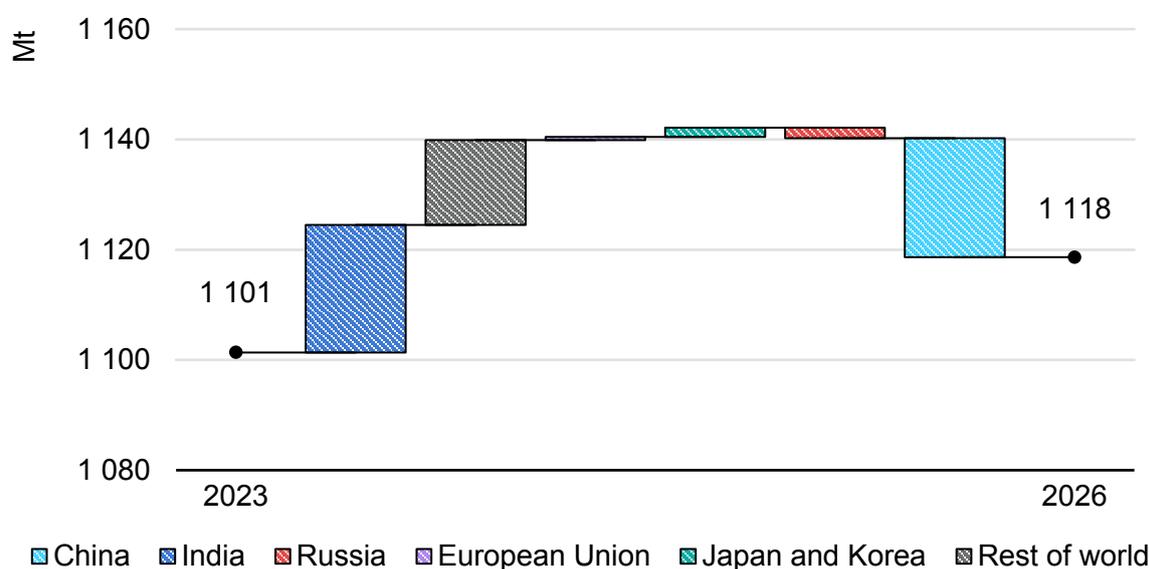
Met coal consumption and annual change by region, 2021-2023



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For the next three years, we do not expect significant changes in met coal consumption as energy markets and economic outlook appear to be on a moderate trend. Furthermore, substitutes for met coal, such as hydrogen, do not appear to be market-ready in the forecast period, and thus producers are unlikely to offset met coal demand amid economic growth. As a result, we forecast overall met coal consumption to slightly increase by 17 Mt to 1 118 Mt over the course of the next three years, with India contributing the most to the uplift. We do not expect Chinese met coal consumption to align with overall industrial activity, as infrastructure-related investments consuming steel are likely to decline in the coming years.

### Forecast change in met coal consumption by region, 2023-2026



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## China is reaching peak coal

With total consumption of 4 520 Mt in 2022, China is by far the world's largest coal consumer, accounting for 54% of global coal consumption. The major share (84%) of China's coal consumption was thermal coal, totalling 3 801 Mt, which was predominantly used for power generation. The remaining volumes were 718 Mt of met coal.

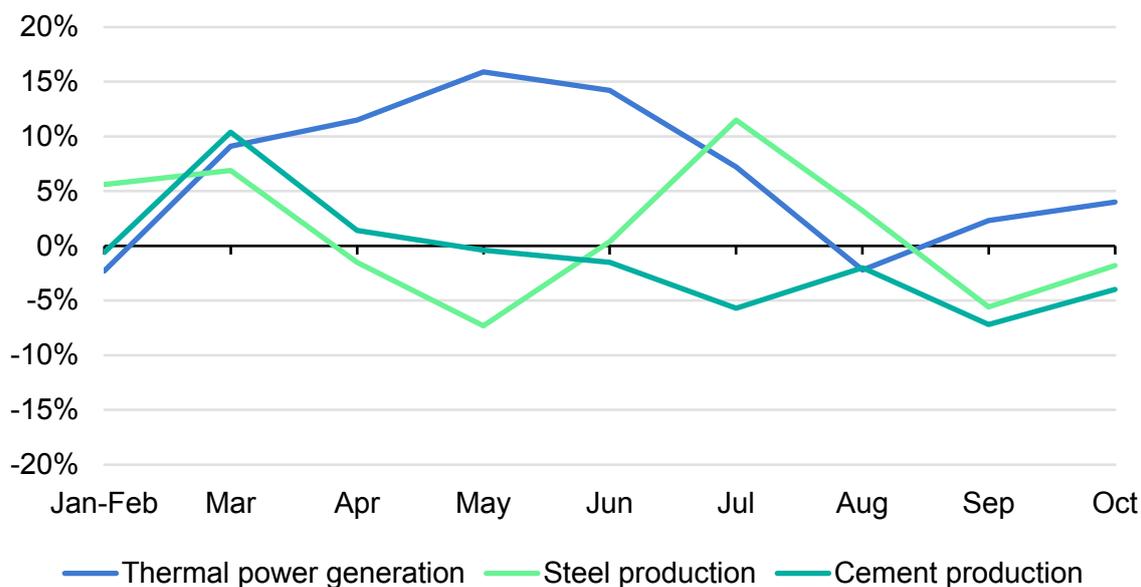
After a weak economic performance in 2022, when severe energy shortages and strict lockdowns imposed by a zero-Covid policy weighed on energy consumption, China has been gaining momentum again. GDP is estimated to have increased by 5.2% in 2023, up 2.2 percentage points from the previous year's growth. However, we expect met coal consumption to have risen by a slower rate, as steel production in the first three quarters of 2023 only rose by 1.7% year-on-year. This

comes as new construction activity, historically driving demand for steel and cement, has entered a subdued period as the housing market appears to be oversupplied. For 2023, we estimate an increase in met coal consumption of 2.7% to 738 Mt.

The main driver behind China’s coal consumption is the power sector. We expect coal-fired power generation to have increased by almost 7% in 2023. Given that non-power consumption of thermal coal has remained almost flat, we estimate growth in total thermal coal consumption of 5% in 2023, reaching 4 002 Mt. Against this background, China is about to reach a new all-time high of 4 740 Mt in 2023.

An important remark is that the quality of coal produced in China deteriorated in 2022 and 2023 following a production push (see “Supply” Chapter ). As a result, the average calorific value of coal used has declined. Therefore, the growth of coal consumption in energy terms – more relevant for the assessment of CO<sub>2</sub> emissions – is lower than in mass terms, which is the measure used in this report.

### Year-on-year percentage change in three economic indicators in China, January-October 2023



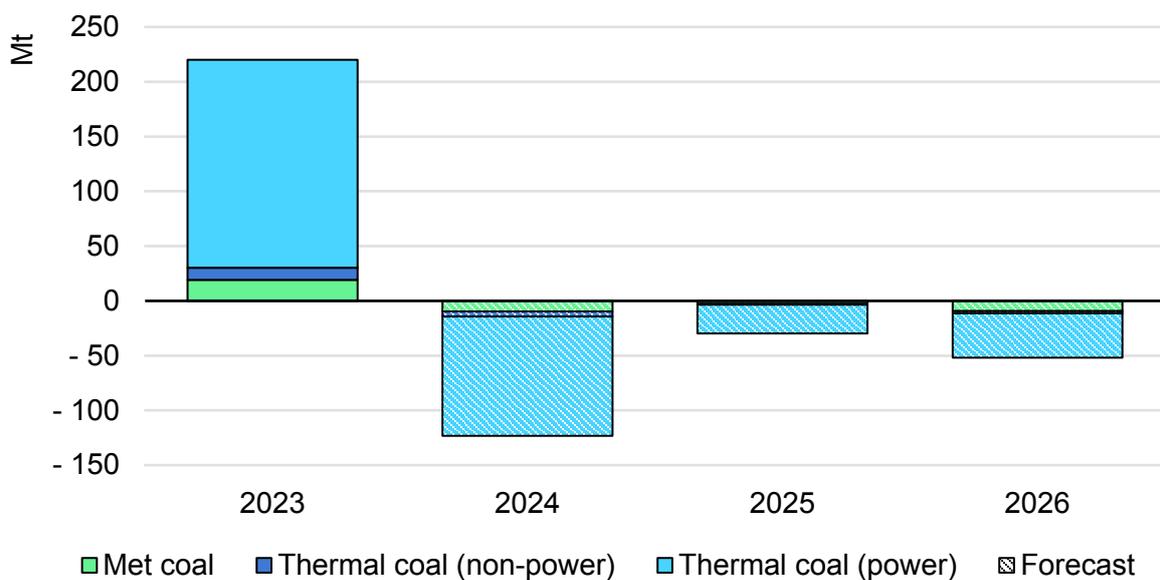
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Source: IEA analysis based on National Bureau of Statistics of China (2023), [Statistical Database](#).

Our forecast for China’s coal consumption in the next three years follows developments in the power sector and projections for industrial production and overall economic growth. The backbone of our estimate is the rise in renewable generation exceeding growth in electricity demand, mainly driven by the acceleration in solar PV deployment and rebounding precipitation in 2024, pushing up hydro generation. This causes thermal coal consumption for power generation

to decline significantly, down by 6% or 175 Mt by 2026. At the same time, met coal consumption and non-power thermal coal consumption are set to undergo moderate declines between 2024 and 2026. As a result, we expect Chinese coal consumption to decrease by 4.3% or 205 Mt by 2026 compared to 2023. For the first time, the structural shift in power generation towards renewables implies not only a peak in Chinese coal demand in 2023 but also a peak in world coal consumption in 2023, as China's development dictates the global trend on the basis that other world regions balance each other out.

**Annual change in coal consumption by grade and use in China, 2023-2026**



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## A strong uptick in renewables initiates the decline in China's coal power generation

With an installed capacity of approximately 1.1 TW and generation of 5 489 TWh in 2022, coal continued to hold its position as the predominant energy source for electricity generation in China. Furthermore, electricity generation is responsible for about 74% of China's thermal coal demand and about 63% of its total coal demand. Historically, both generation and capacity have generally grown in line with electricity demand, providing vital support for China's economic ascent. However, this interrelation appears to be diminishing in the face of the rapid growth of renewable power generation.

Growth in China's coal-fired power generation in 2023 is expected to have accelerated from that seen in 2022, when weak economic activity reined in coal-fired power generation. We estimate electricity demand to have surged by 6% in 2023, surpassing 9 000 TWh for the first time. This increased electricity demand

is rooted not only in robust economic activity but also in heatwaves in several provinces, with Beijing experiencing one of its hottest summers on record. Severe droughts in the first six months of the year were a major driver, weighing on hydropower availability and exacerbating the uptick in coal-fired generation and coal consumption accordingly. Against this background, we estimate thermal coal consumption for power generation to have surged by 190 Mt to 3 018 Mt in 2023.

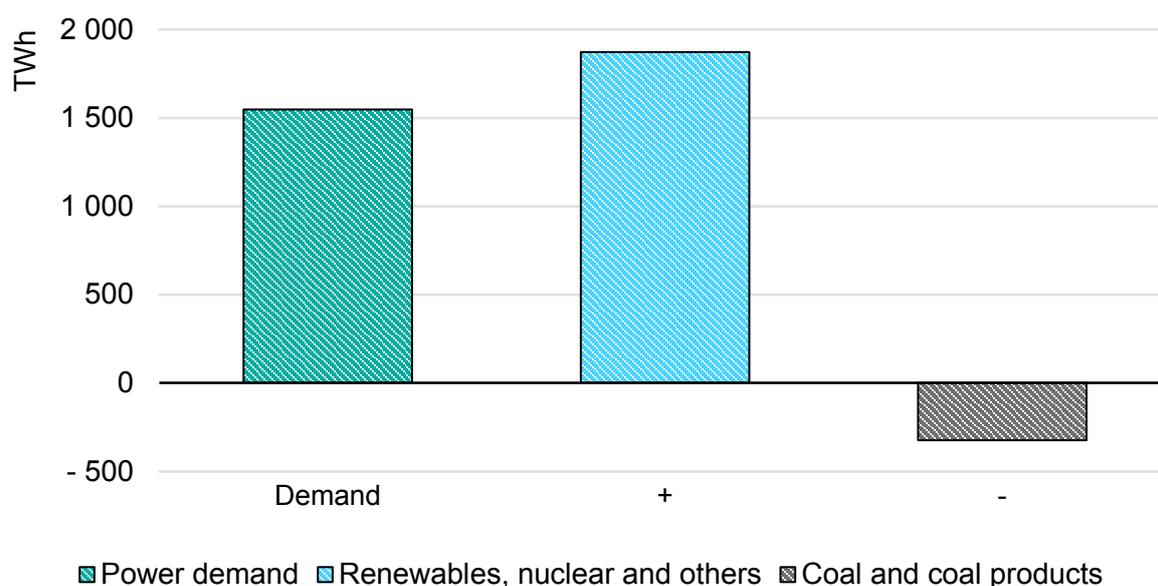
In light of the power shortages in recent years, caused by coal shortage, a lack of available generation capacity and inefficient dispatch incentives, China has been seeking to ensure resource adequacy by expanding its coal-fired power plant fleet. In 2022, Chinese authorities approved more than 100 GW of coal-fired power capacity. In the first half of 2023, China added 17 GW of coal capacity, began construction of 37 GW, and approved 52 GW of new projects. This enlarges the project pipeline up to 243 GW, with another 149 GW announced but not formally approved. The surge in renewables is likely to bear down on the average utilisation of coal-fired power plants, as additional coal capacity is mainly needed to meet increasing peak demands. Actually, on 10 November 2023, the Chinese government announced capacity payments for coal power plants to ensure investment is recovered irrespective of their load factor.<sup>1</sup> However, there is a risk that additional coal capacity may cause lock-in effects, weighing on future efforts to cut emissions.

For the period between 2024 and 2026 we expect a change in China's power generation, laying the foundation for coal consumption to decline from 2024 onwards. The key to this development is a steep upward trajectory in renewable generation, which grows faster than electricity demand. We assume that hydro availability rebounds after a two-year low, and that the accelerating growth in wind and solar capacity bears fruit. Together with steady increases in nuclear generation, this causes coal-fired generation to start its downward trend after 2023. Nonetheless, this structural trend may see temporary deviations, driven by events such as cold snaps, heatwaves, rainfall, and volatility in wind speed and solar irradiance as well as the development of electricity demand. All these factors influence the utilisation of coal plants, which largely serve as the default electricity supplier. In summary, we estimate coal consumption for power generation to decline by 175 Mt during 2024-2026, down to 2 843 Mt.

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<sup>1</sup> The first announcement indicates USD 45/kW per year as the benchmark for fixed costs of coal plants, while the mechanism will cover a percentage of that cost (30% in 2024-2025 and 50% in 2026).

### Forecast change in electricity demand and generation in China, 2023-2026



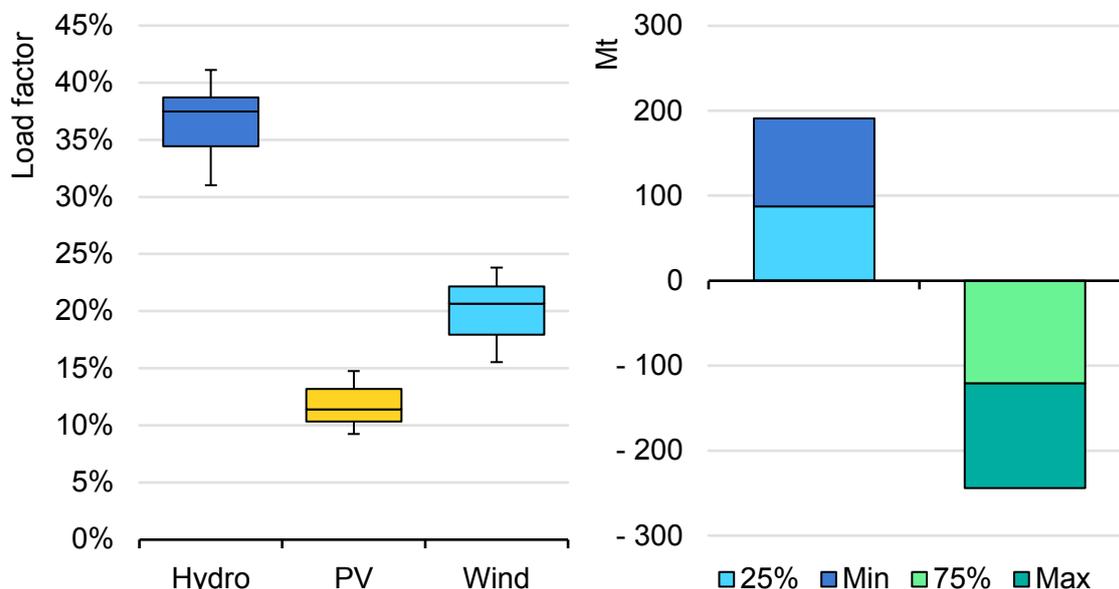
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To demonstrate the effect of uncertainty in renewable generation on coal consumption in China, we can show the variation in the historical load factor of renewables (left graph below) and translate it into hypothetical coal consumption (right graph below). Notably, all renewable technologies – hydro, solar PV and wind – exhibit a certain variability in annual historical load factors. The observation of renewable behaviour over the last two to three decades shows that, in China, hydro displays a spread of 10 percentage points between the minimum and maximum load factor, while wind and solar PV exhibit spreads of 8 and 5 percentage points, respectively. A lower-than-average load factor of renewables needs to be replaced by other technologies, which in the case of China is mostly coal. Given the considerable renewable capacity in China, these fluctuations have a non-negligible impact on coal consumption. In our subsequent analysis, we assume that coal-fired power plants balance different hypothetical load factors, given the renewable capacity in 2023.

The findings reveal that, assuming the weakest performance of hydro, wind, and solar observed over the last two to three decades, the additional coal consumption for power generation would amount to almost 200 Mt. Conversely, the maximum load factor for renewables would exceed 240 Mt of avoided coal use. Assuming a load factor of renewables in the 25<sup>th</sup> or 75<sup>th</sup> percentile would approximately halve the changes in coal consumption compared to the extreme cases. Even though the simultaneous occurrence of extreme load factors remains improbable, the analysis underscores the magnitude of the uncertainty that weather effects have

on coal consumption. And this is only the analysis of the supply side of electricity; the impact of weather on electricity demand is a further relevant determinant for coal consumption.

### Load factor of renewables and hypothetical effect on coal consumption in China



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Notes (left): Hydro load factor based on 1990-2023 data; PV and wind load factors based on 2000-2023 data. The top and bottom edges of the boxes represent the 75th and 25th percentiles, respectively. The lines inside the boxes represent the medians.

Notes (right): Hypothetical coal use represents volumes that would be consumed, if different levels of combined load factors of renewables apply, i.e., 25% corresponds to assuming all renewables are in the 25th percentile load factor. We assume coal consumption of 0.45 Mt per TWh of electricity.

## China's thermal non-power demand saw a remarkable high in 2022, but is set to decline through to 2026

China's thermal coal consumption for non-power uses rose by 7% to 973 Mt in 2022, accounting for 22% of China's total coal consumption. This amount is almost equivalent to the combined coal consumption of Europe and North America.

Despite the efforts made during the past decade to switch from coal to other – mostly gas and electricity – in order to reduce air pollution from small, inefficient and outdated coal boilers, the use of coal in sectors other than power and steel in China is still considerable. Unlike in most developed countries, coal in China is still used in a variety of industries from food to textiles and paper to numerous other sectors. Due to the switch away from coal, we expect coal use in small industry and in residential heating to continue its decline in the coming years.

More difficult is the switch in cement making, which would require the availability of low-cost alternative fuels, given the high proportion of total production costs that fuel accounts for. Cement, which utilises over 200 Mt of coal per year, is the single largest consumer of thermal coal among industries. Cement production in China appears to have peaked in 2020, and after the major decline in 2022 (over 10%), we expect the decline to have continued in 2023, despite growth observed in the first half of 2023. The real estate sector in China is contracting, and this is set to weigh on cement production and so too on coal demand. This applies not only to 2023 but also to the forecast period, as this trend appears to be structural in nature and not resolvable in the short term.

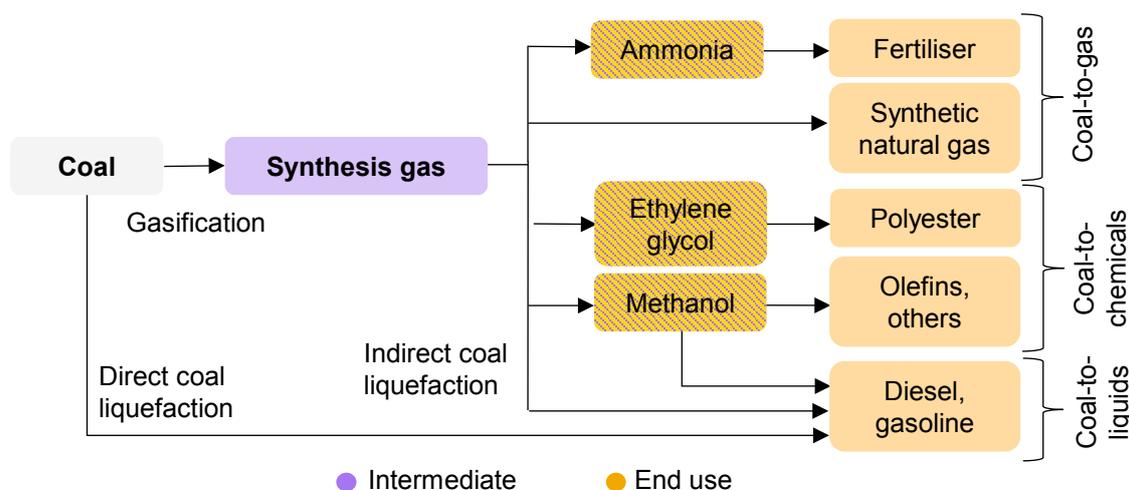
A significant driver of the growth in thermal non-power applications in 2022 was the coal conversion sector, as described in the section below.

Summarising these developments, we estimate thermal non-power coal consumption to have slightly increased in 2023 to 984 Mt. For the trajectory until 2026, we expect declines in industrial and heating applications to more than offset growth in the conversion sector, leading to a reduction of 0.8% down to 976 Mt.

## Strong growth seen in China's coal conversion sector

Coal conversion refers to the processes that use coal as a feedstock to obtain another commodity as the output (usually via coal gasification). Depending on the final product, it is typically classified as coal-to-liquids, coal-to-gas (SNG or synthetic natural gas) or coal-to-chemicals, with methanol playing an important role as a final product or as an intermediate product to produce olefins and other chemicals. For over a decade, coal conversion in China has been seen as a strategy to reduce foreign dependence, amid increasing oil and gas imports, and to monetise domestic coal assets – particularly those considered stranded due to quality or location – while promoting local jobs. On the flip side, these processes are generally energy inefficient, water- and CO<sub>2</sub>-intensive, and have very volatile economic profitability due to its dependence on oil and gas prices.

### Key process routes of the coal conversion sector in China



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Coal-to-liquids refers to the production of liquid fuels such as diesel or gasoline from coal. Coal is either liquified directly in a reactor by hydrogenation or converted into synthesis gas, and, using the Fisher-Tropsch process, then converted to liquid fuels through indirect liquefaction. The biggest among China’s projects is the 4 Mtpa Shenhua indirect liquefaction plant, which came online in 2017. The facility is operated by the Ningxia Coal Industry Group and first reached full capacity in late 2021. In 2021 for China as a whole, 38 Mt of coal was used to produce around 10 Mt of oil products, according to IEA statistics. Liquids produced from coal currently account for 1% of oil consumption in China. Given the projects under construction, we assume annual growth of over 8% for coal-to-liquids between 2022 and 2026.

The predominant end products in the coal-to-gas route are synthetic natural gas (SNG) and fertiliser. Ammonia, which is mainly used to produce fertilisers, is produced in China mostly using synthesis gas from coal gasification, unlike any other country. While the consumption of fertilisers has remained somewhat steady, the need to reduce air pollution in residential areas has spurred the consumption of natural gas and indirectly, the production of SNG. The first two SNG projects commenced in 2013, with a temporary suspension of approvals in 2015 due to environmental issues. In 2016, three new projects were approved. Originally, the government set a target to produce 55 bcm of SNG by 2020, but as of 2021, SNG accounted for around 10 bcm of domestic gas production. Against this background, we assume coal consumption for coal-to-gas to grow by 5% annually between 2022 and 2026. However, this figure is subject to uncertainty, as an estimated 300 bcm of projects are currently at different stages of development, indicating a potential surge in SNG production. In Xinjiang alone, six projects accounting for 26 bcm of SNG capacity per year have been

announced for completion in the next four years. This would involve consumption of around 60-65 Mt. In Inner Mongolia, Xinmeng's 8 bcm per year project currently under construction could consume almost 20 Mtpa of coal once working at full capacity.

The most dynamic sector among coal conversion is coal-to-chemicals, also known as CTX. It involves the gasification of coal to synthesis gas, which is then processed mostly into methanol or ethylene glycol. Methanol is often converted to olefins, the basis for manufacturing plastics, whereas ethylene glycol is the basis for polyester and other materials. Over the past decade the Chinese government has supported CTX processes with subsidies, increasing the share of coal as a source in petrochemicals from 3% in 2010 to 16% in 2018. By the end of 2020, there were operational projects in China with production capacity totalling 16 Mtpa of coal-to-olefins and 4.9 Mtpa of coal-to-ethylene glycol, and since then the sector has continued its growth. We expect growth to continue in the years ahead, as numerous coal-to-olefins projects have been announced in Inner Mongolia, Shanxi, and Gansu, among other regions. For example, Sinopec, which already owns five CTX facilities in Ningxia, Inner Mongolia, Anhui, Guizhou, and Xinjiang, has announced a project to produce a further 0.8 Mt of olefins via CTX in Inner Mongolia from 2024.

## Chinese met coal consumption contracts amid a real estate crisis

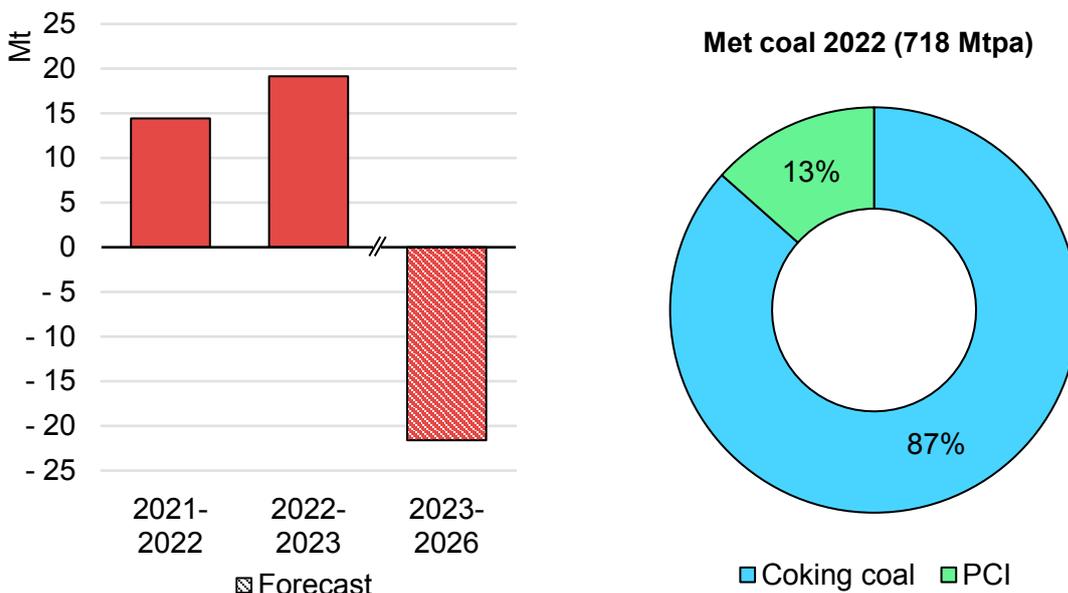
China's met coal consumption stood at 718 Mt in 2022, accounting for about two-thirds of worldwide met coal consumption and 16% of the country's overall coal consumption. The vast majority (87%) of met coal consumption in China is coking coal, which is mostly converted to coke, a reductant in the blast furnace process for pig iron production and other industrial processes. Pig iron, in turn, is the main ingredient to steelmaking. The balance of met coal (13%) is PCI (pulverised coal injection) coal, which is injected in the blast furnace to reduce coke consumption.<sup>2</sup>

2022 marks the second year in a row of pig iron production remaining stagnant, thereby weighing on the growth in met coal consumption. New home construction, a key driver for Chinese steel demand, fell by about 40% in 2022, down to its lowest level since 2009. As with cement demand, the crisis in the real estate sector is likely to continue weighing on met coal demand. Nonetheless, we estimate met coal demand in 2022 to have moderately grown, as the substitution of high-quality Australian with lower-quality coking coal probably increased the specific consumption of coke in the blast furnaces.

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<sup>2</sup> This is an estimate, as Chinese statistics do not report PCI as a separate category.

### Change in met coal consumption in China, 2021-2026, and share of met coal grades, 2022



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For the first half of 2023, the Chinese National Bureau of Statistics reports growth in pig iron production of 2.7% and growth in coke production of 1.8% compared to the first half of 2022, implying slight gains in met coal consumption. For the full year of 2023, we estimate met coal consumption to have gained 2.7%, to a total of 738 Mt.

In our forecast period, we expect steel demand to remain muted as a reflection of the ongoing real estate crisis, affecting pig iron production, and thus met coal demand. Moreover, about 20 provinces have released plans to increase scrap use in crude steel production, which would reduce the production of pig iron. And some Chinese firms plan to install coke production units in Indonesia, which would alter coking coal demand in China. Against this background, our estimate is for met coal consumption to decrease by 1% annually until 2026, down to 716 Mt.

## Coal demand growth in India accelerated in 2022 and 2023

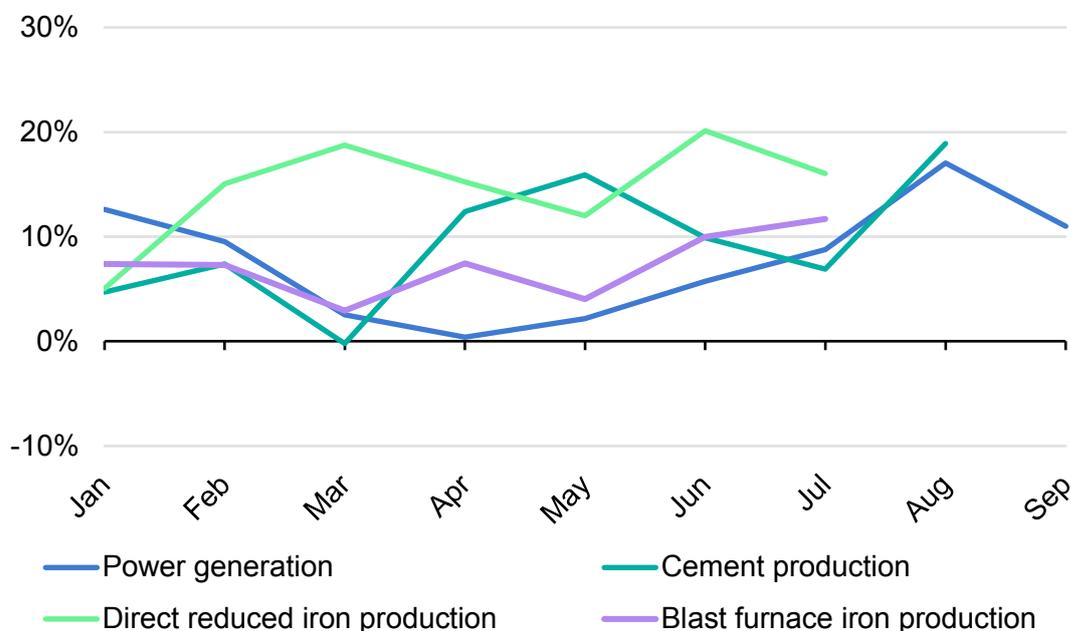
Coal consumption in India surged by 9% to a total of 1 162 Mt in 2022, marking another year of remarkable growth after 2021's 14% rebound from the Covid-19 pandemic. India's coal demand is mainly determined by its use in power generation, accounting for 74% of overall consumption. The remainder comprises 231 Mt of thermal coal and lignite for non-power use, of which cement and direct iron reduction are the main consumers, and 72 Mt of met coal, primarily used in steel production via the blast furnace route. Despite a global contraction in

economic growth and energy prices reaching all-time highs, India's economy continued its upward trend with GDP growth of 7% in the financial year (FY) 2022. Among other factors, this economic development was supported by strong domestic coal production (up 12%) and the country's moderate exposure to global market prices, as India's coal import share stood at less than 20% in 2022.

For 2023, we expect India's economy to have grown again, albeit, at a slower pace compared to 2022, with industrial activity seeing growth of 5% and power generation almost 9% higher. Coal-fired power generation meets most of the growth in power demand, as renewables, despite being on the rise, cannot meet demand growth – unlike in China. For 2023, we expect coal consumption for power generation to have increased by 9% to 937 Mt.

Aligned with the economic outlook, industrial output has also been rising strongly in 2023, pushing up demand for thermal coal and lignite in non-power applications, like cement and direct iron reduction. Accordingly, we estimate non-power thermal coal and lignite consumption to have risen by 12 Mt in 2023, to 243 Mt. Met coal has the smallest share of Indian coal consumption, with an expected total of 81 Mt in 2023. Like other coal grades, met coal consumption is growing as steel production surged through 2023, indicated in our graph by year-on-year changes in direct iron reduction (thermal coal) and blast furnace iron production (met coal).

**Year-on-year percentage change for various economic indicators in India, January-September 2023**



IEA. CC BY 4.0.

Source: IEA analysis based on McCloskey (2023). [McCloskey Coal, Metals and Mining Service](#).

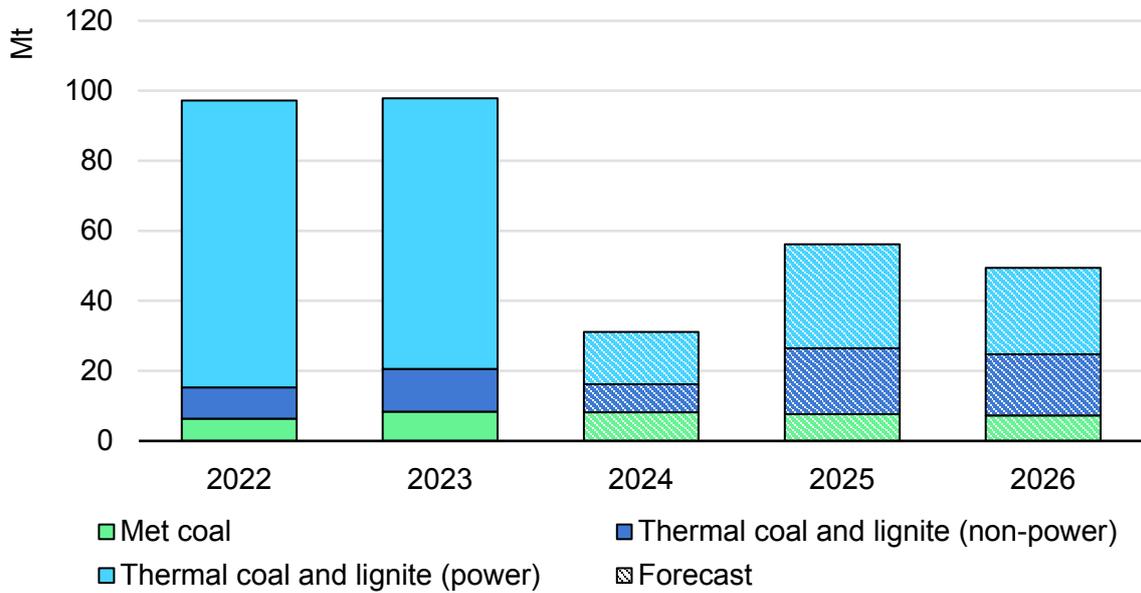
## India becomes the main engine of coal demand growth

India becomes the driving force behind the upward pressure on global coal demand through to 2026, even if the global trend is decided in China. For the forecast period until 2026, we estimate Indian coal demand to rise by 3.5% annually to 1 397 Mt, with growth in every coal grade.

India has a target for renewables to achieve a 50% share of its power generation mix by 2030, thereby reducing the power sector's dependency on coal. As in China, solar PV is set to gain momentum and surge in the period to 2026, with capacity likely to triple by 2026 compared to 2021. Nonetheless, additional coal-fired generation will still be required to meet the growth in demand and ensure security of supply. Against this background, India's latest National Electricity Plan foresees between 19 GW and 27 GW of additional coal capacity up to 2027, depending on the scenario, despite about twice the capacity already being in the project pipeline. For the next three years, our model forecasts annual growth in coal consumption for power generation of 2.4%, whereas renewable generation is forecast to grow by 12% annually. India's new policy on biomass co-firing, starting in April 2024, sets an obligatory blending rate of 5% for coal plants, increasing to 7% subsequently. However, its effect on coal consumption is uncertain, as the biomass supply chain is in its infancy. As a result, we estimate a moderate increase in coal for power generation of 69 Mt to 2026, the total reaching 1 006 Mt.

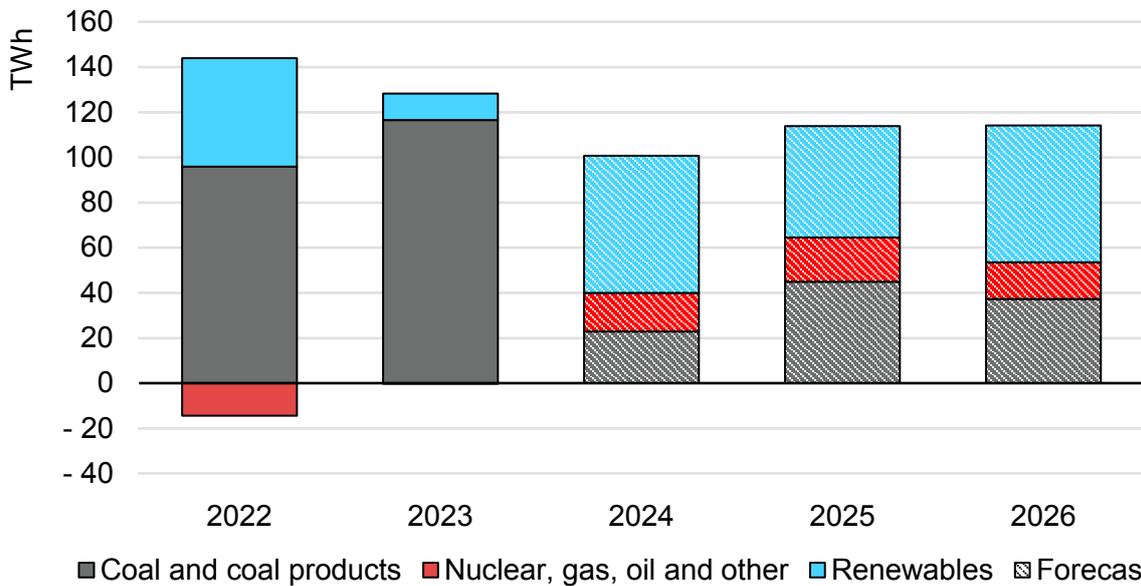
Coal for non-power purposes is expected to surge significantly, with industrial production set to increase annually by 6% between 2024 and 2026. Given the focus on infrastructure, we expect a strong increase in cement production, being one of the main drivers of growth in non-power thermal coal and lignite demand. For example, the Adani Group, the largest industrial conglomerate in India, is aiming to double its production capacity by 2028 up to around 140 Mtpa. The market leader UltraTech is currently running a capacity of about 132 Mtpa and is seeking to reach 160 Mtpa soon. Together with consistently increasing steel demand driving consumption of steam coal (direct iron reduction) and met coal (blast furnace route), we estimate non-power coal consumption of 391 Mt in 2026, growing 21% over the three-year period.

### Annual change in coal consumption by coal grade in India, 2022-2026



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### Annual change in power generation by source in India, 2022-2026



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## The long-standing decline of US coal continues through to 2026

Coal demand in the United States is generally determined by power generation, accounting for more than 93% of US coal demand. Coal-fired power generation had been on a downward trajectory for almost a decade until its short uptick in

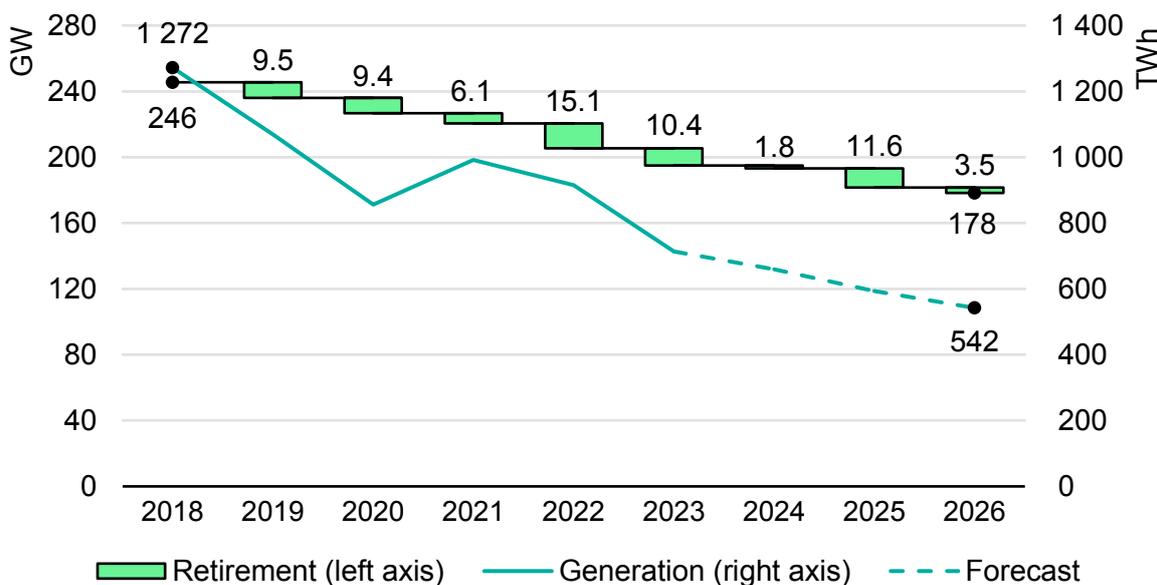
2021, which was rooted in the recovery from the Covid-19 pandemic amid high gas prices. After this brief revival, coal-fired power generation continued its decline in 2022, falling by almost 8% to 915 TWh. Reduced coal-fired generation was compensated by more renewable generation and an increasing share of gas-fired generation despite higher gas prices in 2022.

Following current announcements, US coal-fired generation capacity is set to decrease by about 13% by 2026 compared with 2022. Based on the Energy Information Administration (EIA) we expect planned retirements to total more than 10 GW in 2023 and an acceleration in renewable capacity to support the downward trend in coal-fired power generation. Thus, we estimate thermal coal and lignite demand of 345 Mt in 2023. Moreover, the US Inflation Reduction Act is likely to boost investment in renewables, accelerating this trend.

However, the use of carbon capture and storage (CCS) could support coal-fired generation in the medium term, and the Biden administration significantly increased existing tax credits for carbon dioxide stored underground, incentivising CCS. But, as utilities appear to struggle with the costs and technological complexity of CCS, and with the development of CCS projects taking several years to complete, we do not assume any noticeable effects on coal demand before 2026.

Overall, we forecast coal's share in the electricity mix to fall by 8 percentage points, down to 12% in 2026 compared with 2022. Combined with almost steady demand for met coal in the next three years (at around 14 Mt), this would result in a coal consumption of 276 Mt in the United States in 2026, much lower than any consumption in the United States in IEA statistics since 1960.

### US coal-fired capacity and generation, 2018-2026



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Notes: Capacity values for 2023 to 2026 are based on announced retirements. 2018 aggregated capacity is based on operational capacity in 2022 and retirements and commissions between 2018 and 2022. Retirements after 2022 are planned retirements.

Sources: IEA analysis based on EIA (2023), [Electric Power Monthly](#) and [EIA \(2023\)](#), Coal Data. And IEA estimates.

## After a short-lived uptick, the EU coal demand phase-down continues

Russia’s invasion of Ukraine significantly disrupted the European Union’s coal and gas markets, resulting in unprecedented price levels. Amid an already tight gas market in early 2022, the subsequent shutdowns of Russian gas supplies fuelled price increases even further. Moreover, several policies were enacted to guarantee security of supply over the winter 2022/23, including the obligation to fill gas storage facilities. Among other factors, this led to gas prices skyrocketing in summer 2022.

The crisis also had ramifications for the coal market, albeit without reaching the price levels witnessed in the natural gas sector. Due to the lower marginal costs associated with coal-fired generation, there was a noticeable uptick in coal demand for power generation throughout 2022 compared with prior expectations. The surge in coal-fired generation was propelled by constrained availability of French nuclear units and below-average performance of Scandinavian hydropower. Some European countries developed policies to lift coal-fired plant utilisation, extend the lifetime of existing units, or even restart closed coal-fired power plants to alleviate power markets. In light of high energy prices in 2022, industrial activity slowed, thus causing modest reductions in industrial coal demand.

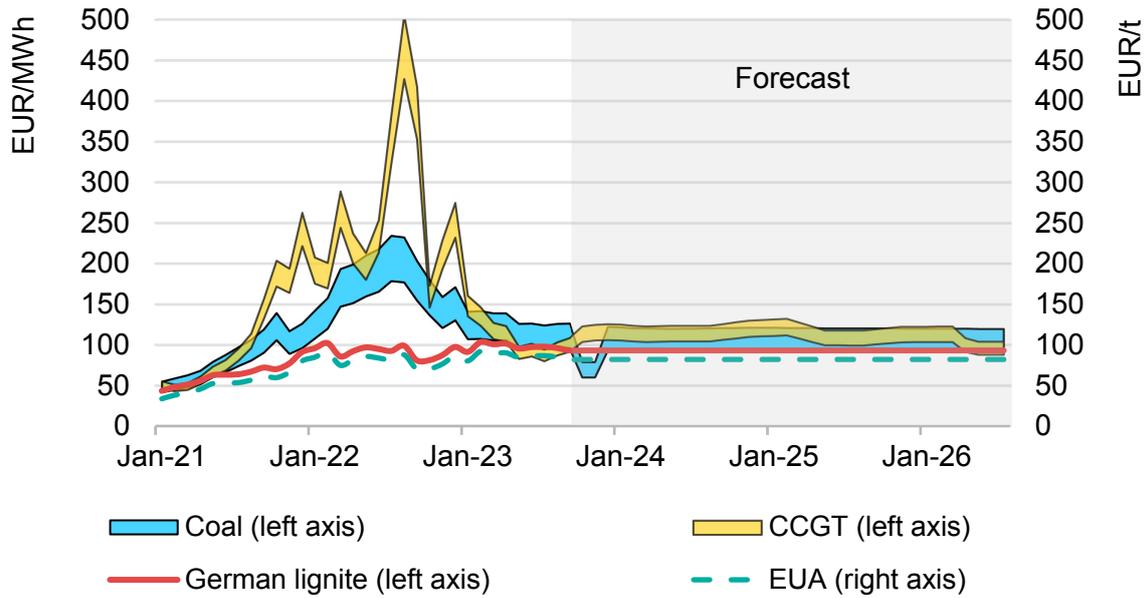
However, with mild weather in the 2022/23 winter and successful policies such as targeted reductions in energy consumption, price levels eventually came down in both coal and gas markets. The return to price levels similar to those occurring at the end of 2021 led to gas-fired units becoming cost-competitive again. Spring 2023 even saw a period when old and inefficient gas-fired units had lower marginal costs than efficient coal-fired units. Together with the return of nuclear units that had been under maintenance for months, and increasing renewable generation over the course of 2023, coal-fired generation – and thus coal demand – plunged. Moreover, electricity demand is estimated to have fallen again in 2023, by more than 4%, leading to the lowest electricity demand seen in the European Union for two decades.

Reflecting an energy market that has eased compared with 2022, coal phase-out plans are still on the agenda, causing significant reductions in coal capacity in the next three years. Germany alone is set to reduce lignite-fired plants by 3.7 GW and hard coal capacity by 8 GW between 2023 and 2025, which also includes plants that temporarily returned from grid reserve to the market during the energy crisis. Accelerating deployment of renewables, especially solar PV, will exacerbate the decline in coal-fired generation. This comes despite elevated gas price levels throughout the coming years, which indicates competitive generation between coal- and gas-fired units assuming strong prices for EU Allowances (EUAs, or CO<sub>2</sub> trading units).

As a result, our models indicate a decrease in EU coal demand from the power sector of 71 Mt between 2024 and 2026, with demand totalling 192 Mt in 2026, and Poland reducing its coal dependency at a slower pace than the other member states using coal for power generation. This corresponds to a significant decline of 27% for the three-year period to 2026. However, the outlook is closely linked to the development of gas prices, which may in turn affect the estimates for coal demand. Driven by power market developments and in part by moderate economic growth, aggregate coal consumption in the European Union is expected to decline from 354 Mt in 2023 to 278 Mt in 2026.

In June 2023, the Republic of Türkiye overtook Germany and Poland in coal-fired power generation for the first time. The increase in coal-fired generation comes despite an overall decrease in coal consumption (down 0.7%), due to a higher utilisation of imported hard coal and less generation from lower-CV domestic lignite. The Turkish government has not announced proposals to stop using coal yet and plans to enable new coal mining activity to fuel power generation despite the pressure of environmental movements. By 2026, our model forecasts decline in coal demand to 109 Mt, as renewables replace significant shares of coal-fired generation.

### EU marginal coal- and gas-fired power generation costs, 2021-2026



IEA. CC BY 4.0.

Notes: EUA = European Union Allowance. CCGT = combined-cycle gas turbine. CCGT net efficiency = 49-58%. Coal net efficiency = 35-46%. Lignite net efficiency = 39%.

Sources: IEA analysis based on Argus Media group. All rights reserved. And IEA estimates.

## Coal demand growth in ASEAN is driven by Indonesia

ASEAN coal consumption totalled 413 Mt in 2022, up by 13% compared to the previous year. Coal consumption across ASEAN is determined by power generation, accounting for 71% of consumption in 2022. Nearly half of ASEAN consumption was in Indonesia (49%), followed by Viet Nam (20%), Malaysia (9%) and the Philippines (9%). For 2023, we expect ASEAN consumption to have continued its increase to reach 444 Mt, mainly driven by a surge in Indonesian demand. Given the strong economic outlook for the region and the number of coal-fired power plants under construction, we forecast demand of 528 Mt in 2026, growing by 6% annually.

Despite Indonesia aims to transition to clean energy and reduce coal usage, underlined by the USD 20 billion package in the Just Energy Transition Package (JETP)<sup>3</sup>, it is about to construct multiple new coal-fired power facilities tailored for industrial purposes. These captive coal plants, whose primary objective is to feed nickel, cobalt and aluminium smelters, account for 13 GW of the total 18 GW in

<sup>3</sup> Just Energy Transition Partnership (JETP) Indonesia is an initiative launched on 16 November 2022 in Bali by the Government of Indonesia (GoI) and the International Partners Group (IPG). The IPG will provide financial support to Indonesia to get a just energy transition.

the pipeline. This expansion reflects Indonesia's strategy to transform the country into a prominent manufacturing hub for electric vehicles and batteries, in which nickel plays a key role.

[Nickel](#), the fifth-most common element on earth, is considered a critical mineral. It is used in a wide range of applications due to its special chemical characteristics, including its high melting point and its resistance to corrosion. About 70% of primary nickel production is used in steel production, followed by battery production with a share of about 11%, which is set to increase in the coming years with surging demand for batteries. According to its purity, nickel can be categorised into Class 1 (with a nickel content higher than 99.8%), which is used in battery manufacturing, and Class 2 (with a nickel content lower than 99.8%), which is predominantly used as an alloying metal in steel production.

Indonesia is the world's largest nickel miner, mining around half of the global total, and has become a major producer of Class 2 nickel; however, it is also extending its Class 1 capacity with growing demand from global battery manufacturers. In general, two main nickel production processes are applied in Indonesia: the rotary kiln-electric furnace (RKEF) and the high-pressure acid leach (HPAL) process.

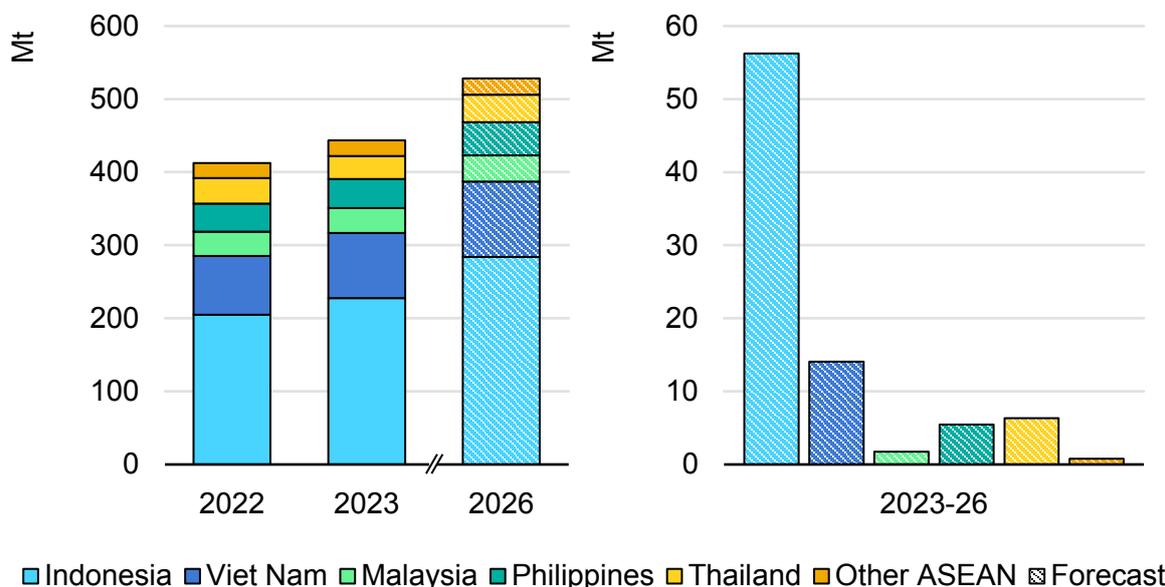
In the more energy intensive RKEF process, crushed nickel ore is first processed with a reductant in a rotary kiln before an electric furnace melts it to ferronickel (FeNi) or nickel pig iron (NPI), both of which are Class 2 nickel. FeNi and NPI can either be used in steel production or converted to nickel matte, which, in turn, can be processed into Class 1 nickel for batteries. In Indonesia, coal is used directly in the process and often in captive plants dedicated to smelting, to produce the electricity required in this process.

In the HPAL process, nickel ore is mixed with acid and steam in an autoclave. After this, the leach is washed by counter-current decantation before mixed hydroxide precipitate (MHP) is obtained through the addition of magnesium oxide, or mixed sulphide precipitate (MSP) is obtained through the addition of hydrogen sulphide. MHP and MSP can finally be processed to Class 1 nickel for batteries. Coal is used indirectly for power generation – often in captive plants – in this process.

With growing demand for electric vehicles and batteries, demand for nickel is increasing and so is the investment in nickel production capacity in Indonesia, led by Chinese companies active in the electric vehicle industry supply chain. Significant investments are being made in both processes. For example, Chinese nickel producer Lygend alone will add a production capacity of more than 0.4 Mtpa nickel metal equivalent by 2024, according to Argus Media, including six HPAL projects totalling 0.12 Mtpa and 20 RKEF projects totalling 0.28 Mtpa.

Mainly driven by the development in the power sector and rapidly growing nickel production, we expect Indonesia’s coal consumption to have increased by 23 Mt in 2023 to 228 Mt. Surging demand for nickel is set to strengthen the production of NPI in the coming years, and thus we estimate coal demand of 284 Mt in 2026.

**Development and forecast change in coal consumption in ASEAN countries, 2022-2026**



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The expectation is that coal demand increased in Viet Nam in 2023, mainly due to heatwaves that resulted in summer temperatures of up to 44°C driving up cooling demand. Reduced hydro generation caused by low water levels further pushed coal consumption, which is estimated to have totalled 89 Mt. Looking ahead, Viet Nam recently aligned its coal capacity expansion targets with the JETP agreement. According to current targets, coal capacity should peak at 30 GW in 2030, indicating an increase of 4 GW from today’s active capacity. Against this background we estimate a surge in coal consumption to 103 Mt in 2026.

In the Philippines, we expect coal consumption to have increased slightly from 39 Mt in 2022 to 40 Mt in 2023. Like most countries, coal consumption in the Philippines is mainly determined by power generation, and the major share of coal consumed is imported from Indonesia. In light of a strong economic outlook, we expect coal consumption to increase as well, reaching 45 Mt in the next three years, as renewable additions seem unlikely to offset the growth in electricity demand in the near future.

Thailand uses significant amounts of lignite to power electricity generation. In 2022, lignite accounted for 15 Mt of Thailand’s combined coal consumption of 35 Mt. Lignite-fired capacity is set to be expanded by 0.7 GW by 2026; however,

the remaining coal-fired capacity is unlikely to change significantly in the coming years. For 2023, we expect coal consumption to have decreased by 9%, and by 2026 we forecast a slight increase to 38 Mt.

## Coal demand is set to decline in mature Asia Pacific economies

Coal consumption in the Asia Pacific region is dominated by its use for power generation. Key consumers in this region are Japan, Korea, Australia, and Chinese Taipei with a combined consumption of 468 Mt in 2022.

In Japan, coal consumption was almost steady from 2021 to 2022, slightly increasing by 2 Mt to a total of 185 Mt. Despite skyrocketing LNG spot prices, coal-fired generation has not been affected significantly during the past year's energy crisis as Japanese LNG supplies are largely covered by long-term contracts. The return to pre-crisis price levels in energy markets as well as ambitious targets for the deployment of renewables (i.e. the doubling of the renewable electricity share by 2030 compared to the 2019 level) are weighing on the outlook for thermal consumption. Moreover, Japan's Kansai Electric Power has restarted operations at its Takahama 1 and 2 nuclear reactors, which had been shut down following the Fukushima disaster, adding about 1.5 GW to the system. Also, as of 2023, a regulatory adjustment allows for the extended operation of old nuclear plants beyond 60 years, improving the prospects for nuclear generation. Besides power generation, met coal demand is expected to remain almost steady. Against the background of these developments, we estimate Japanese coal consumption to decrease by 8% by 2026 to a total of 157 Mt.

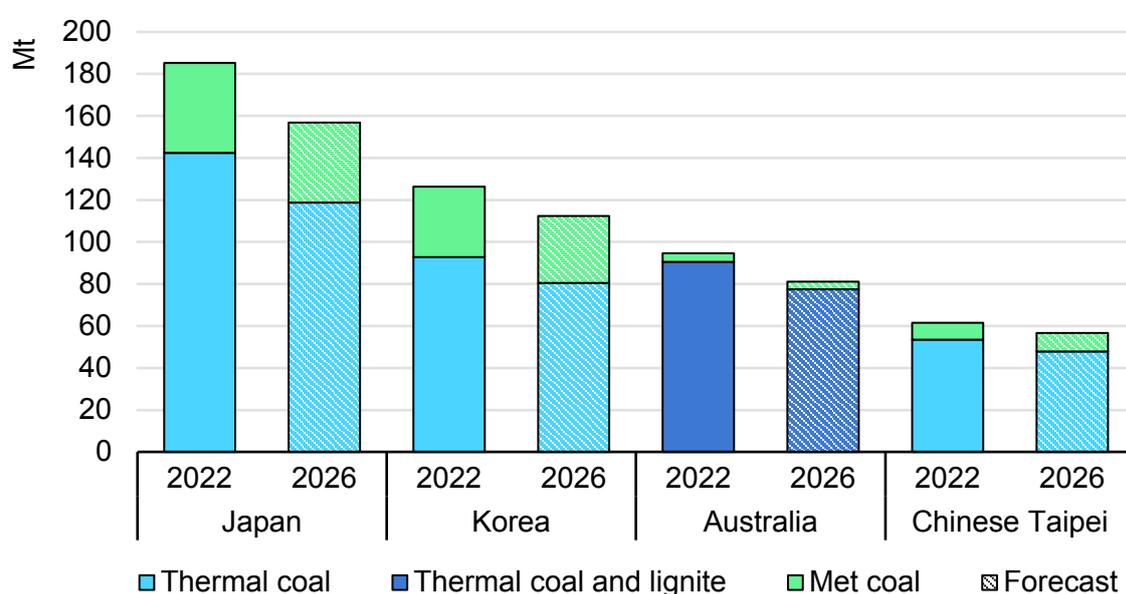
Coal consumption in Korea also barely changed in 2022 (down 1 Mt), totalling 126 Mt. Despite prices declining in 2023, Korea's coal consumption is expected to have decreased this year, down to 120 Mt. In April, Korea restructured its emission targets for 2030 as it tightens the targets for the power sector while relaxing them for the industrial sector. The adjusted target for the power sector is to be reached by increased nuclear and renewable generation, while reducing the share of coal in power production from about 34% in 2021 to about 20% in 2030. Accordingly, these targets are reflected in our estimates for the next three years, with coal consumption decreasing to 112 Mt in 2026.

Overall coal consumption in Australia declined from 100 Mt in 2021 to 95 Mt in 2022 and is estimated to have continued its decrease over the course of 2023 with a reduction of 4%. For the outlook until 2026, we consider further declines in coal-fired power generation to be likely, as coal capacity increasingly serves as backup power to cover peak hours. The Australian Energy Market Operator expects two-thirds of coal-fired power plants to be decommissioned by 2033, although current

renewable additions are falling short of targets, raising concerns about grid stability and power outages. By 2026, we expect a decrease in coal consumption of 11% to 81 Mt.

Coal consumption in Chinese Taipei amounted to 62 Mt in 2022 with 46 Mt used for power generation. In 2023, we expect coal consumption to have remained almost steady, as renewable expansion continued, but nuclear generation decreased. Chinese Taipei plans to fully phase out nuclear power by 2025, and at the same time seeks to push up the share of renewables in the power mix. We estimate aggregate coal consumption of 57 Mt in 2026.

**Coal consumption by grade in a selection of mature Asia Pacific economies, 2022 and 2026**



IEA. CC BY 4.0.

## Robust coal demand in South Asia

Emerging markets such as Pakistan, Bangladesh, and Sri Lanka were greatly affected by the high energy prices of 2022. At times, these countries could not afford to purchase sufficient amounts of primary energy, such as coal or gas, to ensure their growing demand was met, partly resulting in energy shortages. Our estimation for 2023 includes steady to moderate gains in these markets, as coal prices have declined significantly relative to 2022 levels.

The Pakistani rupee saw an inflation rate of almost 20% in 2022, and inflation remained high during 2023. This led to a decline in the purchasing power of Pakistani buyers, increasing the cost of coal imports. To counteract this, Pakistan’s coal miners steadily boosted domestic production. SECMC, Pakistan’s largest coal miner, has set a target to increase its output by around 50% by 2024,

including the significant expansion of lignite production. Furthermore, the 1.3 GW Thar Block-I power plant funded by the China-Pakistan Economic Corridor (CPEC) began operating in February, fuelling coal demand. This recent start-up is in line with Pakistan's latest announcements of a shift away from gas to coal in reaction to the high LNG prices suffered in 2022, aiming to quadruple its domestic coal-fired capacity to 10 GW. However, financing for these projects is uncertain as China, the largest financier, has committed to not finance new coal plants abroad. Given these developments, our model calculates an increase in coal consumption from 32 Mt in 2023 to 39 Mt in 2026.

Similar developments in respect of inflation took place in Bangladesh, where the value of the Bangladeshi taka sharply decreased and made coal imports costly. Even a new coal plant, commissioned in late 2022, ran out of coal and was idle for several weeks in 2023. Together with adverse weather conditions causing higher demand, this led to disruptions in electricity supply, especially between May and July. However, coal capacity in Bangladesh is set to increase. The 1.2 GW Matarbari and 1.2 GW Banshkhali coal plants are in the testing phase and are expected to begin commercial operation shortly. In November 2023, the 1.3 GW Maitree Power Plant was commissioned, putting coal generation capacity above 5 GW. Although projects are under consideration, their progress is uncertain as funding institutions from outside the country pledge to withdraw from financing coal projects internationally. Coal consumption in 2022 was 7 Mt and is expected to have increased to 13 Mt in 2023. Our estimate is for coal consumption to increase to 19 Mt by 2026, fuelled by significant capacity additions and a strong economic outlook.

Coal consumption in Sri Lanka plunged to 1.9 Mt in 2022 and is expected to have remained almost steady during 2023. Our estimate is for coal consumption to increase to 2.6 Mt by 2026, but this is subject to the performance of the Lakvijaya power station, the only coal power plant in Sri Lanka.

## **Coal plant performance in South Africa is decisive for African coal consumption**

Coal consumption in Africa decreased by 4.4 Mt in 2022 to a total of 187 Mt amid persistent issues in South Africa's coal plant fleet. However, the decrease was modest as consumption was already at a reduced level in the aftermath of the Covid-19 pandemic. During 2023 economic activity in Africa has been stagnant, and power cuts in South Africa continued to weigh on the continent's coal demand. For the period until 2026, we forecast a U-turn in the continent's coal consumption trend, with total demand increasing to 193 Mt in the next three years, mainly due to better performance of the coal assets operated by the state-owned power utility Eskom.

Africa's coal consumption is mainly driven by developments in South Africa, accounting for 84% of the continent's consumption in 2022. Amid high energy prices and slow recovery from Covid-19, South Africa's coal consumption decreased in 2022 by 6 Mt to 160 Mt. For 2023 South Africa is set to have experienced record load shedding, affecting households and industrial activity alike. The poor performance of coal power plants, owned by Eskom, is the main culprit for the power shortages. These power cuts are estimated to have shaved 2 percentage points off the country's GDP. Considering the low availability of the coal-fired power plant fleet, we estimate coal consumption in 2023 to have decreased further to 154 Mt.

South Africa is part of the JETP, which aims to close almost half of South Africa's coal plants by 2030. Looking ahead, the circa USD 500 million Eskom Just Energy Transition Project (EJETP), funded by the World Bank, seeks to decommission the 56-year-old Komati coal plant and in turn fund the installation of around 0.2 GW of renewable capacity and about 0.2 GW of battery capacity. The coal plant was shut down in late 2022 and recorded low availability in recent years. However, given the critical supply situation, South Africa's climate policy body recently suggested delaying the retirement of coal plants without specifying a timeline. In addition to that, Eskom was due to restart 2.4 GW of coal capacity by the end of 2023. Against this background, we expect coal consumption to rebound to 164 Mt by 2026.

In Zimbabwe, a 0.3 GW coal-fired power unit started operation in March, and another block of a similar size is expected to come online in late 2023. Coal capacity in Botswana is about to increase as well, as a new 0.6 GW coal plant is planned for construction by India's Jindal Steel and Power Ltd., with completion due in 2026. Beyond these, we expect no new coal projects to be commissioned in Africa by 2026.

## **Global coal demand is likely to show its fourth significant decline since the 1980s**

With this year's coal report forecasting a structural reversal in global coal consumption, it is worth putting recent developments into perspective. The historical trajectory of coal consumption exhibits an almost constant increase over the last four decades, doubling in the 30-year period from 1984 to 2014. However, three crisis-driven events caused coal consumption to decline sharply for a short period.

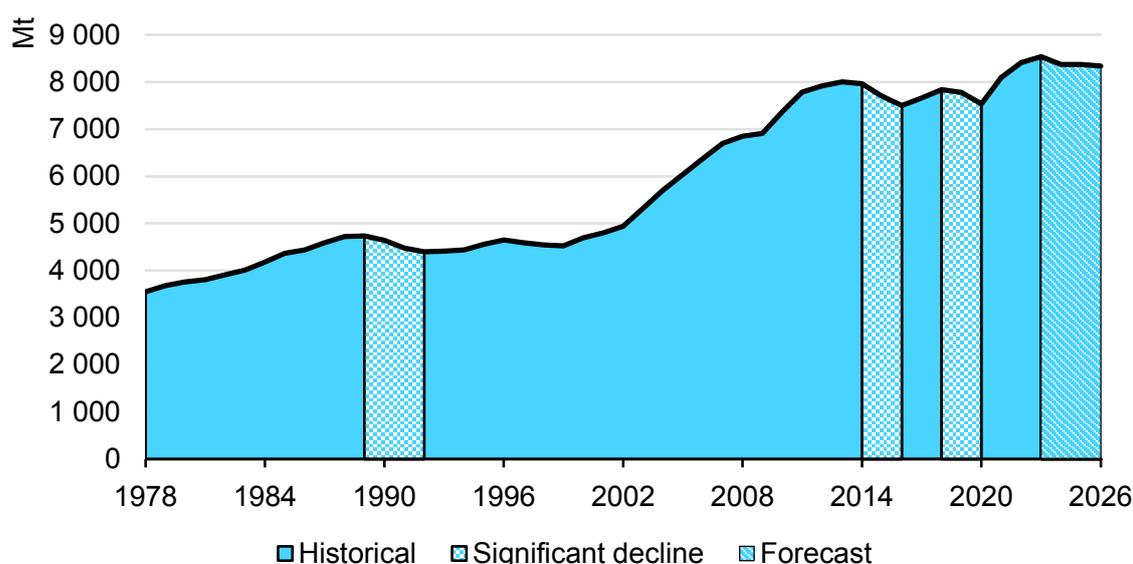
The first event initiating a downward trend was the collapse of the Soviet Union around the 1990's marking the end of the Cold War. The resulting political uncertainty and the dismantling of heavy industry in the USSR and countries in its orbit weighed on economic activity, which in turn led coal consumption to decline by 7% between 1989 and 1992.

Another remarkable decline in coal consumption took place during the period 2014-2016, when an economic slowdown in China curbed global coal demand. With weak growth in power demand, more than met by non-coal generation sources, lower demand for non-power applications and contraction in the steel and cement sector, Chinese coal demand dropped by 9% in these three years, and global demand by 6% as a consequence.

The latest drop in global coal consumption started in 2019, when natural gas prices falling to well-below average levels and slow growth in power demand weighed on coal-fired generation. The decrease in coal consumption was even stronger in 2020, with Covid-19 as the driver of the downturn. The pandemic caused the disruption of supply chains, industrial activity to plunge, and power demand to drop accordingly. During the two-year period global coal demand saw a decline of 3.9%.

All the above-mentioned declines in global coal consumption were reversed during the recovery once the effects of the crisis were over. Now, amid steady demand for met coal, we appear to be facing a structural change in coal demand for power generation triggered by the rise of renewables, which are about to grow more strongly than electricity demand. In the short term, the uncertainty comes from weather variability, which significantly impacts renewable generation. Over the longer term, the accelerating growth of renewables is likely to continue. Irrespective of demand levels, the eastward shift of coal consumption leaves coal bastions such as China, India and the ASEAN countries to be decisive for the actual trend in global coal markets.

### Global coal consumption, 1978-2026



IEA. CC BY 4.0.

Note: The period to 2020 shows data without adjustment from the fiscal to the calendar year in some world regions.

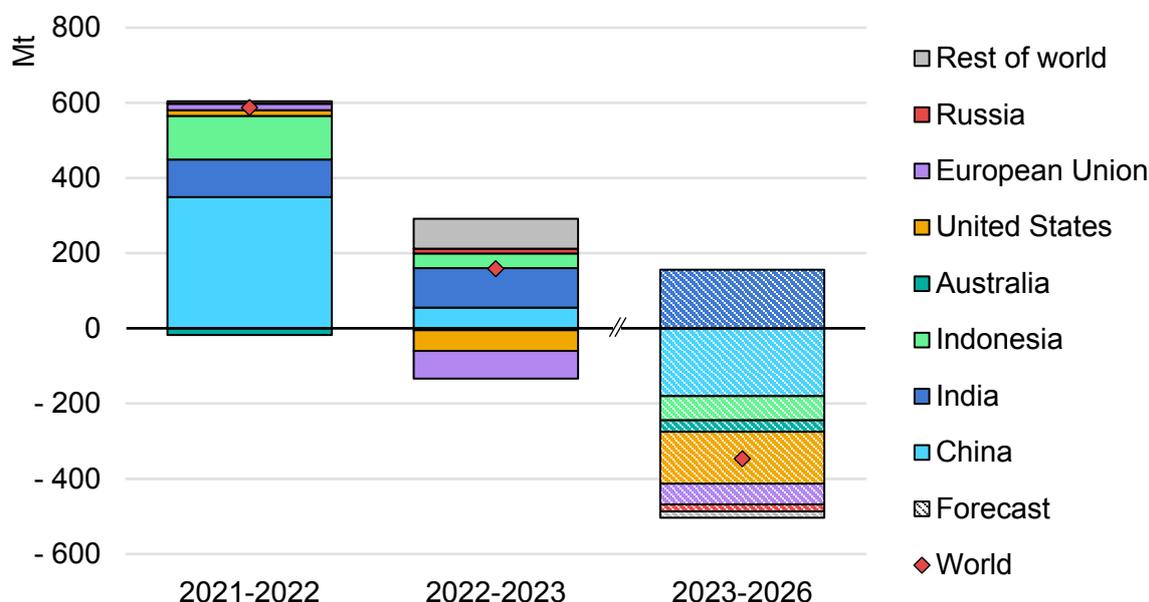
# Supply

## Global coal supply is likely to have peaked in 2023 and then to decline in line with demand

Further growth in global coal demand in 2022, after the big rebound in 2021, pushed global coal supplies to new highs of about 8 582 Mt (up 7%). The increase was led by China, which drove up domestic production to reduce its exposure to high import prices and to avoid supply shortages. Indonesian production growth overtook Indian growth, with exports seeing a remarkable uptick to serve increased seaborne demand for thermal coal amid a rise in domestic demand.

Global coal production is forecast to have risen by 1.8% in 2023, with continued growth in India, China and Indonesia more than offsetting declines in the United States and the European Union. Thus, 2023 marks another all-time high in global coal production, totalling 8 741 Mt. Steam coal and lignite account for about 87% of global coal production and their growth in production accounts for similar share of the global production increase. Coking coal accounts for the balance, driven by strong growth in Mongolia.

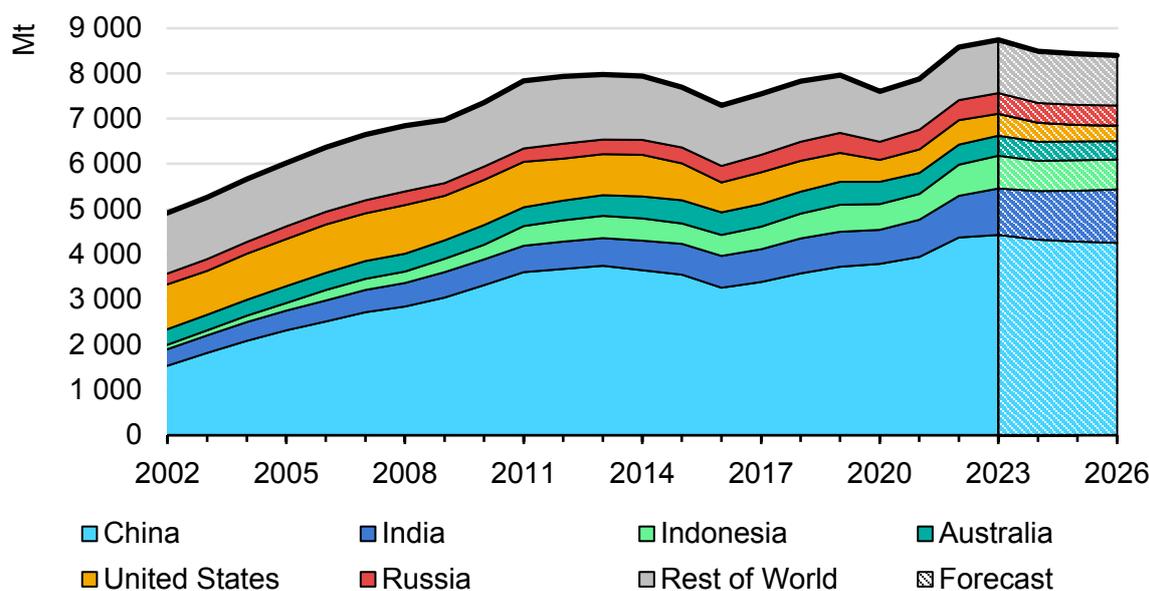
Change in global coal production, 2021-2026



IEA. CC BY 4.0.

For the forecast period, we expect a net reduction in global coal production starting in 2024, which would mean global coal production peaking in 2023 in line with global coal demand. Ongoing declines in the United States and the European Union are likely to be complemented by reduced production volumes in Indonesia, as Chinese demand for seaborne thermal coal is likely to decrease. The last bastion of remarkable growth in production is India, serving the growing demand from its power sector. Our model suggests that declines in other countries will more than offset this growth, resulting in global production of 8 394 Mt in 2026.

### Global coal production, 2002-2026



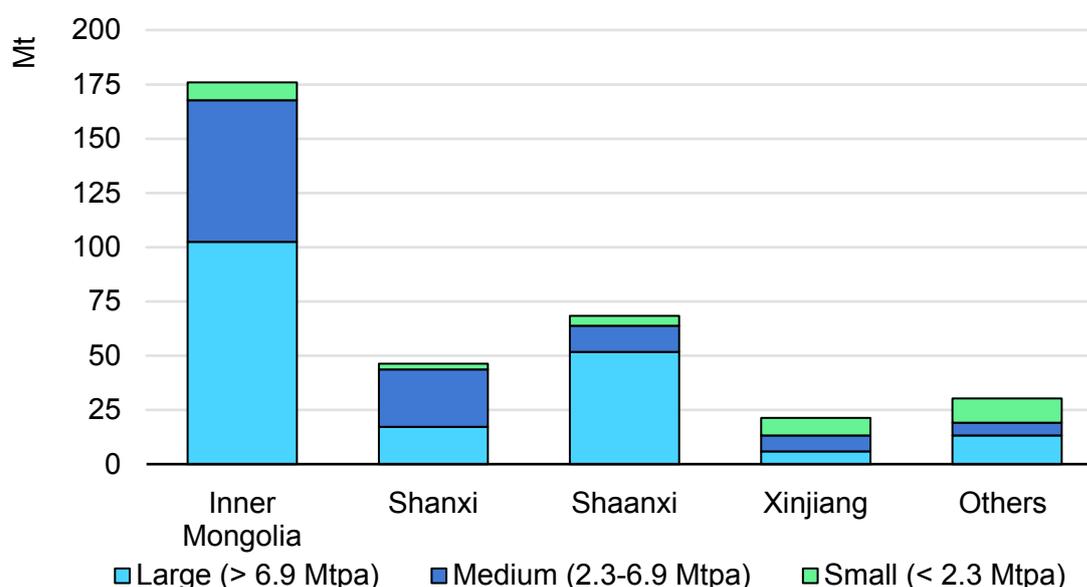
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## Coal production in China saw a remarkable uptick in 2022

In 2022, China's coal production grew by almost 9% to 4 374 Mt, an all-time high. China significantly boosted domestic coal production in response to a policy released in autumn 2021, which made coal production a key energy policy priority, as earlier coal shortages caused severe power cuts. Furthermore, a ramp-up of domestic coal production was aimed at reducing China's exposure to import prices, which reached extraordinarily high levels in 2022. Domestic production rose to unprecedented highs, passing 400 Mt in a single month for the first time in December 2022, according to the National Bureau of Statistics.

At about 85%, most of China’s coal production is thermal coal, complemented by met coal<sup>4</sup>. More than 80% of its thermal coal production is concentrated in just four regions: Inner Mongolia (34%), Shaanxi (23%), Shanxi (20%) and Xinjiang (6%). Whilst 2021 saw a decrease in output from small- and medium-sized mines in some regions, thermal coal output rose in all mine segments in 2022. The four major regions accounted for more than 90% of the total thermal coal output increase of 10%, predominantly driven by expanding output from large-scale mines. Inner Mongolia alone contributed more than half of the growth.

**Change in thermal coal production in China’s major producing regions by mine size, 2021-2022**



IEA. CC BY 4.0.

Source: IEA, adapted from CRU (2023). Thermal Cost Model (database).

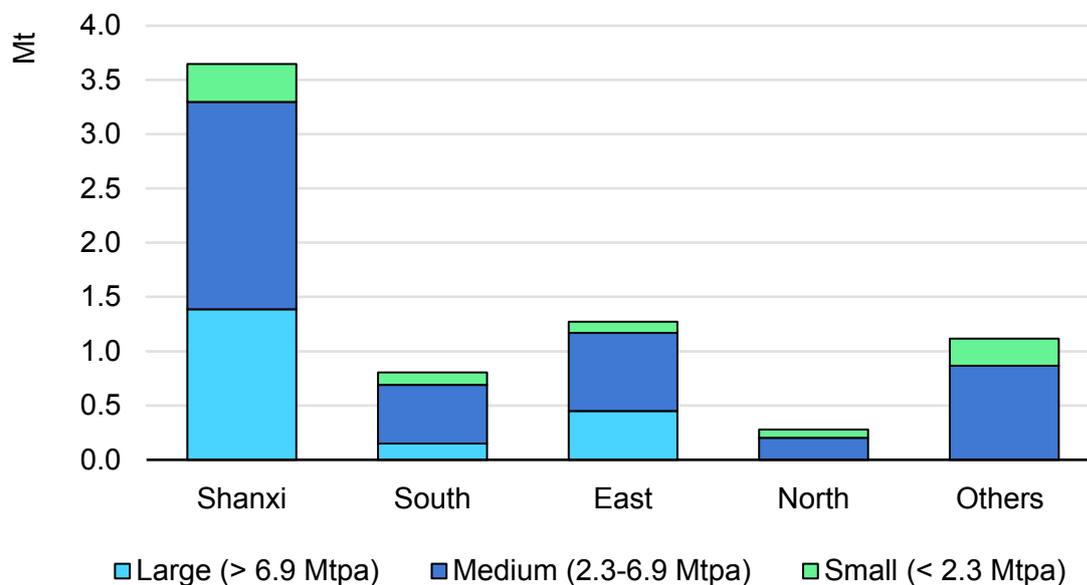
However, as China boosted domestic production to avoid supply shortages, the quality of the thermal coal has declined. In a recent report, the Cinda Securities Research and Development Centre noted that the growth rate of coal consumption for power generation has been significantly higher than the rate of growth in thermal power generation, indicating a decline in coal quality. Furthermore, key mining areas in northern Shanxi are reported to have shifted from high-quality to lower-quality thermal coal, as their high-quality reserves deplete. In addition to that, estimated washing ratios, an indicator for coal quality, have decreased by almost five percentage points between 2020 and 2022.

Met coal production rose by 1.1% in 2022, with Shanxi contributing most of this growth. Shanxi remains the most important met coal producer with a share of more

<sup>4</sup> Although China also produces anthracite and lignite, available data do not report these categories separately.

than 50%. As in thermal coal production, there has been a trend towards upper-medium-sized and large mines. Nonetheless, driven by surging demand in recent years, smaller mines also contributed to production expansion.

### Change in met coal production in China's major producing regions by mine size, 2021-2022



IEA. CC BY 4.0.

Source: IEA, adapted from CRU (2023). Metallurgical Cost Model (database).

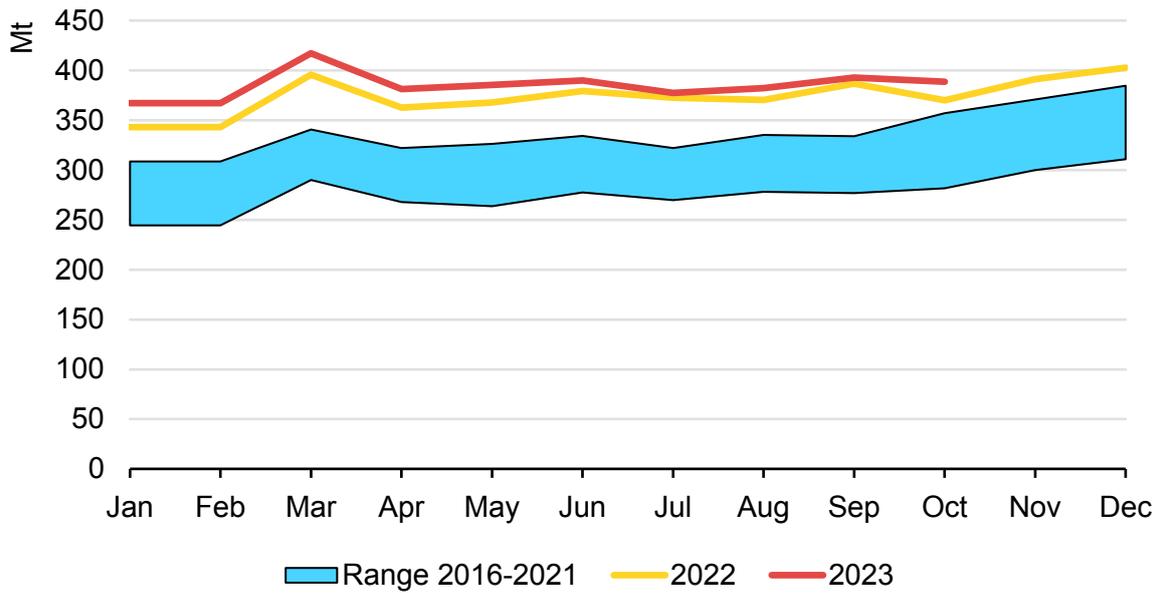
## Chinese production growth slowed in 2023

We estimate China's coal production to have increased by 1.3% in 2023, to 4 429 Mt. In March, China reached a new monthly high of 417 Mt, surpassing the record set three months earlier. Production typically edges higher in March due to restocking after China's New Year celebrations.

Growth in domestic production has been slowing as the tightening of safety measures, including safety checks, improvements to mining facilities and a tightening of approval processes in response to fatal mine accidents weigh on mine output. In the first three quarters of 2023, raw coal production rose by about 139<sup>5</sup> Mt, more than of a third of which was added by Shanxi, China's largest coal mining region. Output in Shanxi rose by about 5% compared to the same in 2022. The second largest coal producing region, Inner Mongolia, added another 26 Mt (up 3%). The strongest relative production growth was recorded in Xinjiang with almost 9% or 25 Mt.

<sup>5</sup> Monthly data based on NBS does not necessarily match IEA data, as monthly volumes are adjusted in the annual reporting. In addition, NBS reports raw coal and IEA reports marketable coal.

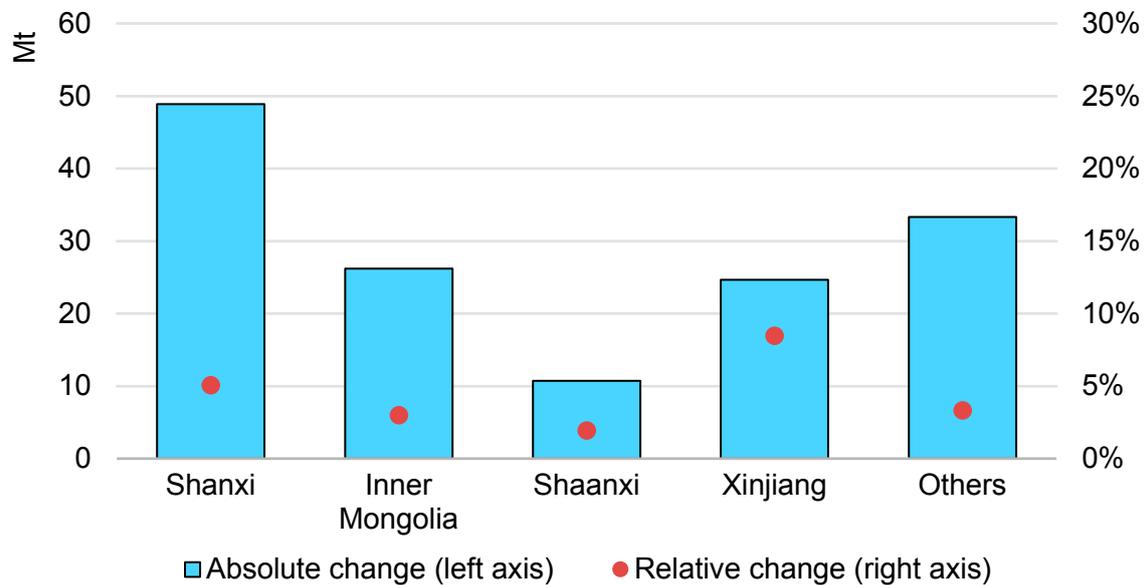
### Coal production by month, China, 2016-2023



IEA. CC BY 4.0.

Source: IEA analysis based on National Bureau of Statistics of China (2023), [Statistical Database](#).

### Year-on-year change in coal production by region of China, January to September, 2022-2023



IEA. CC BY 4.0.

Source: IEA analysis based on National Bureau of Statistics of China (2023), [Statistical Database](#).

## The difficult balance of China's coal supply through to 2026

After the power shortages – partly attributed to coal shortages and high coal prices in recent years, particularly in 2021 – China's coal production has ramped-up steeply since summer 2021 to avoid similar events. At the same time, spurred by lower prices on international markets and with the aim of reducing the risk of shortages, China has also increased its imports significantly (see “Trade” Chapter). Indeed, the successful acceleration of production together with increasing imports, combined with slower growth in coal consumption, have resulted in a surplus of supply and considerable stock building. At power plants alone, coal stocks were reported to amount to 200 Mt in June 2023. The expectation of lower demand signals a reduction in supply through to 2026, but the question is the degree to which domestic supply and imports will be affected by the current glut.

To address this question, we need to consider that 2023 will have seen well over 1.2 billion tonnes of coal – over 800 Mt from domestic mines and almost 400<sup>6</sup>Mt from imports – arriving at Chinese coastal regions. The arbitrage between domestic production and imports is determined by different factors. First is the cost. As Chinese production is moving to the west of the country, so transport costs and therefore final costs are increasing too. However, these cost increases only partially weigh on the supply of domestic coal, as the contract policy protects the domestic market and stabilises final prices. For 2024 the National Development and Reform Commission has requested power generators to procure 80% of their coal needs via term contracts. This share has been reduced compared with 2023 owing to the abundant coal stocks currently existing at power plant sites. Moreover, on the supply side, all production capacity approved since September 2021 must be sold through term contracts in order to stabilise domestic supply. Conversely, the favourable quality characteristics of some imported coal (e.g. Indonesian coal with a low ash and sulphur content) make it beneficial to blend domestic and imported coal in some Chinese coal power plants, underpinning the requirement for imports.

We expect both coal production and imports to decrease through to 2026, but this is something that we need to monitor and will adjust accordingly in the future. In addition to the uncertainty about the performance of the Chinese economy, increasingly weather-dependent electricity supply and demand are further increasing uncertainty. Indeed, currently abundant coal stocks are a protection against the weather vagaries.

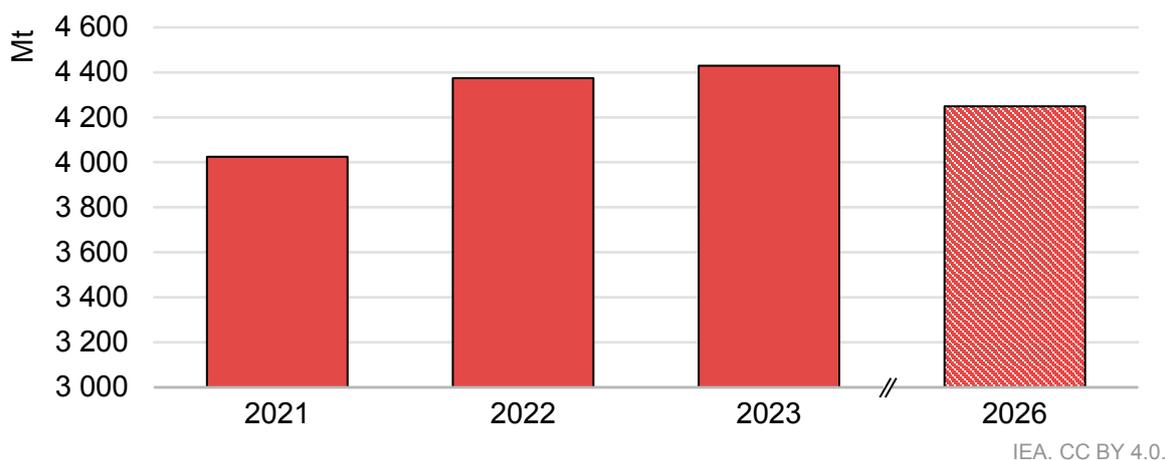
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<sup>6</sup> Total imports are over 400 Mt, which include some land-based imports from Mongolia and Russia.

Chinese policy currently continues to incentivise high production quantities. However, an initial indication of lower production volumes is central authorities commenting on the deterioration of domestic coal quality, which has been induced by factors such as mining areas with lower quality or lower washing ratios to fulfil production targets. It is important to note that the quality deterioration (i.e. declining calorific value) discussed in the demand section is independent of the supply-demand imbalance, as both production and consumption are measured in tonnes. In a situation of oversupply, the push to increase output will moderate and the return to quality versus quantity will also help balance the market.

We forecast Chinese coal production to start its downwards trend from 2024 onwards, in line with the development of demand. We expect coal production to decline by 1.4% annually to 4 250 Mt in 2026. However, in December 2023 the Chinese government has decided to establish a mining capacity reserve of 300 Mtpa starting in 2027, but this is after our forecast period.

#### Coal production by year, China, 2021-2026



## India surpasses the 1 billion tonne production mark and continues its growth

In 2022, India's domestic coal production rose to about 922 Mt, up 12% compared to 2021. By boosting domestic production India tried to avoid supply shortages and reduce import dependency amid the high-price environment and in view of rising demand. At 99%, almost all of India's domestic production is thermal coal and lignite<sup>7</sup>; in 2022 it totalled close to about 915 Mt.

<sup>7</sup> In this report, coking coal used for thermal purposes is considered thermal coal.

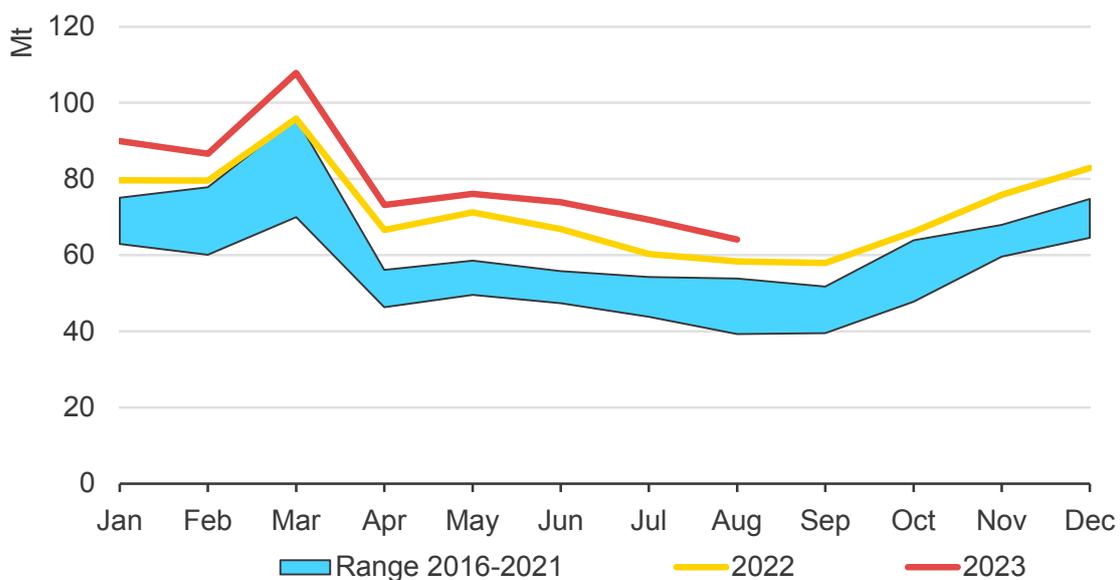
India’s coal sector can be divided into three categories: public, captive, and commercial mining.

In the public sector, two state-owned coal mining companies – Coal India Ltd (CIL) and Singareni Collieries Company Ltd (SCCL) – are the main producers of hard coal, whereas state-owned NLC India Ltd produces lignite. CIL, which accounts for about 80% of domestic coal production, contributed three-quarters of the total growth seen in 2022, recording a 12% increase in production. CIL is planning to continue production growth and Mine Developers cum Operators (MDOs) are a key pillar of its strategy. CIL is increasingly using MDOs, and it has a target to outsource 90% of production in five years.

The captive category includes mines, serving demand from industrial or power facilities owning the mines. While the share of captive blocks is only 12% of India’s coal production, they have grown at a remarkable pace, up 27% in the first eight months of 2023. NTPC, the largest power producer, is ramping up production in its captive blocks at a rapid pace. In FY 2023, they increased its output by 65% up to 23 Mt, with plans for further growth. We analyse the development in the commercial category in the section below.

We expect coal production in 2023 to have further increased by about 11% to a total of 1 027 Mt, surpassing the 1 billion tonne mark for the first time. This estimate is backed by another record in monthly production: according to India’s coal ministry, monthly coal production exceeded 100 Mt for the first time in March, totalling 107 Mt. In addition to that, weaker-than-usual monsoons in September supported coal output.

### Monthly coal production, India, 2016-2023



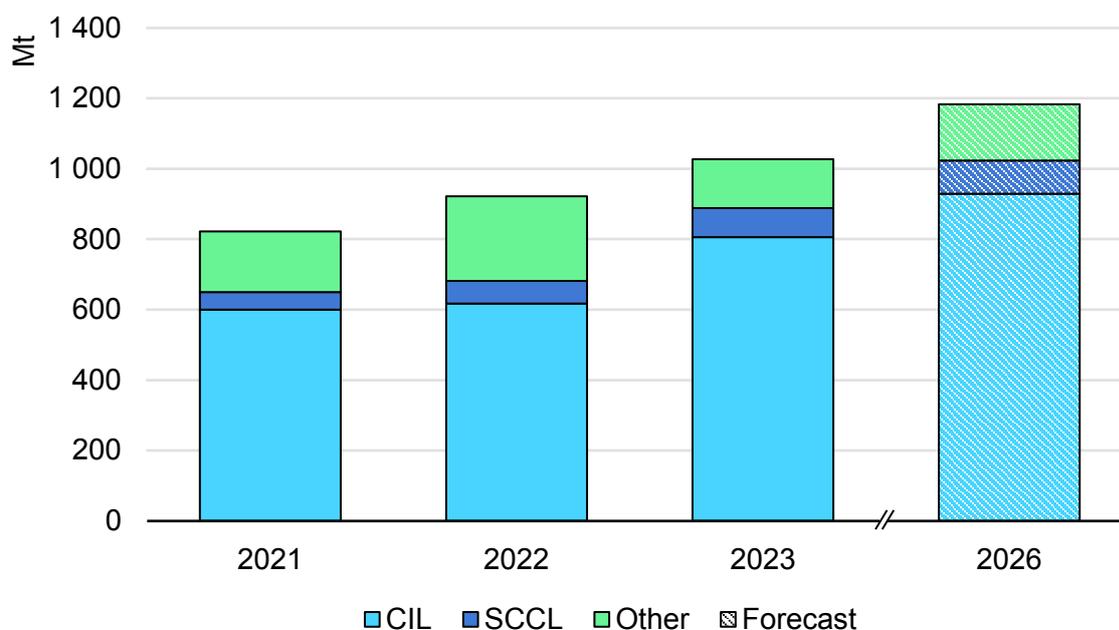
IEA. CC BY 4.0.

Source: IEA estimates based on McCloskey (2023). [McCloskey Coal, Metals and Mining Service](#)

Domestic production is being supported by extensive infrastructure investments of about USD 3 billion by CIL through to the end of FY 2029 in view of expected growth in coal demand. Investment is planned to improve the first mile connectivity of mines, adding pipe conveyors with a combined capacity of about 764 Mtpa. Furthermore, with the completion of the 1 337 km Eastern Dedicated Freight Corridor, coal from the east of India can now access the northern regions in half the time it took before its completion. Another initiative that may ease transport costs is the Rail-Sea-Rail Strategy, which aims to integrate rail and sea routes in order to reduce costs and improve the efficiency of coal transport, in particular from Odisha, Chhattisgarh and Jharkhand to the western regions.

With coal demand set to rise in the years ahead, mainly driven by increased coal-fired power generation, we expect coal production to increase accordingly. The strategic focus of the Indian government on reducing its import dependency is likely to lead to growth in domestic supply surpassing growth in demand. We anticipate production growth of 156 Mt by 2026, output totalling 1 183 Mt. In November 2023 the Coal Ministry announced plans to increase production to 1.4 billion tonnes in FY 2027. The ministry estimates a requirement of 400 Mtpa to feed 80 GW of new capacity, although actual consumption may be lower depending on the contribution of renewables and the development of electricity demand. Therefore, we will monitor developments in the sector, and potentially review our production forecast upward in the future if needed.

### Annual domestic coal production by company, India, 2021-2026



IEA. CC BY 4.0.

Sources: IEA analysis based on McCloskey (2023), IEA estimates.

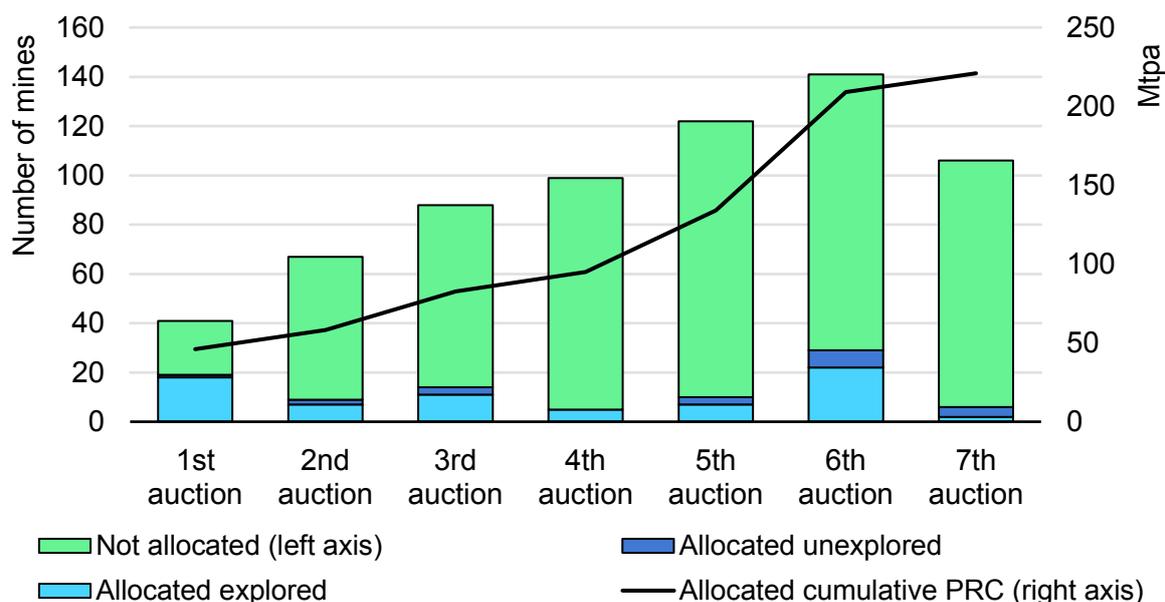
## Commercial mines in India are progressing faster than expected

The Indian government decided to partially end CIL's monopoly in the coal mining sector in 1993 by opening it to private companies, therefore enabling captive blocks. In 2015 the possibility of commercial sales was approved in order to boost domestic production. The aim was to close the growing gap between demand and production, which was increasing the volume of imports, and to increase the coal sector's competitiveness and spur industrial development. The mechanism for the allocation of mines is currently organised in the form of tenders, with the first tranche having been launched in June 2020.

Seven auction rounds have been completed successfully and the eighth round was launched on 15 November 2023, offering 39 mines. A total of 91 mines have been allocated to bidders in the seven auctions that have been completed. The vast majority of offered and allocated mines are thermal coal mines, serving demand from captive or on-grid coal power plants. The cumulative peak rated capacity (PRC) of the allocated mines that have been fully explored totals around 221 Mtpa, which is more than 20% of India's current annual coal production. This number should increase once the exploration of the remaining mines is completed.

The highest number of coal mines was allocated in the sixth auction in the first half of 2022, totalling 22 explored mines with a combined PRC of 75 Mtpa, and seven unexplored mines. However, the number of mines offered in each round has been disproportionately higher than the number of mines allocated, as many sites are in deep forest and difficult terrain, and therefore struggle to find bidders. This is especially true for the latest auction, in which only six out of 106 mines were allocated. To attract more buyers, the Indian coal ministry has prepared drone videos for the next auction, giving buyers an idea of the mines' topography.

### Commercial coal auction results, number of mines and PRC, India



IEA. CC BY 4.0.

Note: Allocated cumulative PRC exclusively shows PRC of fully explored mines.

Sources: IEA analysis based on India, Ministry of Coal (2023), Argus Media Groups. All rights reserved.

The range of companies that have placed successful bids in the last seven auctions is diverse. Among them are big names like state-owned NLC and stock market quoted Jindal Power, but also captive industrial consumers and several smaller companies with little experience in coal mining.

In contrast to some expectations, the auctioned commercial coal mines are progressing at a remarkable pace. Already, five out of the 91 allocated mines have commenced operations, despite being acquired only three years ago. Four more mines have obtained all the necessary permissions and are poised to commence production soon, signalling that the commercial coal auction mechanism is a successful strategy for India to boost its domestic production and reduce import dependency.

## Output in Indonesia is driven by domestic and international demand

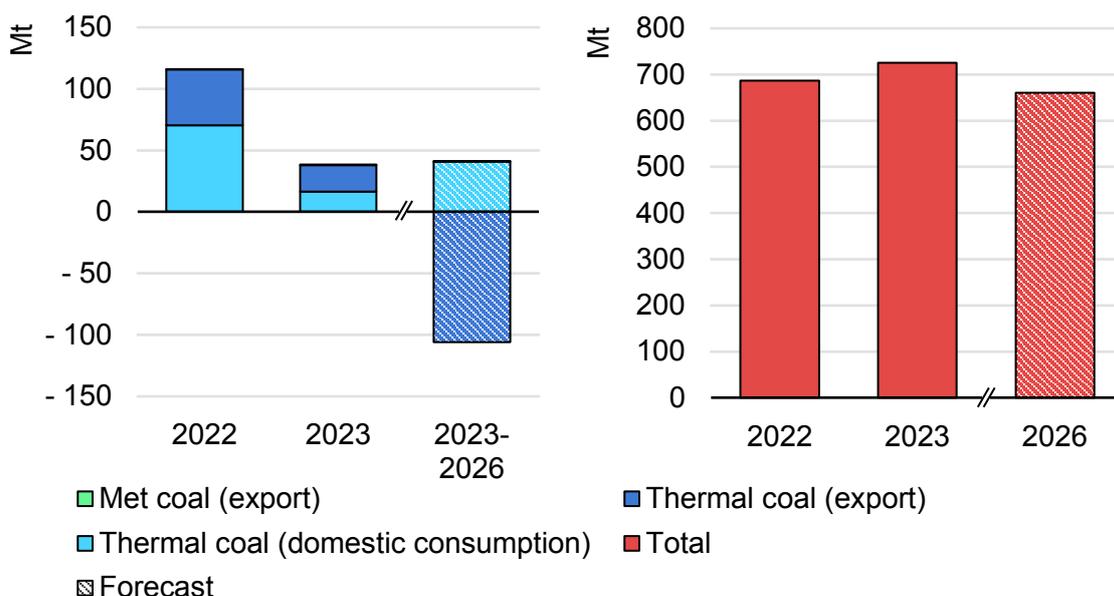
Indonesia's coal production rose by about 20% to 687 Mt in 2022. The country was one of the few coal exporting nations to significantly increase production to supply the extraordinarily tight coal markets seen in 2022. This comes despite an export ban in early 2022 causing some miners to hold output back and intense rainfall partially disrupting mining operations.

For 2023, we estimate Indonesian production to have continued its growth to 725 Mt, surpassing the national target of 695 Mt by 30 Mt, and the 700 Mt mark

for the first time ever. However, annual growth compared to 2022 is estimated to have slackened. Indonesia exports about 70% of its coal, the vast majority of which is low calorific value (CV) thermal coal serving demand mostly from China and India. Both export markets are likely to have seen record levels of coal imports in 2023, with Indonesia increasing production to meet seaborne demand. Nonetheless, some Indonesian mining companies have considered production cuts in response to market prices approaching production cost levels. Furthermore, Indonesia’s coal infrastructure still faces inefficiencies, for example the Jambi province is likely to have fallen 50% short of its 36 Mt production target, as inadequate transport capabilities constrain coal output.

In the next three years, we expect Indonesian aggregate coal production to decline, as significant reductions in exports more than offset gains in domestic coal consumption. Reduced seaborne demand is triggered by India trying to lower its import dependency and by an all-time high in Chinese coal production. Overall, we expect a reduction of 64 Mt by 2026, down to 661 Mt.

**Change in coal production and total coal production, Indonesia, 2022-2026**



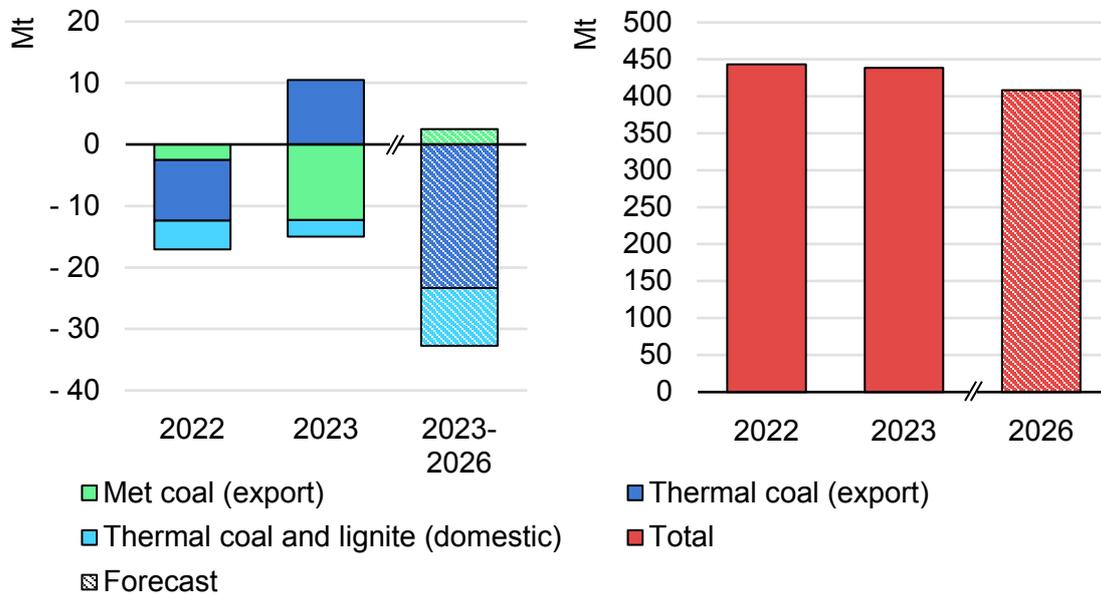
IEA. CC BY 4.0.

## Australian coal producers: Between gloomy domestic demand and the more attractive seaborne market

Australia’s coal production slightly decreased in 2022 by 3.7%, as La Niña caused adverse weather conditions with frequent torrential rainfall and mine floodings, and as the aftermath of the Covid-19 pandemic continued to weigh on the industry.

After three consecutive years of La Niña, Australia experienced El Niño for the first time in seven years in 2023. El Niño is associated with hotter and dryer weather conditions, creating better operating conditions. At the same time, a higher risk of bush fires could affect production, and mines are still reported to face labour shortages. China lifting its unofficial ban on Australian coal imports in early 2023 sent a positive signal for Australian production. However, Chinese demand for Australian coal remains behind expectations, as other world regions such as Russia and Mongolia are more cost-competitive. Increasing met coal demand in India, caused by surging steel production, is being met by higher imports. Demand from Japan remained stalled throughout 2023, weighing on Australian met coal production. Against this background, we estimate production to have slightly decreased this year to about 439 Mt.

**Change in coal production and total coal production, Australia, 2022-2026**



IEA. CC BY 4.0.

Through to 2026, we forecast Australian thermal coal and lignite production to continue its decline, as new thermal coal projects face increasing headwinds in light of pressure from environmental, social, and governance (ESG) standards, and from financing and insurance issues, as well as domestic demand for thermal coal and lignite being on a downward trajectory. In addition, demand from Japan, a primary destination for Australian high-CV thermal coal, is contracting over the next three years. As a result, we expect a decline in thermal coal and lignite production of 33 Mt, down to 250 Mt in 2026. We forecast met coal production to rise again through to 2026, with some new mines coming online, reaching 159 Mt by 2026.

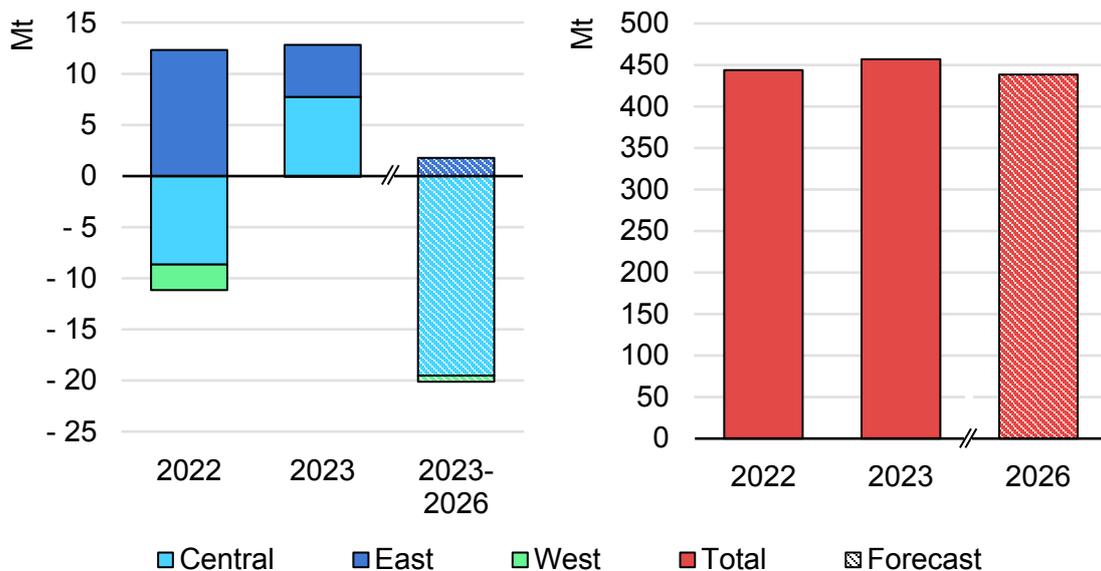
## Russian coal production is shifting to the east with exports

In 2022 Russia’s coal production remained stable at about 444 Mt (up 0.3%). The sanctions imposed on Russia in response to its invasion of Ukraine and eastbound railway bottlenecks hindered it from extending production to benefit from high global demand and coal prices. The geopolitical situation further implied a shift in production within Russia from central and western parts of the country to the east.

For 2023 we estimate Russia’s coal production to have increased by 2.9% to 457 Mt. Its decision to introduce an export duty on coal from October 2023 is likely to put pressure on exports and production. Also, rearranging supply chains with the shift eastwards may still cause disruptions to production; during 2023, railway deliveries to western and southern export terminals were restricted. But overall, China’s appetite for Russian coal is likely to have supported Russian production, especially in the east. However, forecasts for Russia are difficult under the current wartime circumstances.

Up to 2026 we expect coal production in central Russia to decline, whereas eastern production sites should continue to increase output, thereby strengthening ties with China. But as global seaborne import demand are likely to decline in the next three years, this will have an impact on Russian exports, and thus on production. We expect aggregate coal production in Russia to decrease by 18 Mt to 439 Mt.

**Change in coal production by region and in total, Russia, 2022-2026**



IEA. CC BY 4.0.

Sources: IEA, adapted from CRU (2023), Coal Cost Model (database). And IEA estimates.

Mongolia also regards China as its primary coal export destination. New railways enabling higher exports provide positive signals for more coal production. We forecast production to more than double by 2026 compared to 2022, reaching 84 Mt.

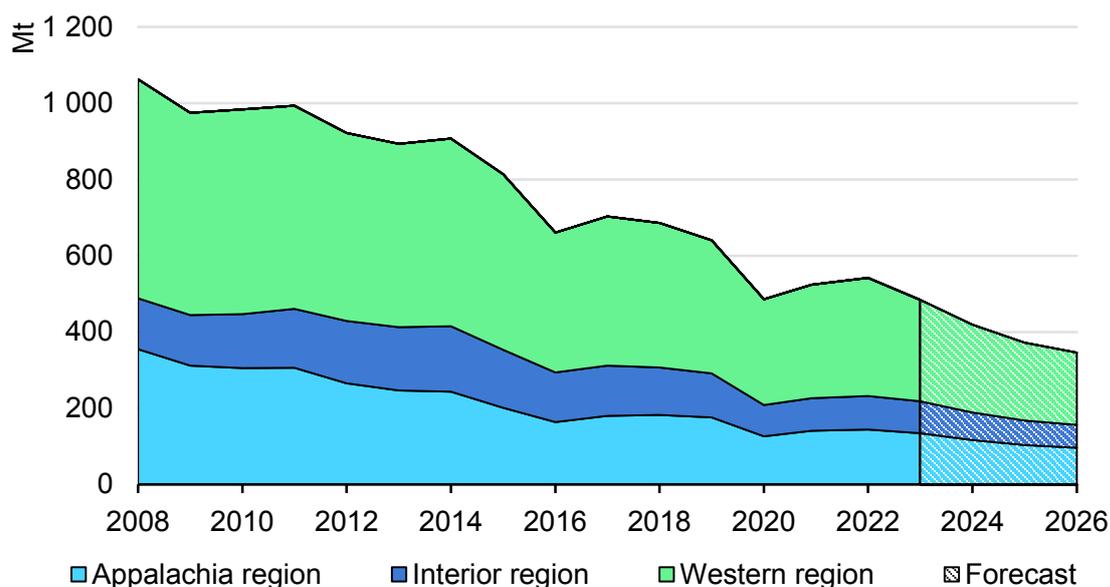
## US coal output is back on a downward trajectory

Despite attractive export market conditions, coal production in the United States rose by only 3% to 539 Mt in 2022. Persistent supply chain disruptions and tight labour markets weighed on coal output and limited production growth.

After seeing growth in 2022, we expect US coal production to have returned to a declining trend in 2023, falling by 10% compared to 2022. The decline in production is half of the decline in consumption, owing to domestic stock building and higher exports. The Energy Information Administration (EIA) expects stockpiling in 2023 to reach about 47 Mt, mostly at power plant sites. Many US coal plants are under long-term contracts, ensuring steady supply, but coal-fired generation has turned out lower than expected, resulting in surplus coal. The western region has been disproportionately contributing to the reduced production, with the West Elk mine in Colorado experiencing geological issues, and in Utah partial closures of the Lila Canyon mine and a longwall move at the Skyline mine slowing production.

For our forecast period, we expect the steep decline in coal-fired power generation to continue to weigh on coal output, causing reductions in all key mining regions. For the next three years, we forecast a reduction of almost 11% per year, with production totalling 346 Mt in 2026.

**Coal production by region, United States, 2008-2026**



IEA. CC BY 4.0.

Source: IEA estimates based on US EIA (2023) [Coal data](#).

## International markets are the main drivers for Colombia and Canada

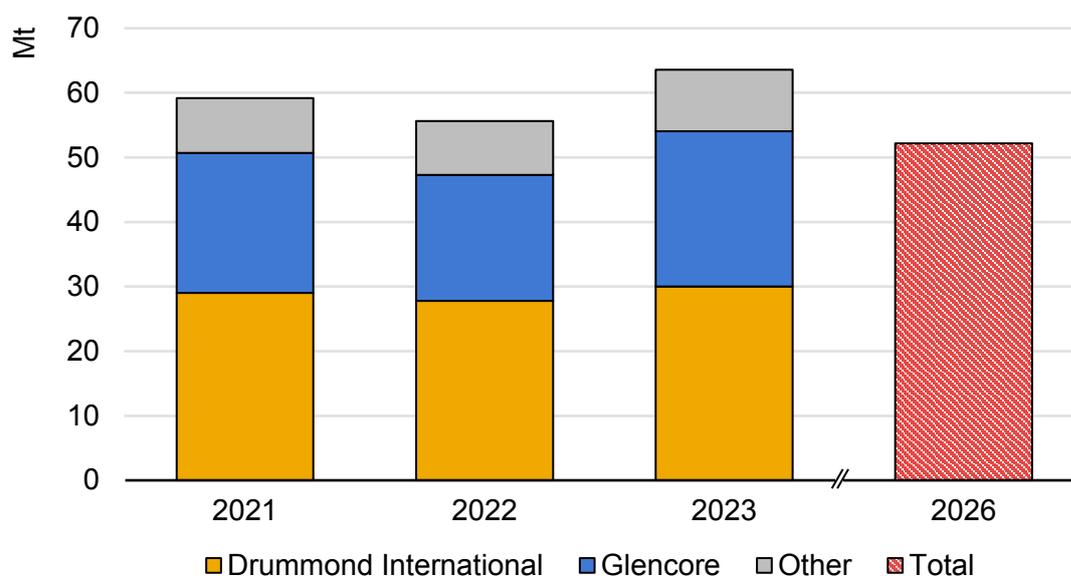
Despite high export prices, Colombia’s coal production slightly decreased by 2.8% to about 54 Mt in 2022. Adverse weather conditions and protests at El Cerrejón, the largest coal mine, weighed heavily on the country’s coal output.

For 2023 we estimate coal production in Colombia to have surged by a remarkable 18% to 64 Mt, driven by favourable weather conditions in mining regions. Glencore’s output is reported to have recovered from 2022’s dip by increasing production at the Cerrejón mine by 5 Mt, whereas output from Drummond International’s El Descanso mine is expected to have grown by 4 Mt in 2023.

Meanwhile, the future of the country’s coal mining industry is being debated. President Gustavo Petro, elected last year, is seeking to accelerate the country’s energy transition, and issued presidential decrees imposing a ban on new coal mines and expansion projects in the department of La Guajira. These were overruled by the Constitutional Court, but the environment ministry is about to issue another decree delimiting open pit coal mining, underlining the government’s desire to end coal mining. The re-opening of mines closed by Prodeco (La Jagua and Calenturitas) is very unlikely.

Against this background, we expect coal production to decrease 7% annually in the next three years to 52 Mt in 2026.

**Coal production by company, Colombia, 2021-2023, and forecast production, 2026**



IEA. CC BY 4.0.

Source: IEA, adapted from CRU (2023), Coal Cost Model (database).

Canada's coal production, which is characterised by almost equal volumes of thermal and met coal, decreased by about 2.1% to almost 47 Mt in 2022. In 2023, we estimate met coal production to have increased, thereby pushing total Canadian production up to 49 Mt. In light of Canada's coal-fired generation phase-out and its plan to end thermal coal exports by 2030, met coal projects are favoured over thermal coal projects. Based on this trend, we expect met coal production to slightly decrease from 29 Mt in 2023 to 27 Mt in 2026, and thermal coal and lignite production to decline faster from 20 Mt in 2023 to 13 Mt in 2026. Teck Resources has just agreed on the sales of its coal branch Elk Valley Resources. So far, the effect of this operation on future coal production in Canada is not clear.

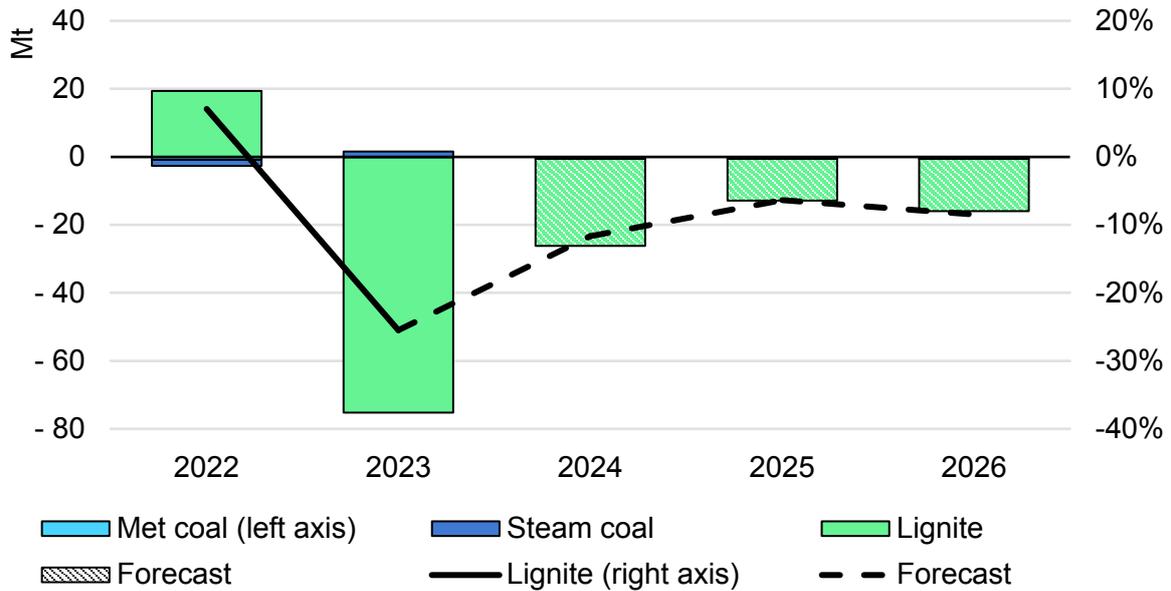
## EU lignite production re-enters its phase-out course

Amid the energy crisis and driven by elevated demand for coal-fired power generation, coal production in the European Union rose for the second consecutive year in 2022 growing by 17 Mt to 349 Mt (up 5%). The output increase was driven by a 7% rise in lignite production which makes up 84% of the European Union's overall coal production. By contrast, production of steam coal (down 4%) and met coal (down 6%) decreased.

Germany (37% share) and Poland (31% share) are the two largest coal producers in the European Union. Germany, which only produces lignite, increased outputs to about 131 Mt (up 4%). Meanwhile, in Poland decreasing steam (down 4%) and met coal production (down 2%) compensated its increase in lignite production (up 4%).

The increase in coal production was led by Bulgaria, which recorded a substantial 26% growth in lignite production to 36 Mt (up 7 Mt). Bulgaria overtook Czechia (35 Mt) to become the third-largest coal producer in the European Union in 2022. In Czechia, increases in lignite production (up 14%) were partially offset by declines met coal production, resulting in an overall increase of 11%.

**Year-on-year change in coal production, European Union, 2022-2026**



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With demand for lignite dropping, production should follow a similar trend. We consider coal production in the European Union to have seen a reversal of 2022’s crisis-driven uptick, plunging by an estimated 74 Mt or 21% in 2023.

In the next three years, we expect EU coal production to continue its phase-out course, with annual declines between 13 Mt and 26 Mt resulting in total coal production of 221 Mt in 2026. We do not account for production at the new Woodhouse Colliery in the United Kingdom given the uncertainties linked to the project, but we will revise this in the future if the project goes ahead. The pattern of decline is principally driven by German efforts to phase out lignite and its target to generate 80% of its electricity from renewable energy by 2030. Conversely, we expect moderate reductions in Poland, with lignite production down by 6 Mt until 2026. Elsewhere, production should follow consumption, which is determined by lignite-fired power generation, as hard coal production is negligible outside Poland and Czechia.

**South Africa’s coal production remains constrained – not only by transport infrastructure**

Owing to persistent infrastructure issues and demand destruction mostly due to the wide unavailability of domestic coal power plants after years of poor maintenance, coal production in South Africa remained stable at about 230 Mt (up 0.6%) in 2022, despite prices reaching record levels in overseas markets.

Coal production continues to be affected by a malfunctioning transport system. The national railway operator, Transnet, has recorded multiple severe interruptions in recent years, including derailments, strikes, locomotive shortages, hacking and cable theft. Due to these ongoing interruptions, coal producers increasingly use truck transport, which is less efficient than rail.

Given the continued issues in coal transport infrastructure and demand from the power sector plunging on record low availability of coal plants, we estimate coal production in 2023 to have declined by 3% to 223 Mt. Up to 2026, we expect South Africa's coal production to stabilise at current levels, as we assume moderate gains in coal demand to be offset by a moderate decrease in exports.

Amid last year's high prices, coal production in other African countries rose by 31% to 28 Mt in 2022. The countries contributing the most to this increase were Zimbabwe (up 2 Mt), Mozambique (up 2 Mt), Tanzania (up 1.5 Mt) and Nigeria (up 0.5 Mt). The Botswanan government supports diversification away from diamond mining, and projects under consideration are progressing (see "Coal mining projects: Export" Chapter). Nonetheless, we take a cautious approach and will monitor the development. If projects go ahead, we will revise our estimate upward in the future. Other African countries seem unlikely to keep coal production at high levels, and therefore we expect aggregated coal production in these markets to remain almost constant until 2026.

# Trade

## International coal trade towards a new historical record in 2023

International trade in coal rose to 1376 Mt in 2022, up by 1% from the previous year. Traded coal accounted for about 16% of overall coal demand. With a share of about 77%, most of the traded coal was thermal, rising by 1.6% in 2022, while the trade in metallurgical coal slightly decreased by 1%. Total seaborne exports rose to about 95% of all exports.

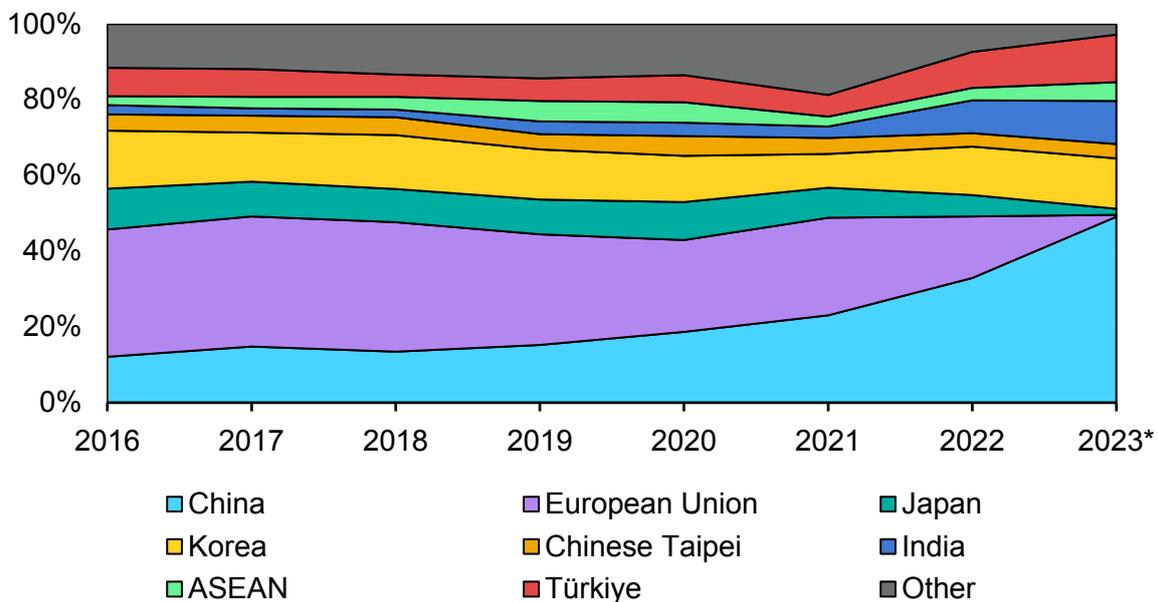
The global trade in coal is continuing its shift eastward. While traditionally the coal trade was concentrated in the Pacific and Atlantic basins, the volumes currently traded across the Indian Ocean are greater than those in the Atlantic Basin, driven by ongoing demand declines in Europe and increasing demand from India, Pakistan and Bangladesh. About 78% of all exports are directed to countries in the Asia Pacific region. In 2022, the largest importer outside Asia was Germany at about 42 Mt, up 10% compared to 2021, driven by elevated demand and security of supply concerns after Russia's invasion of Ukraine and tensions in the gas market.

At 471 Mt and a 34% share of global exports, Indonesia was the largest exporter by volume in 2022, followed by Australia at a total of 344 Mt representing about a quarter of global exports. For the first time, Indonesia also became the largest exporter in energy terms, overtaking Australia, which exports coal with an average CV more than 25% higher than Indonesia. At about 224 Mt, Russia was the third-largest exporter.

Russia's war against Ukraine and the subsequent international sanctions against it led to a reshuffling of coal supply chains and a further shift of exports from land-based to seaborne transport. Sanctions affect the conduct of business, such as exclusion from the international payment service SWIFT, as well as physical deliveries. The European Union imposed a ban on Russian coal imports starting with a ban on new coal purchases from Russia from April 2022. The ban came into full effect on 10 August 2022, when all physical deliveries from Russia were halted. Before 2022, Russia exported about 33 Mt of coal by rail mainly to Ukraine, Poland, Germany and China. Following the onset of the war and the EU ban, Russia's exports by rail contracted by 75%, with mainly China remaining for land-based exports. To strengthen its ties with China, Russia is investing in eastbound railway projects. In November 2022 the Tongjiang Bridge between Russia and China opened, and further projects, including another bridge across the Amur River, have been approved.

In 2023 global coal exports are expected to have reached an all-time high of about 1 466 Mt. Global trade has further shifted to Asia, with about 83% of imports being directed to the Asia Pacific region. China and India are expected to have increased their share to about 47% of global imports. China especially benefits from cheap coal imports from neighbouring countries such as Russia – trading coal at a discount due to sanctions – and Mongolia, which lacks alternative buyers. We estimate China’s overall coal imports to have increased by 50% to 451 Mt in 2023, although final numbers can change as China’s imports in December are historically very volatile. At the same time, Russia’s dependency on customers in China and India is increasing. In the first nine months of 2023, about 60% of coal exports from Russia were directed to China and India.

**Export destinations as a share of total exports per year, Russia, 2016-2023**



IEA. CC BY 4.0.

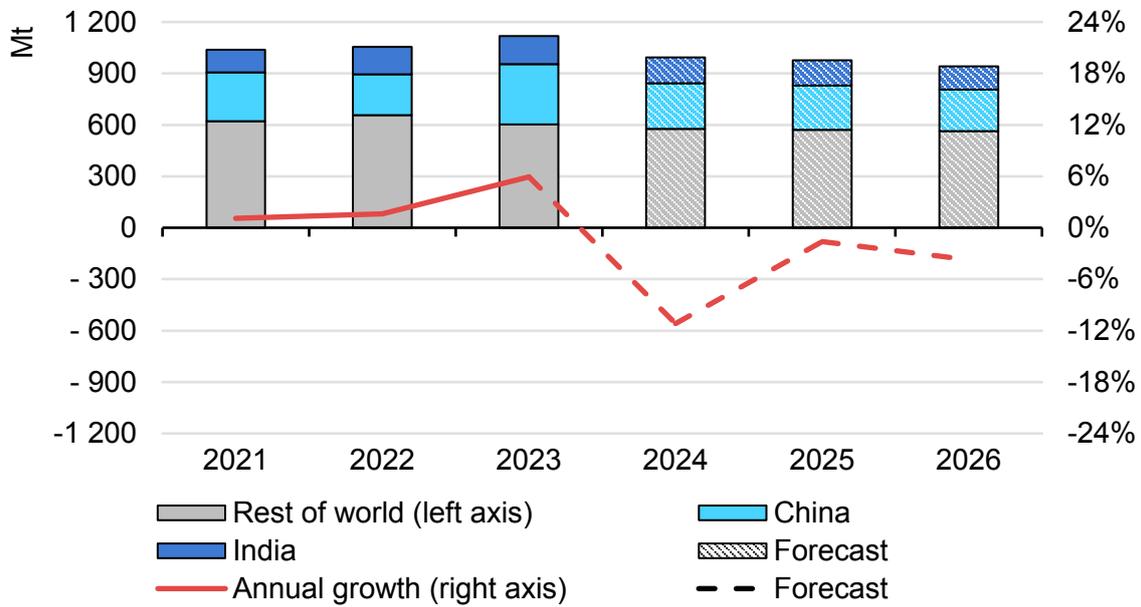
\* 2023 is based on January to September data.

Source: IEA estimates based on IHS Markit (2023), [Coal Price Data and Indexes](#).

Through to 2026, we expect global coal trade to decline by about 12%, driven by growing domestic production in coal-intensive economies such as China and India and coal phase-out plans elsewhere, such as in Europe. While thermal coal exports are expected to decline by about 16% by 2026, exports of met coal are expected to slightly increase by almost 2%.

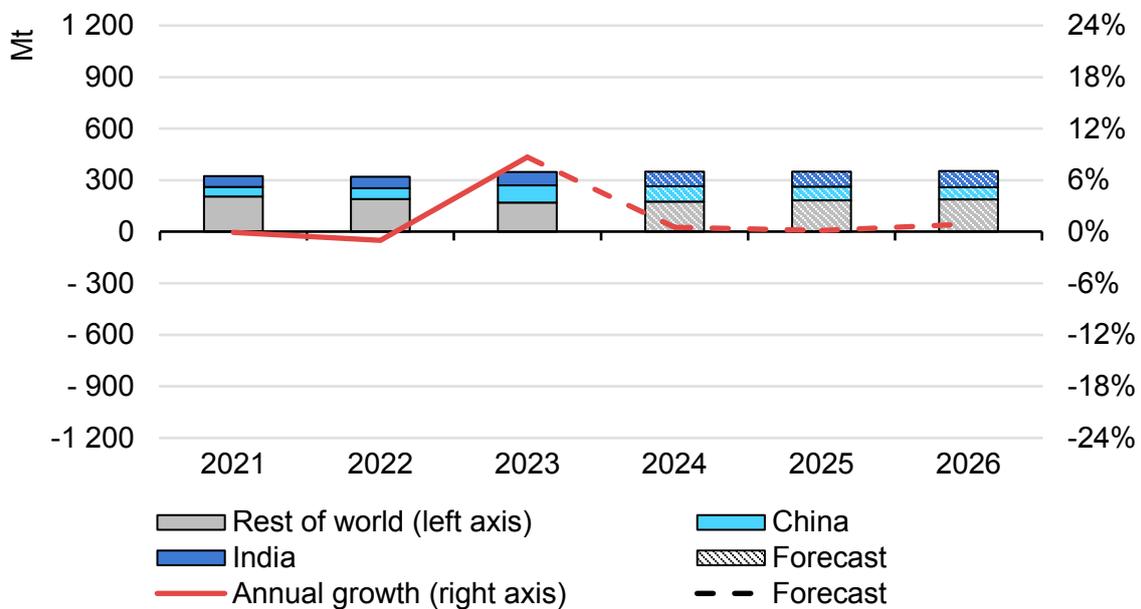
## Thermal coal trade is expected to have peaked in 2023, while met coal trade flattens out after 2023

Thermal coal trade developments, exports by destination, 2021-2026



IEA. CC BY 4.0.

Met coal trade developments, exports by destination, 2021-2026



IEA. CC BY 4.0.

## Thermal coal

### Amid high prices, thermal coal trade increased in 2022

As explained in the “Demand” Chapter, amid the energy crisis and extraordinarily high gas prices<sup>8</sup> in 2022, global coal demand grew strongly. However, the largest consumers, China and India, ramped-up domestic production, and therefore, global demand growth only partially translated into increased thermal coal trade. Thermal coal exports rose to 1 056 Mt, up 1.6% compared to 2021, and coal imports remained constant.<sup>9</sup> The share of thermal coal demand met by international thermal coal trade stood at 14%.

The trade in thermal coal is predominantly concentrated in the Asia Pacific region, with both the five largest importers and the two largest exporters located there. In 2022, the Asia Pacific region was the origin of 63% and the destination of 84% of the global thermal coal trade. With a 44% share of total exports, Indonesia was the world’s largest exporter of thermal coal, followed by Australia (17%) and Russia (16%).

To reduce exposure to high market prices and ensure supplies, China and India, the two largest importers of thermal coal, increased domestic coal production significantly in 2022. China’s thermal coal imports decreased by 17% to about 237 Mt due to increased production. Despite higher domestic production, India’s thermal coal imports rose by 22% to 161 Mt. At 140 Mt, Japan remained the world’s third-largest importer of thermal coal.

Imports into ASEAN decreased by 1.9% to about 117 Mt, after declines in Viet Nam, Thailand and Malaysia. In comparison, the gas-to-coal switching and energy security concerns drove up thermal coal imports into the European Union by 38%, an even stronger increase than the year before, when EU economies were rebounding from the Covid-19-induced decline.

In 2022, high prices encouraged exporters to ramp up coal production in some countries, while others could not, mainly due to infrastructural bottlenecks or adverse weather conditions. Indonesia was the most flexible thermal coal exporter, ramping up production by about 20% to 681 Mt. In contrast, in Australia, the world’s second-largest thermal coal exporter, thermal coal production decreased by 5%, as coal production was severely impacted by adverse weather conditions due to La Niña. Subsequently, Australia’s thermal coal exports decreased by about 6% to 181 Mt.

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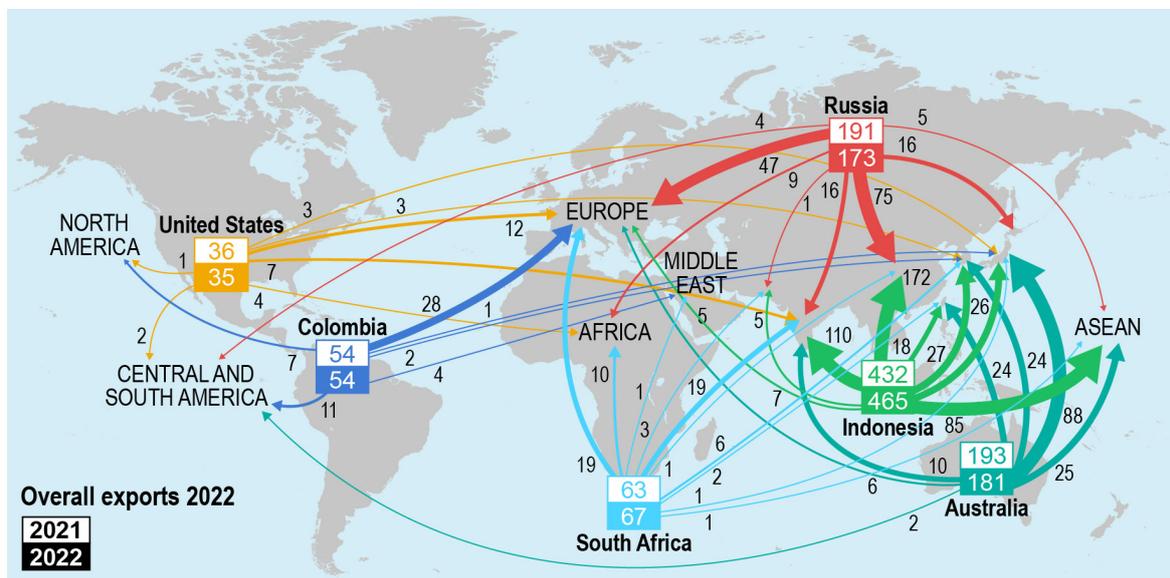
<sup>8</sup> For more details on gas markets dynamics, see the IEA Gas Market Report.

<sup>9</sup> Imports and exports differ, due to the time lapse between departures and arrivals, and reporting issues.

Exports from South Africa rose by about 8%, although the industry has suffered from infrastructural disruptions in recent years. In contrast, thermal coal exports from Russia, the third largest exporter of thermal coal, decreased by 9% to a total of 173 Mt, as thermal coal originally destined for the European Union could not be fully redirected elsewhere due to eastbound infrastructural bottlenecks. Thermal coal exports from the United States declined by 4.5% to about 35 Mt, mainly because rail bottlenecks hampered US producers' ability to benefit from high international prices.

## Amid EU's uptick in thermal coal imports in 2022, South Africa and Colombia made up for lower Russian exports

Main trade flows in the thermal coal market, 2022 (Mt)



IEA. CC BY 4.0.

Note: Map values are based on available export data and do not necessarily match import numbers due to reporting times.

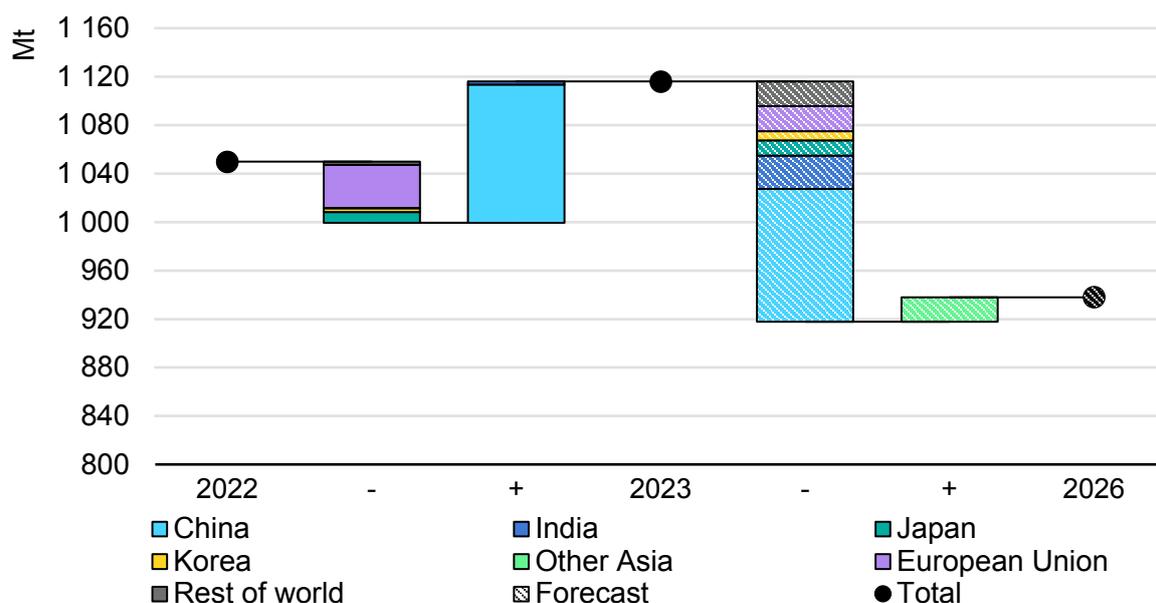
## The decline in demand acts as a drag on thermal coal trade through to 2026

Thermal coal exports in 2023 are expected to have increased by almost 6% to a total of 1 118 Mt, accounting for about 76% of total coal exports. China's thermal coal imports are expected to have grown by 114 Mt (up 48%) to 351 Mt, driven by plummeting coal prices compared to the year before and ample coal demand. China's ramp-up of thermal coal imports is backed by ending the unofficial ban on Australian coal. India's thermal coal imports are forecast to have risen by about 1.3% in 2023, despite strong expansion of domestic supply. Nonetheless, to ensure the security of supply, India's government revised the blending mandate for imported coal upward from 4% to 6% in October 2023. The regulation directs power plant operators to blend domestic coal with imported coal to minimise the risk of shortages in domestic supply. At the same time, the government urged coal mine producers to maximise output.

Imports of thermal coal into the European Union are expected to return to a downward trajectory in 2023 after two years of increases. We estimate thermal coal imports to have fallen by about 44%, to 46 Mt, a level of decline last seen in the Covid-19 year 2020. Thermal coal imports into Germany, the largest importer in the European Union, are estimated to have decreased by about 38%, while the second-largest importer, Poland, is likely to have more than halved its imports, although this depends on the performance of domestic mines.

Global thermal coal imports are expected to have peaked in 2023 and then to fall to 2026, in line with the peak in global demand.

Global thermal coal import changes, 2022-2026

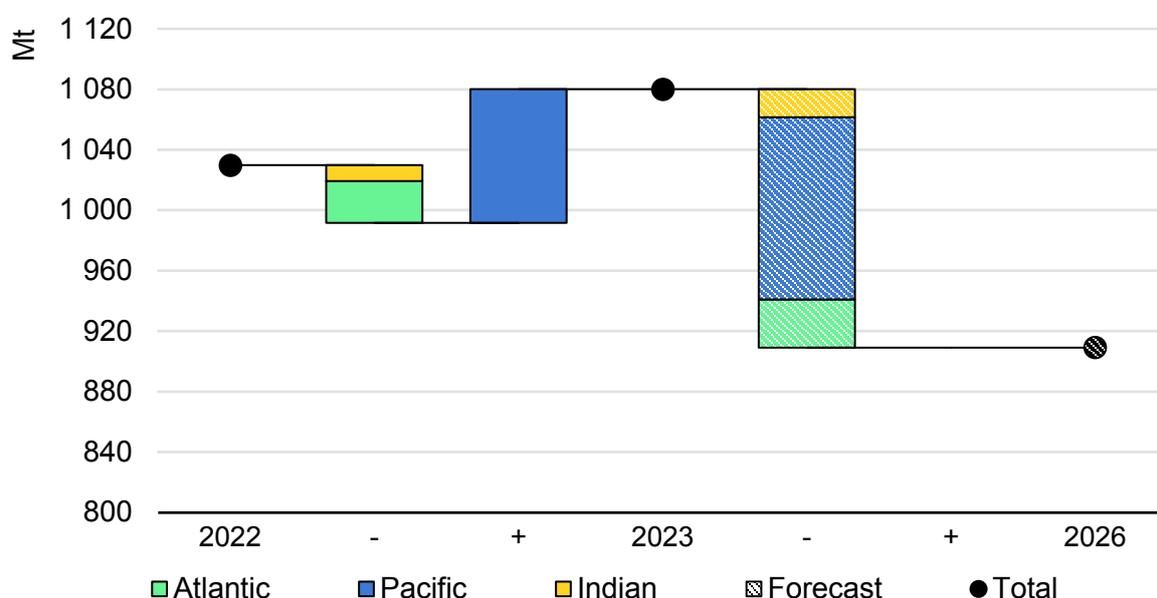


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The overall expected decline in thermal coal imports between 2023 and 2026 is led by China, with imports declining by about 110 Mt (down 31%), while imports into India are expected to decline by about 27 Mt (down 17%). Imports into Japan are forecast to contract by 13 Mt (down 10%). Thermal coal imports into the European Union are expected to decline by 20 Mt (down 44%).

Seaborne thermal coal exports are expected to have surpassed the former 2019 record in 2023, together with overall thermal coal exports, as a decrease in trade across the Atlantic and Indian basins was more than offset by increasing trade in the Pacific Basin. We expect seaborne trade in 2023 to have increased by about 5%, with Indonesia exporting close to 500 Mt, a level never reached by any country before. After the growth in 2023, seaborne trade is expected to decrease globally by about 16% by 2026.

### Seaborne thermal coal trade changes by basin, 2022-2026



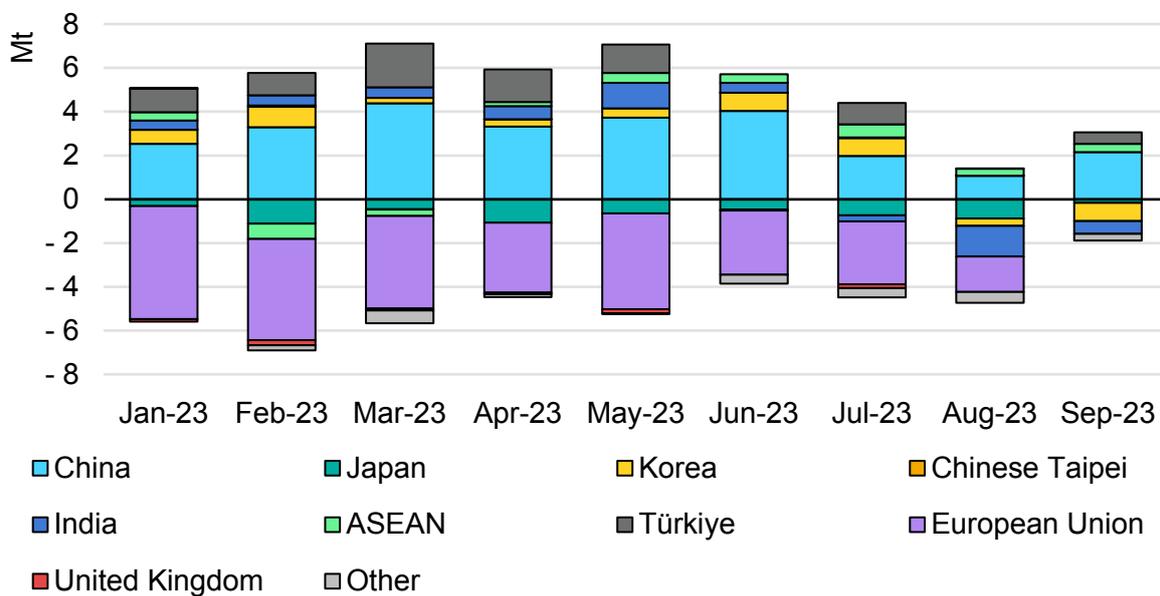
IEA. CC BY 4.0.

## Russia's exports are increasingly dependent on China

Russia's invasion of Ukraine led to sanctions from mainly Western countries, which in turn led to a reshuffling of thermal coal trade flows in 2022 and 2023. In April 2022, the government of Japan decided to phase out Russian coal imports gradually. Consequently, imports of thermal coal from Russia fell by 41% in 2022. The European Union issued a ban on Russian imports, which came into full effect in August 2022. Imports fell by 49%. In August 2023, the United States, Japan and South Korea decided to further reduce their dependency on Russian energy in a trilateral summit.

Driven by the sanctions, Russian export destinations continue to trend eastwards and become more limited. In the first nine months of 2023, the share of thermal coal exports directed to China rose from 28% in the previous year to 49%, indicating a high Russian dependency on Chinese customers. Thermal coal exports from Russia to India rose by about 19%, while about 16% of its thermal coal exports went to Türkiye. At the same time, rail deliveries to western and southern export terminals have been restricted. Driven by additional infrastructure projects under construction, ties with China are expected to strengthen further. Total exports of thermal coal from Russia are expected to stand at 170 Mt in 2023 (down 2.2%).

### Monthly y-o-y change in thermal coal imports from Russia by destination, 2023



IEA. CC BY 4.0.

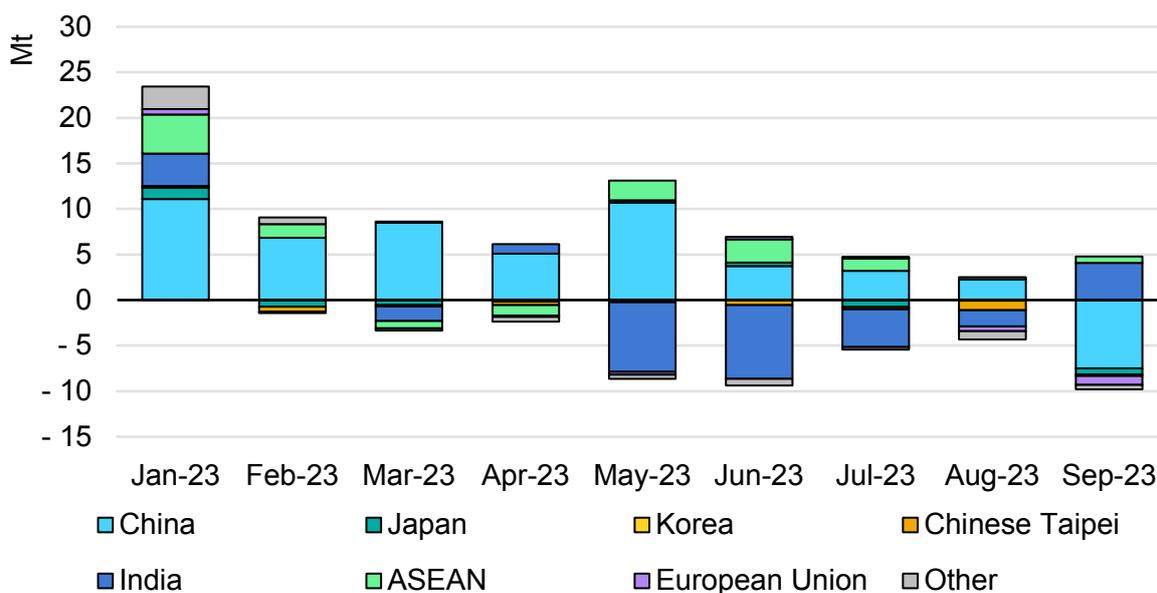
Source: IEA analysis based on IHS Markit (2023), [Coal Price Data and Indexes](#).

## China and India are pivotal for coal exporters

We expect Indonesian thermal coal exports to have increased to about 500 Mt in 2023, up by more than 6%. Indonesia's domestic market obligation requires coal producers to provide at least 25% of overall production to the domestic market. This particularly affects thermal coal, as it constitutes about 99% of overall production. In 2022, as some companies did not comply with the obligation, the Indonesian government issued a temporary ban on exports in view of depleting coal stocks at power plants in January. Compared with 2022, 2023's ample domestic production and reduced attractiveness of exports, owing to lower market prices, has ensured sufficient supplies to the domestic market.

China is Indonesia’s largest buyer of thermal coal. In 2021, China’s share of Indonesian thermal coal exports rose to around 45%. In 2022, however, this share decreased to 37% as Chinese buyers were reluctant to buy high-priced coal from the global market. Instead, Indonesian thermal coal was mainly directed to India. In the first nine months of 2023, this trend is reverted again, as the share of exports to China grew to 42%, while the share of exports to India fell below 20%, down from 26% in 2022.

**Change in Indonesia’s monthly y-o-y thermal coal exports by destination, 2023**



IEA. CC BY 4.0.

Source: IEA analysis based on IHS Markit (2023), [Coal Price Data and Indexes](#).

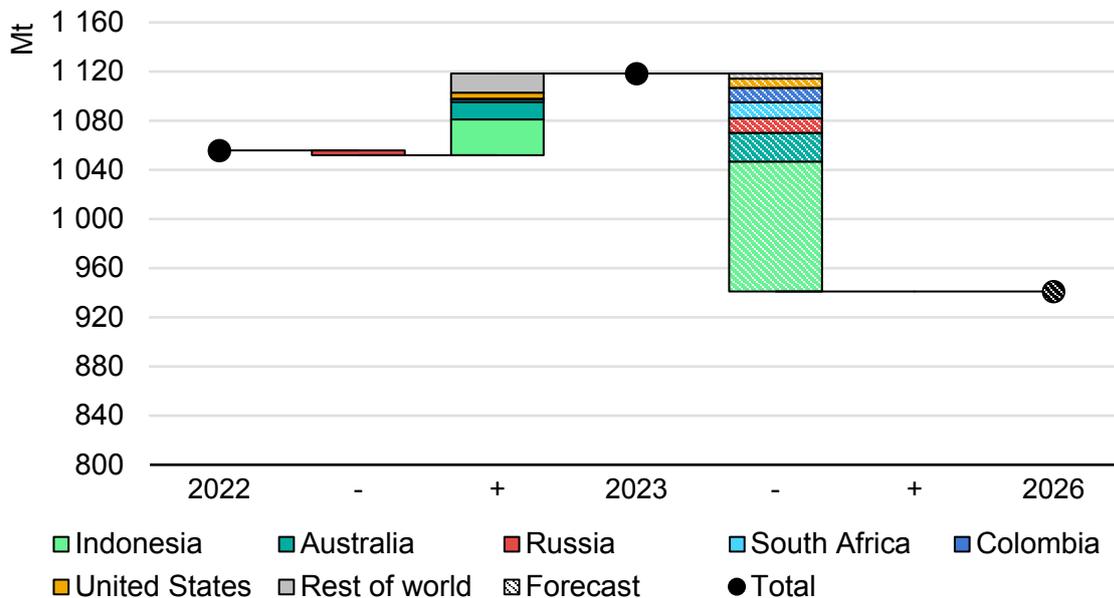
In Australia, the La Niña weather phenomenon caused adverse weather conditions in recent years, with floodings interrupting supply chains. This has now changed to El Niño, which is associated with hotter and drier weather, and is likely to improve mining conditions. Total thermal coal exports are expected to have increased by 8% to a total of 196 Mt in 2023. Meanwhile, export destinations changed again in 2023, as in February of that year China ended its unofficial ban on Australian coal – in place since late 2020 due to political tensions – and ramped up imports from Australia.

South Africa’s thermal coal exports are expected to have grown by 3% to 69 Mt in 2023 despite ongoing severe infrastructural disruptions. Elsewhere in Africa, Tanzania increased its exports in 2022, attracted by extraordinarily high prices. While formerly only exporting to other African countries and India, a substantial fraction of Tanzania’s total coal exports was directed to the European Union in 2022. With decreasing global coal prices, exports to the European Union dried up in 2023.

Thermal coal exports from the United States are expected to have grown by 14% in 2023, to a total of 40 Mt. The United States used to be a swing supplier, supplying when the markets were tight and international prices went up. However, it is losing this status due to its declining coal industry and the lack of flexibility in coal production. Accounting for 30% in 2021, India was the largest buyer of thermal coal from the United States. In 2022, about 31% of its thermal coal exports were directed to the European Union, up from about 14% in 2021, due to ample demand and a high willingness to pay. Meanwhile, India's share declined to about 20%. With prices plunging in the first nine months of 2023, this trend reversed again and the share of US exports to India increased to about 30%, while the share of exports to the European Union decreased to 23%. At the same time, Colombian thermal coal exports are estimated to have increased by 0.9% in 2023.

After peaking in 2023, global exports of thermal coal are expected to decline in line with global demand. Total thermal coal exports are forecast to fall to about 941 Mt in 2026, well below the amount seen in the Covid-19 year 2020. The decrease is driven by declining demand and ample domestic supply in countries such as China and India. The share of total thermal coal demand met by exports is expected to decrease from 15% to about 13%. Exports from all major coal exporting countries are set to decrease. With a drop of about 106 Mt (or 21%), Indonesian exports are expected to see the largest decrease, followed by Australia with a decrease of 23 Mt (or 12%).

**Change in global thermal coal exports, 2022-2026.**



IEA. CC BY 4.0.

## Metallurgical coal

### Japan, Korea and the European Union led the decline in met coal imports in 2022

In 2022, met coal trade flows were subject to reshuffling, driven by the sanctions imposed on Russia, although the impact was smaller than on thermal coal given Russia's lower share of global met coal exports. The trade in met coal slightly declined by about 1% to 320 Mt, with exports covering about 30% of the total demand for metallurgical coal. Thus, trade plays a larger role in met coal than in thermal coal, although met coal accounts for only about a quarter of the overall coal trade.

Australia is by far the largest exporter of met coal, accounting for about 50% of the export market in 2022, followed by Russia (16%), the United States (13%) and Canada (9%). These four countries supplied over 88% of exports in the highly concentrated met coal market.

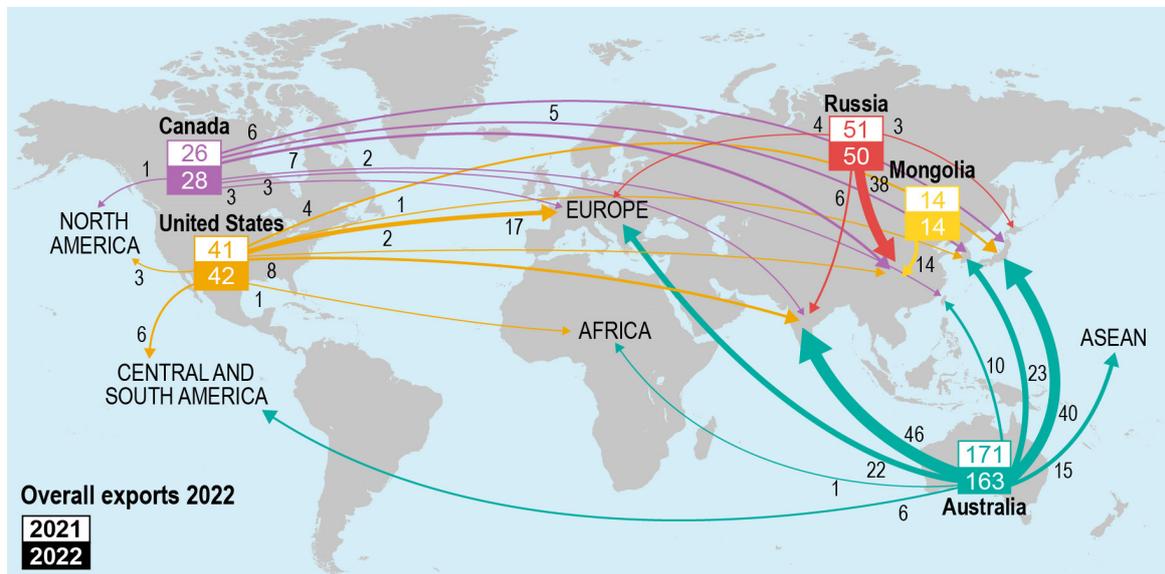
Australia's met coal exports decreased by about 5% to 163 Mt in 2022. Adverse weather conditions disrupted supply and pushed prices to extraordinary highs, reducing the attractiveness of Australian met coal for some buyers. India, the largest buyer of Australian met coal, partially moved over to Russian coal, and reduced met coal imports from Australia by 16%. One year earlier, in 2021, India had taken a record 54 Mt of met coal imports from Australia, fuelled by China's ban on Australian coal.

Russia's met coal exports slightly decreased to 50 Mt (down 1%) in 2022, with robust demand from China, replacing Mongolian and Australian coal. Additionally, when the European ban on Russian coal came into full effect in August 2022, Russian exports to India increased strongly. Its met coal exports to China and India almost doubled in 2022.

In 2022, India continued to be the world's largest importer of met coal, with a share of about 21% and a total of about 66 Mt. Its imports grew by 5% compared to 2021, when India surpassed China for the first time. At about 20% and a total of about 64 Mt, China was the second-largest importer in 2022. China's import growth stated 17%. Meanwhile, imports into Japan remained stable at 44 Mt, while imports into Korea slightly decreased to 34 Mt (down 6%). Imports into the European Union remained stable at around 46 Mt, while imports into ASEAN declined by 15% to about 20 Mt.

## Russian met coal exports adapted to sanctions and bans in 2022

### Main trade flows in the met coal market, 2022 (Mt)



IEA. CC BY 4.0.

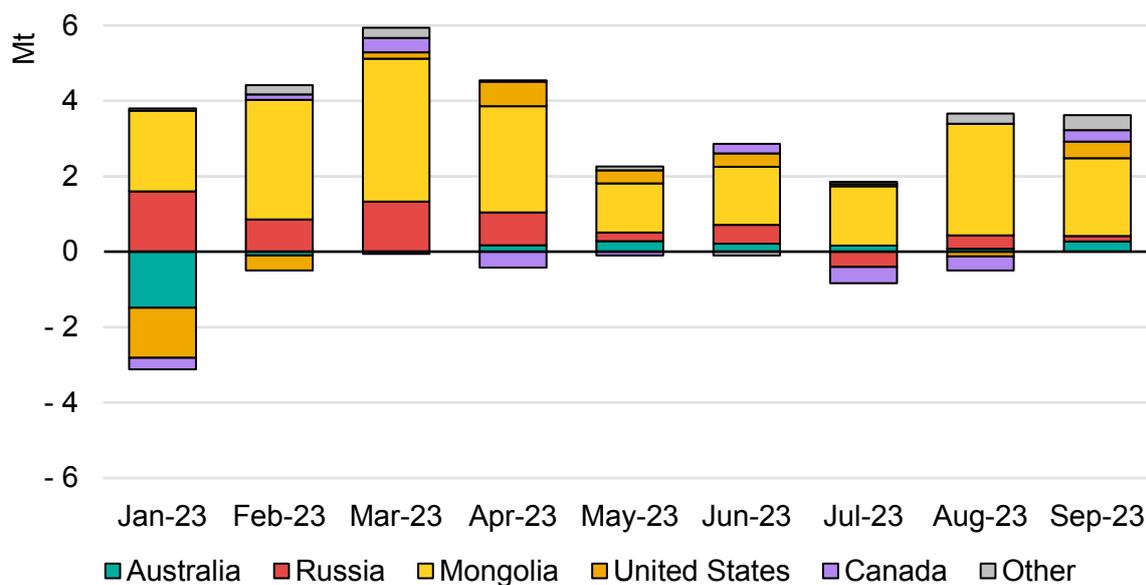
Note: Map values are based on available export data and do not necessarily match import numbers due to reporting times.

## Ample appetite in China and India has driven met coal imports in 2023

We expect global met coal imports to have increased by about 11%, to 352 Mt in 2023. The increase has been driven by China and India, which are forecast to have significantly increased met coal imports, with China surpassing India to become the largest met coal importer again. China's imports are expected to have increased by 56% to 100 Mt, an all-time high, while India's imports are expected to have grown by 17% to 78 Mt.

Despite ending the unofficial ban on coal imports from Australia, China only marginally resumed met coal imports from Australia in the first nine months of 2023. Instead, large quantities of metallurgical coal are imported from Mongolia, as a rail link between the two countries began operating and pandemic measures at the border were lifted. In the first nine months of 2023, China's imports from Mongolia rose by 131%, while imports from Russia rose by 37%. In the future, imports from Mongolia are expected to increase further, as additional rail lines connecting both countries are under construction.

### Change in China's monthly y-o-y met coal imports by origin, 2023



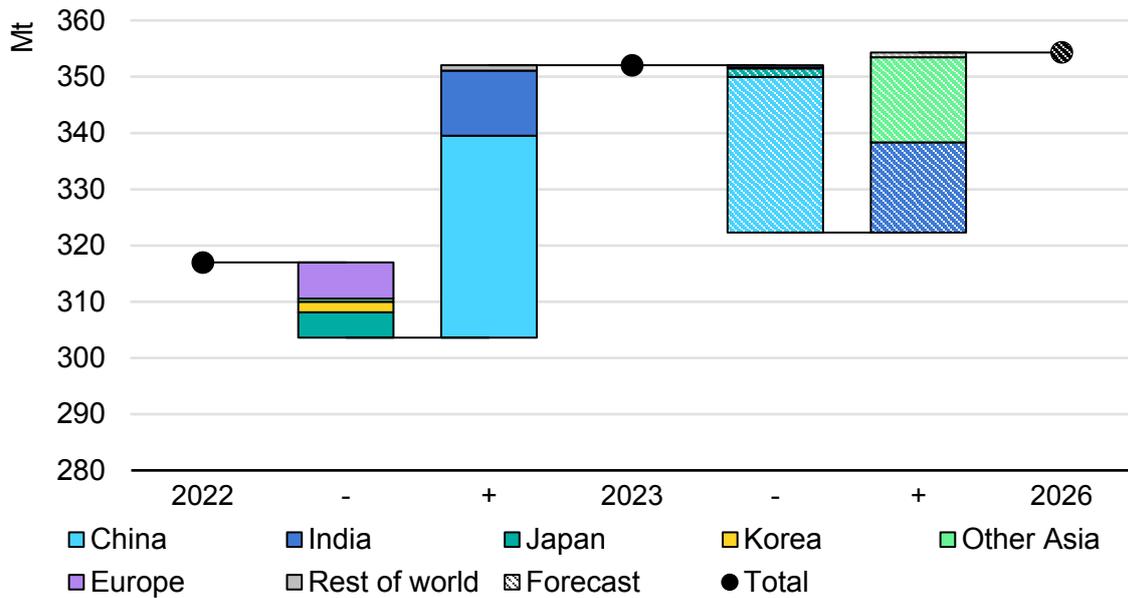
IEA. CC BY 4.0.

Source: IEA analysis based on McCloskey (2023), [Coal Price Data and Indexes](#).

Benefiting from price discounts on Russian coal, India is increasingly replacing Australian met coal with Russian. While in 2021 about 65% of India's met coal imports were of Australian origin, this share decreased to 53% in 2022. During the same period, the share of imports from Russia increased from 5% to 11%. In the first nine months of 2023, Australia's met coal share was down to 48%, while Russia's share grew to 18%.

Met coal trade is expected to increase by almost 2% to 353 Mt in 2026. A decrease of about 28 Mt (or 28%) in met coal imports into China is expected to be offset by increasing imports elsewhere. Imports into India are expected to increase by 2026, by 16 Mt (or 21%), driven by increasing steel production via the blast furnace-basic oxygen furnace route and limited availability of suitable domestic coking coal. Against this background, India will once more become the world's largest met coal importer.

### Change in met coal imports, 2022-2026

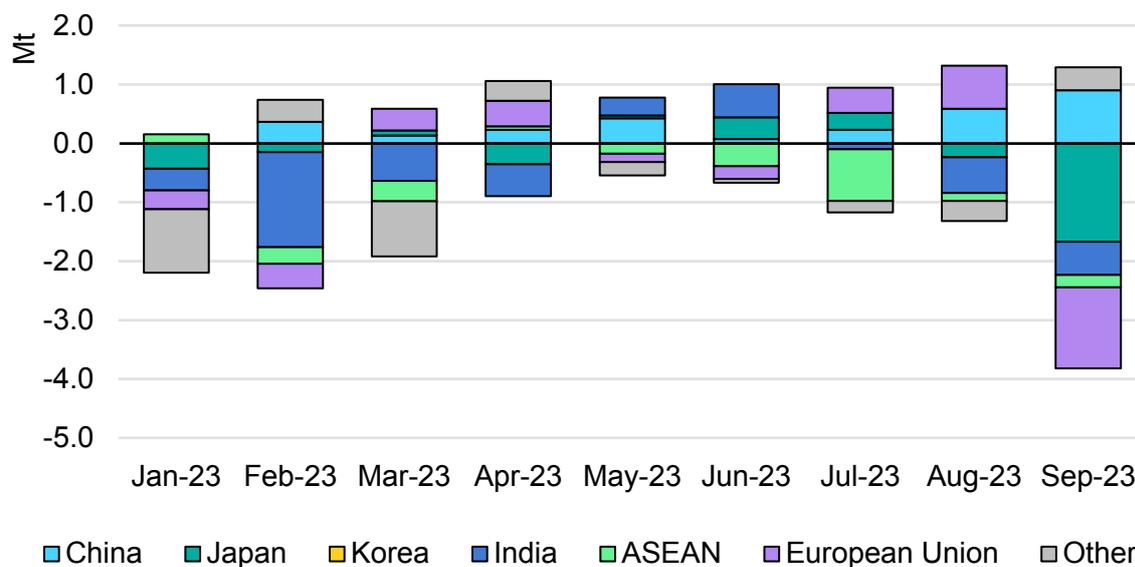


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## Low-cost met coal exports from Mongolia and Russia weigh on Australian exports

Global met coal exports are expected to have grown by almost 9% to 348 Mt in 2023. Exports from Australia, however, are expected to record a decline of about 6% to 152 Mt, despite improved mining conditions compared to the previous year. Among other factors, a train derailment in January at the Port of Gladstone caused supply chain issues, weighing on Australian met coal exports in the first quarter of 2023. After China ended its unofficial ban on coal imports from Australia in early 2023, Chinese buyers only partially returned to Australian coal. Small increases in met coal exports to China were more than offset by decreasing exports to ASEAN and India, which diverted to Russian deliveries in the first nine months of 2023.

### Change in Australia's monthly y-o-y met coal exports by destination, 2023



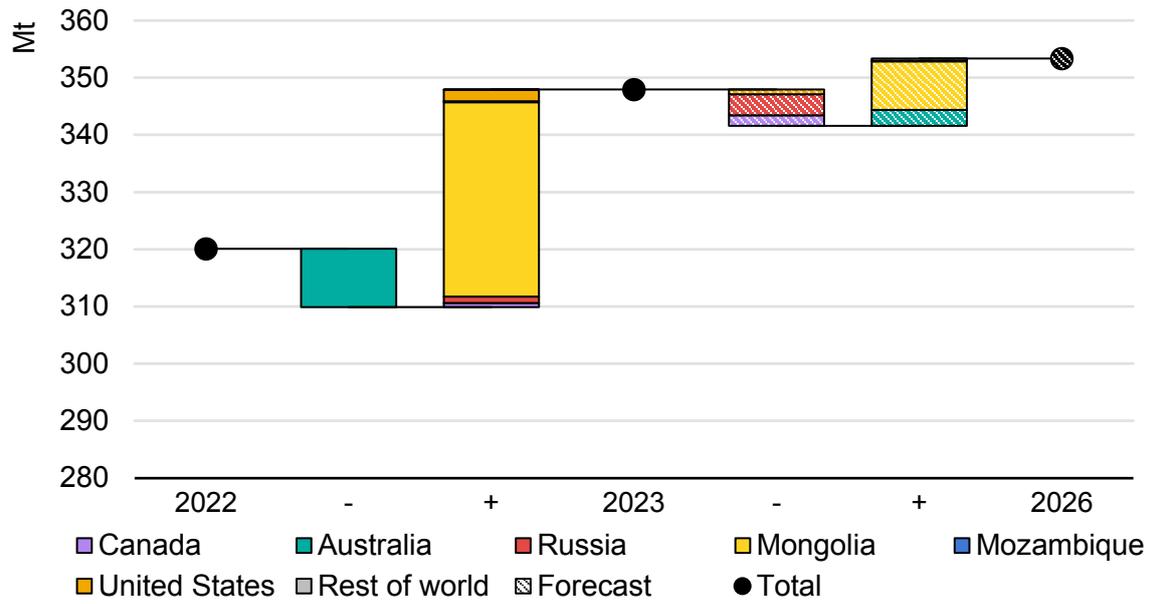
IEA. CC BY 4.0.

Source: IEA analysis based on McCloskey (2023), [Coal Price Data and Indexes](#).

We expect Russian met coal exports to have increased by 2.2% to 51 Mt in 2023, although the buyer base for Russian coal has been shrinking. Russia exported about 22% of its met coal exports to China and about 9% to India in 2021. These shares more than doubled to 45% and 18% in 2022 and we estimate them to have increased further. With a respective share of 49% and 26%, China and India accounted for three-quarters of Russia's overall met coal exports in the first nine months of 2023. Exports to China rose by 37% year-on-year, while exports to India more than doubled.

The growth of met coal exports in 2023 has predominantly been driven by Mongolia, which is forecast to have more than tripled its met coal exports, backed by a blend of lifted pandemic containment measures at the border with China, a rail link that began operation and additional mining capacity ramping up. Mongolia's exports are expected to have increased by 242% to about 48 Mt in 2023, mainly to China. Surprisingly, Mongolia could become the second-largest coking coal exporter after Australia. The increase was driven by large appetite from China. The Tavan Tolgoi Expansion, which commenced production in 2023, has contributed to the growth.

**Change in met coal exports, 2022-2026**



IEA. CC BY 4.0.

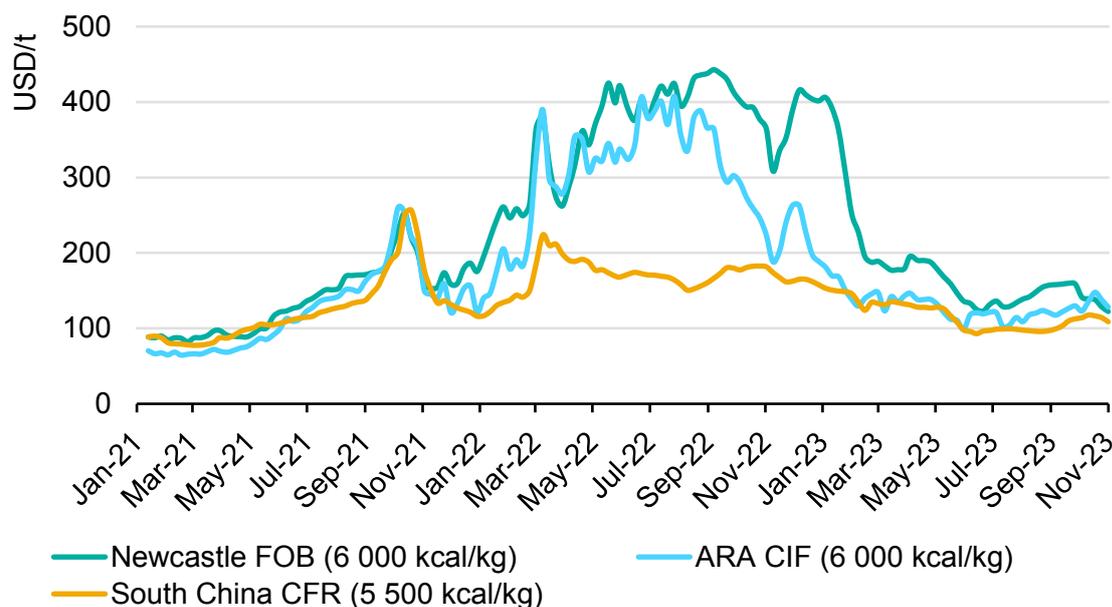
# Prices and costs

## Prices

### International coal prices remain well above pre-crisis levels

Coal prices reached unprecedented highs in 2022. They were driven by surging gas prices caused by Russia's invasion of Ukraine, which unsettled the market and led to a war premium, as well as inflexible coal supply which suffered from adverse mining conditions and infrastructural bottlenecks. In general, coal supply chains are efficient and well-integrated; however, there is not much spare capacity. On the demand side, soaring gas prices drove up coal-fired power generation in many countries, just as economies continued to recover from the pandemic. On the supply side, in Australia coal production was severely impacted by adverse weather conditions associated with La Niña, bringing heavy rainfall and flooding. Mining in the state of New South Wales, where predominantly thermal coal is mined, was hit most severely, weighing on Australia's thermal coal production. Meanwhile, South Africa continued to grapple with infrastructural shortages which impeded coal production. Furthermore, following the European Union's ban on Russian coal, a portion of Russian supplies could not be fully redirected to alternative markets due to constraints in eastbound rail transport. Temporarily adding to the market's overall strain, the Indonesian government imposed a temporary export ban in January 2022 to address domestic shortages, tightening the market of low- and mid-CV thermal coal.

### Thermal coal prices markers, 2021-2023



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Notes: ARA = Amsterdam Rotterdam Antwerp. CFR = cost and freight. CIF = cost, insurance and freight. FOB = free on board. Newcastle = port on the east coast of Australia.

Source: IEA analysis based on Argus Media Group. All rights reserved.

Up to the end of 2021, price markers for high-CV coal from Australia, in the European Union<sup>10</sup> and at ports in South China exhibited similar patterns. After October 2021, when China started boosting its production, the price markers for Australia and the European Union on the one hand, and China on the other, diverged significantly. In March 2022, Australian and EU price markers surged to unprecedented highs, surpassing USD 400/t<sup>11</sup>, fuelled by tightened markets and the unsettling impact of Russia's invasion of Ukraine. Conversely, thermal coal prices in China entered a lower price path as abundant domestic supply in China eased the market segment with a CV of approximately 5 500 kcal/kg. After briefly surpassing the USD 200/t mark in March, prices remained between USD 150/t and USD 180/t until October 2022, before starting a steady decline and to reach a level of USD 100/t in March 2023, still approximately USD 20/t above pre-crisis levels.

After the price shock in March 2022, EU and Australian markers shortly dipped below USD 300/t in April, before they surpassed the USD 400/t mark several times, driven by a persistent war premium and an inflexible supply side.

While prices in Europe moved to a downward slope in August 2022, prices in Australia remained elevated due to ongoing supply shortfalls and ample demand

<sup>10</sup> Australia: Newcastle FOB. European Union: Amsterdam, Rotterdam, Antwerp (ARA) CIF.

<sup>11</sup> Daily prices surpassed USD 400/t. The chart above shows weekly prices.

for Australian-quality coal from east Asia, e.g. from Japan. Prices fell until early November, when a cold spell in Europe propelled gas prices and revived coal-fired power generation. Australian prices rebounded to above USD 400/t, while European prices tapered off to about USD260/t.

Subsequently, European prices converged with those in South China, whereas Australian prices did not decline until January 2023, when they dipped just below USD 200/t, approximately USD 40/t above prices in the European Union and China. Prices stabilised in the second quarter of 2023 at levels above those last observed in early 2021. In the third quarter of 2023, prices for high-CV coal from Australia started to tick up again, driven by increased demand from Japan to replenish coal inventories.

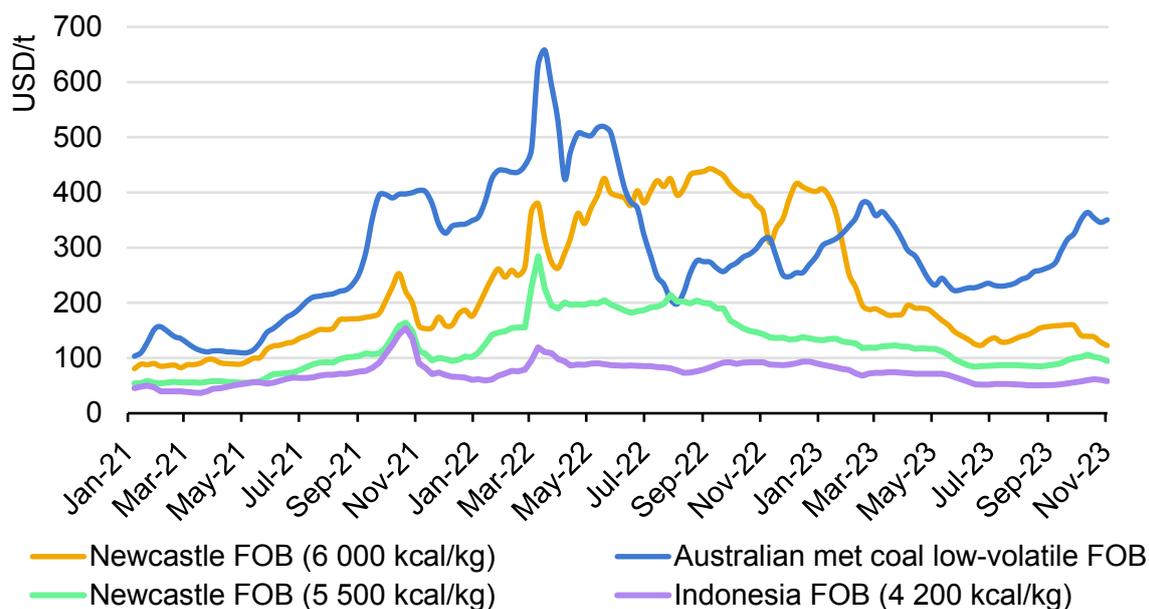
## Spreads between different qualities of coal remain above pre-crisis levels

In the Pacific Basin, the prices for various coal qualities are typically linked. These coal types are predominantly distinguished by their calorific value in the case of thermal coal. Nonetheless, in the year 2022, price markers for distinct coal qualities experienced a partial decoupling, driven mostly by market turbulence caused by Russia's invasion of Ukraine. The divergent price trajectories for different qualities of thermal and metallurgical coal indicate how they represent distinct market segments, which is partially due to their use. Met coal, characterised by its physical properties and generally higher carbon and energy content, is predominantly used directly, for example in steel production. Thermal coal is broadly categorised into low-, mid- and high-CV<sup>12</sup> coal and is predominantly used in power generation. Despite being different coal market segments, the different coal types can partially substitute each other: by blending higher-grade with lower-grade coal, a desired average calorific value can be reached. However, the substitution is limited due to existing contracts and technical limitations. For instance, burning met coal instead of thermal coal in power plants would be subject to the flexibility of handling systems, mills, burners and other factors.

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<sup>12</sup> In terms of thermal coal, we distinguish between low-CV (4 200 kcal/kg), mid-CV (5 500 kcal/kg) and high-CV (6 000 kcal/kg).

### Price markers for different types of coal in the Pacific Basin, 2021-2023



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Note: FOB = free on board. Newcastle = port on the east coast of Australia.

Source: IEA analysis based on Argus Media Group. All rights reserved.

The prices of met coal and thermal coal increased from 2021 until March 2022, reaching a temporary peak in early October 2021. However, they did so at different rates. The rising price of met coal was triggered by supply-side disruption, mainly caused by adverse weather conditions, which tightened the market, and ample demand due to economic recovery after the pandemic.

Between March 2021 and March 2022, the spread between met coal and high-CV thermal coal increased from about USD 15/t to USD 342/t. After March 2022 the markets for different qualities of coal decoupled. The spread between met coal and high-CV thermal coal diminished until June 2022, as supply disruptions affecting met coal eased and prices for thermal coal rose amid the gas crisis and energy security concerns. In the following months, high-CV thermal coal traded above met coal for the first time, with the premium reaching a maximum of USD 218/t at the end of July 2022. At that point, met coal was even traded below mid-CV thermal coal, something exceptional given the differences in quality between met and thermal coal. A central driver for these trajectories was the severe scarcity in the high-CV market segment, which could not be relaxed sufficiently as the substitution with other coal grades has been limited in part due to the strict quality requirements of utilities in northeast Asia.

Prices converged again towards mid-November 2022, but market dynamics went back to normal only at the end of January 2023, when prices for thermal coal plummeted, whilst prices for met coal increased, supported by Chinese buyers

resuming imports from Australia in February 2023. Since then, met coal has traded at an average premium of about USD 109/t above high-CV thermal coal.

Compared to Australian prices for higher-CV coal, low-CV Indonesian coal prices were affected to a lesser extent by market turbulence in 2022. As one of the most flexible coal suppliers, Indonesia managed to expand coal production. Additionally, China's demand eased in view of firm domestic supply, and Indonesia faced higher competition from Russia on the low-CV market. Nevertheless, prices in 2022 almost doubled on average compared to the beginning of 2021. At the beginning of 2023 prices started to decline again, reaching pre-crisis levels by mid-2023.

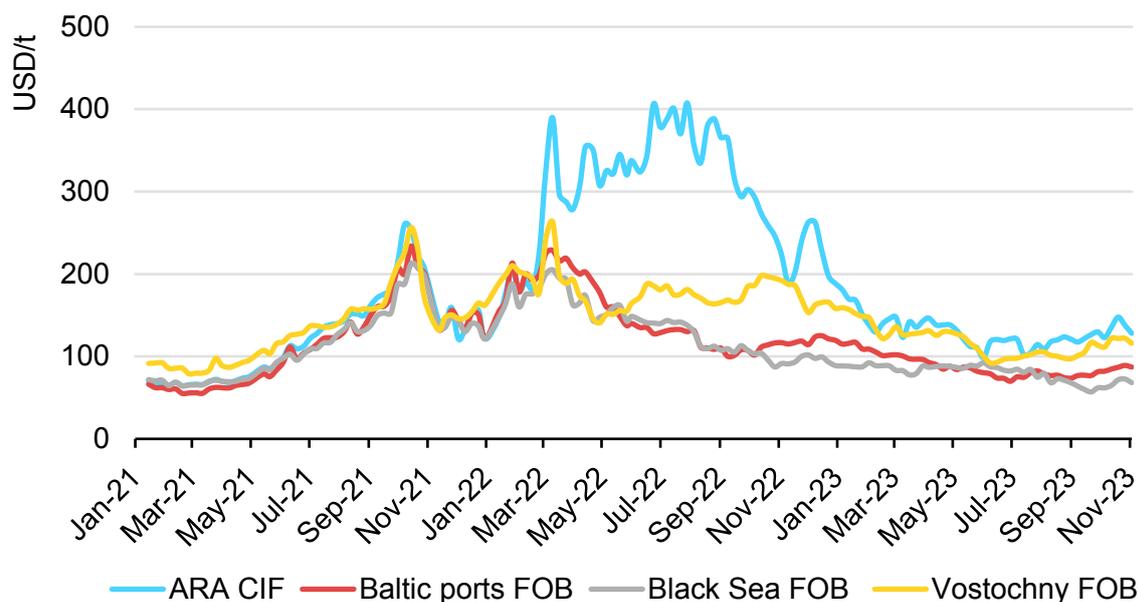
By mid-2023 the spreads between the different types of coal were still considerably higher than at the beginning of 2021. Since September 2023, prices for Australian met coal have surged markedly above USD 350/t amid an uptick in demand from India and China, which is facing temporary mine closures after recent accidents in Shaanxi.

## Discounts for Russian high-CV thermal coal disappear

After Russia invaded Ukraine in February 2022, several countries responded with sanctions against Russia, including an exclusion from the international payment system SWIFT. Besides payments for coal trades, cargo insurance was also impeded due to the sanctions. A range of countries became reluctant to buy Russian coal or even imposed a ban on importing it, including the European Union. As the European Union, Japan and Korea collectively accounted for about 40% of Russian coal exports, a large portion of Russian exports was affected.

Despite only taking full effect in early August 2022, the European spot market reacted swiftly with a notable uptick in prices. In contrast, Russian coal was traded at a discount, as Russian traders made efforts to divert the affected coal to other markets and to attract new buyers. Whilst prices for high-CV coal in the European market reached unprecedented highs above USD 400/t, Russian coal traded at a discount of up to USD 280/t in August 2022.

### European and Russian high-CV thermal coal (6 000 kcal/kg) price markers, 2021-2023



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Notes: ARA = Amsterdam Rotterdam Antwerp. FOB = free on board. CIF = cost, insurance and freight. Vostochny = port in the Russian Far East.

Source: IEA analysis based on Argus Media Group. All rights reserved.

However, Russian discounts evolved differently according to geographical location. Prior to the sanctions placed on Russia, its Baltic ports mainly served EU demand, while its Black Sea ports mainly supplied Türkiye, the Middle East, North Africa and India. The Far Eastern port of Vostochny supplied the Pacific Basin.

From March until May 2022, prices at the Baltic ports were about USD 40/t above prices at ports in the Black Sea and at Vostochny, as demand for Russian coal from Europe was temporarily elevated before the ban on Russian coal came into full effect in August 2022. From June, coal at Vostochny traded above coal at the western ports, reaching a premium of about USD 80/t. This was driven by increasing demand from China and ASEAN countries.

Discounts at the Baltic ports and in the Black Sea ranged from about 43% in March to about 73% in September, after prices dropped by about USD 20/t in August when the EU coal import ban came into full force. However, from October 2022 until April 2023, coal at the Baltics ports traded above coal at the Black Sea ports. This was due to the beginning of the heating period when Kazakh coal was shipped to the European Union through Russia's Baltic ports.

With plummeting European prices, price spreads began to narrow in the final quarter of 2022. Price discounts at Vostochny had vanished by mid-November before a cold spell gave European prices a short uptick. At the beginning of 2023,

prices converged again. Discounts at the Baltic ports and in the Black Sea reduced to an average of about USD 40/t in 2023.

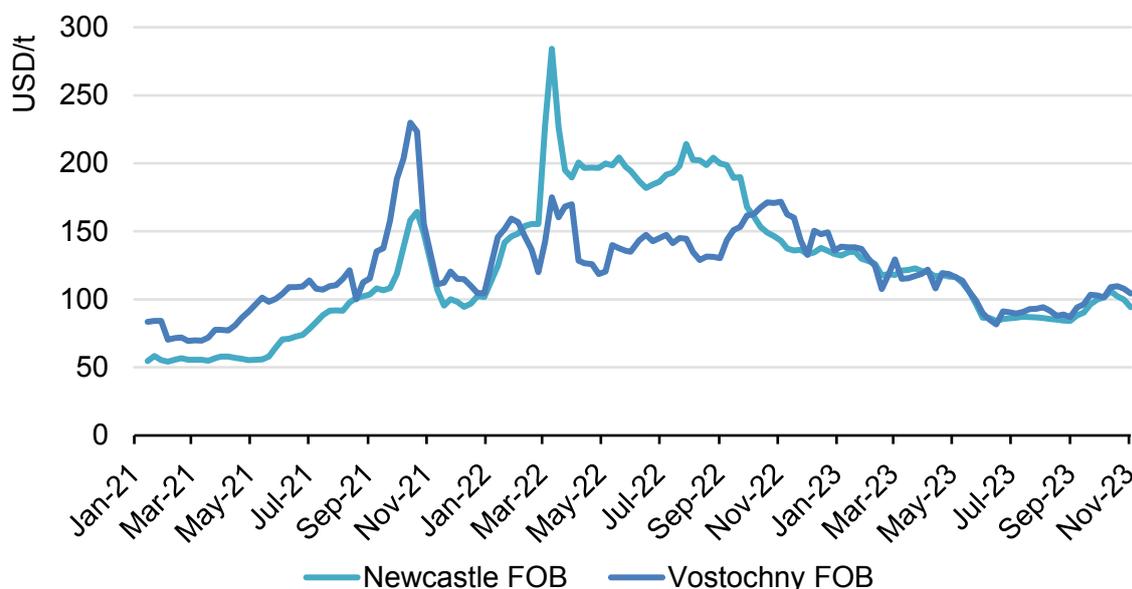
## The evolution of discounts for mid-CV thermal Russian and Australian coal

In the category of mid-CV coal (5 500 kcal/kg), the discount on Russian coal at the country's Far Eastern port of Vostochny was less pronounced and more limited in duration than at other ports.

Throughout 2021 and until February 2022, Russian mid-CV coal traded at a premium to mid-CV coal from Australia. The markets for Australian and Russian mid-CV coal were effectively split, as China had issued an unofficial ban on Australian coal over political tensions in late 2020. The ban resulted in higher demand for Russian mid-CV thermal coal from China, driving up prices.

Despite the informal ban still being in place, coal at the port of Vostochny traded at a discount of about USD 54/t, between March and October 2022 as a result of the war and subsequent sanctions, and the need for Russian traders to attract new buyers in view of the imposed sanctions. From October 2022 until January 2023, Russian coal predominantly traded above Australian coal again, before both price markers converged in early 2023 after China lifted its unofficial ban on Australian coal.

**Australian and Russian mid-CV thermal coal (5 500 kcal/kg) price markers, 2021-2023**



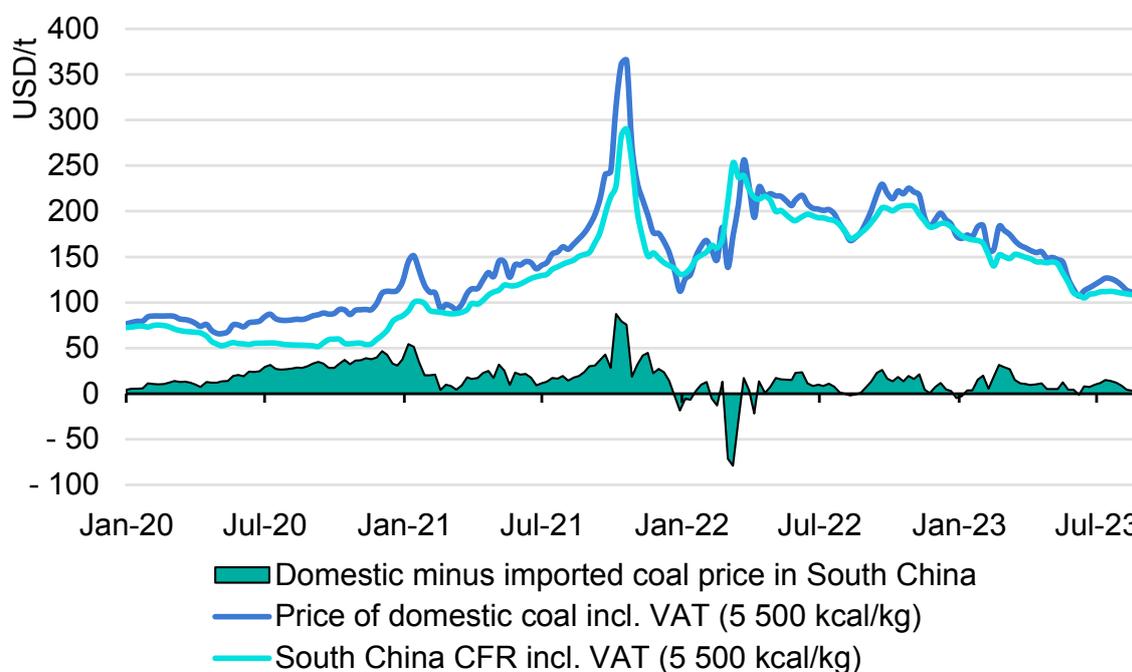
IEA. CC BY 4.0.

Notes: FOB = free on board. Newcastle = port on the east coast of Australia. Vostochny = port in the Russian Far East.  
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## China's import price spread narrows on high domestic production and a return to Australian coal

Given China's geography, even domestic coal is shipped over long distances to reach its destination. About 800 Mtpa of domestic coal is shipped from the northern mining provinces to the coastal demand regions in the south. This is twice China's imports and equivalent to more than three-quarters of all global coal exports. In recent years, China's policies to curb imports have led to a spread between domestic coal prices and prices in the Pacific Basin, as traders are restricted in exploiting arbitrage opportunities. Driven by China's import quotas, the exact terms and conditions of which are unknown, and the introduction of an unofficial ban on Australian coal in 2020, domestic coal has mostly traded at a premium to imported coal; however, they still show a strong correlation.

### Price arbitrage domestic versus imported coal, China, 2020-2023



IEA. CC BY 4.0.

Note: FOB = free on board; CFR = cost and freight; VAT = value-added tax.

Source: IEA analysis based on CRU (2023), Coal Cost Model (database).

During 2022 the premium of domestic coal over imported turned negative several times, as China's ample domestic supply made high-priced imports uncompetitive. Domestic coal traded at a maximum discount of USD 79/t in March, when the Russian invasion of Ukraine unsettled global markets and sent global prices to record highs. In total, the average premium shrank to USD 4.4/t during 2022, compared to an average of about USD 24/t in the two years before.

During the first nine months of 2023, prices for domestic and imported coal decreased steadily, backed by ample stocks and plentiful domestic supply, as well as softening global prices. The average premium rose to about USD 10/t, as prices for imported coal decreased slightly further than domestic coal. However, spreads remained well below pre-crisis levels, as the end to the unofficial ban on Australian coal took effect.

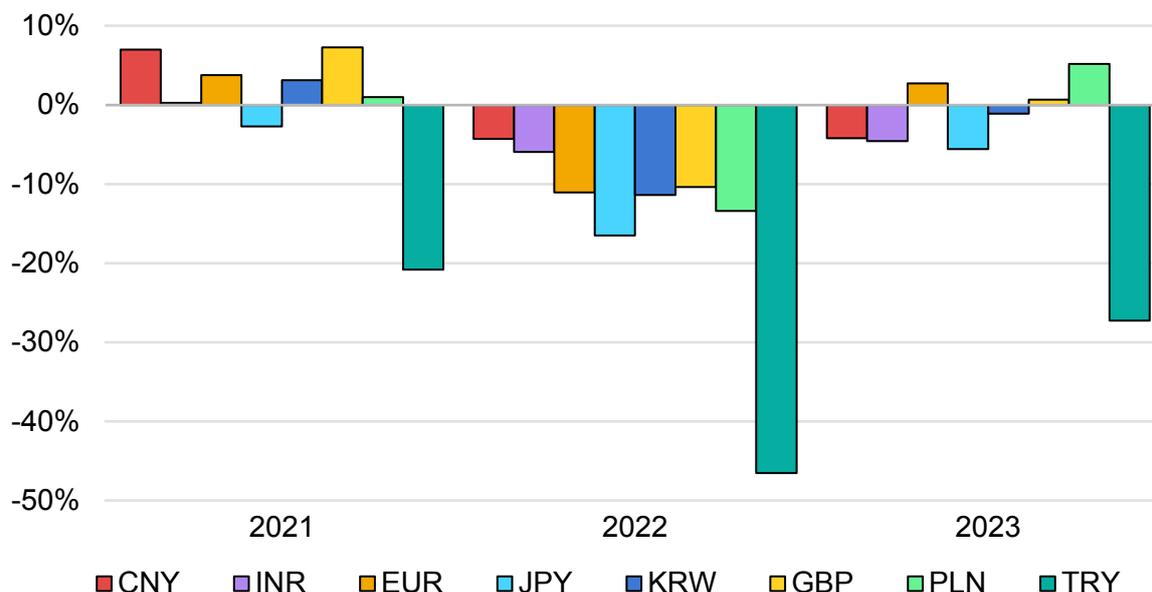
## **The appreciation of the US dollar slowed or even turned to depreciation against some currencies**

International coal deliveries are predominantly contracted in US dollars. Therefore, exchange rates against the US dollar have vitally important impact on the affordability of coal imports. Currency depreciation against the US dollar makes coal purchases more expensive for potential buyers.

In 2021, with economies recovering from the pandemic-induced lows, the currencies of major importing countries and regions appreciated against the US dollar, except for the Japanese yen (down 2.7%), the Turkish lira (down 20%), and the Indian rupee (which remained constant).

Between early 2022 and mid-2023, the US Federal Reserve raised interest rates eleven times, which led to the US dollar gaining value against other currencies. Particularly in 2022, this implicitly increased already high coal prices. The currencies of major importing countries and regions recorded low double-digit declines in value, with the Turkish lira standing out for declining more, and the Chinese yuan renminbi and the Indian rupee for declining less. Nonetheless, despite being affected by depreciation to a lesser extent, importers in China and India still turned to lower grades of coal, boosting the Indonesian low-CV coal market. In 2023, currency depreciation against the US dollar lost momentum, with the Polish zloty (5%), the euro (2.7%), and the British pound sterling (0.7%) even appreciating.

### Year-on-year development of selected importing countries' currencies against the US dollar, 2021-2023



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Notes: CNY = Chinese yuan renminbi. INR = Indian rupee. EUR = euro. JPY = Japanese yen. KRW = Korean Republic won. GBP = British pound sterling. PLN = Polish zloty. TRY = Turkish lira. 2023 values represent average exchange rates to October 2023, except for CNY and INR, which are to September 2023.

Source: OECD (2023), [Monthly Monetary and Financial Statistics \(MEI\) exchange rates \(USD monthly averages\)](#).

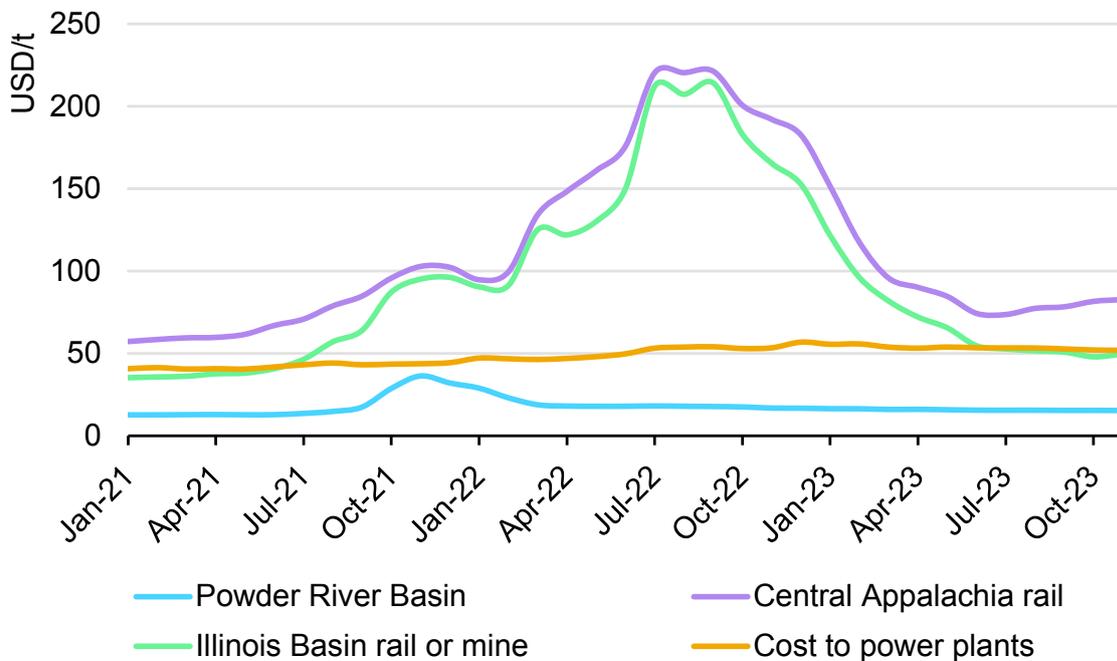
## US prices return to close to pre-crisis levels

More than 86% of the coal produced in the United States is consumed domestically and traded under long-term contracts, which are often indexed to cost inflation indicators. Consequently, average costs for coal delivered to US power plants were affected to a lesser extent by surging global spot prices for thermal coal in recent years. Between January 2021 and September 2022, the cost of coal delivered to US power plants rose by 33%. During the same period, spot prices rose almost threefold in the Central Appalachian region and more than fivefold in the Illinois Basin, mainly driven by surging export prices. Meanwhile, spot prices in the Powder River Basin did not react to global export prices as only a minor fraction of coal from this region is designated for export through ports on Canada's west coast.

Due to the high share of long-term domestic contracts, exporters did not fully benefit from surging export prices. Instead, rising operating costs while serving long-term contracts led to surface miners beginning to link prices in new long-term agreements to diesel indexes or to add reopener or repricing triggers to avoid fully bearing the price risk. Also, despite elevated prices, exporters did not show significant interest in expanding their capacity. Given the industry's lack of long-term prospects, financing new projects and hiring workforce are hard.

After peaking in November 2022, prices in the Central Appalachian region and the Illinois Basin started to fall. By May 2023, prices reached levels close to those last seen before the crisis.

### Spot coal prices in different regions of the United States and cost of coal supplied to power plants, 2021-2023



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Sources: IEA analysis based on Argus Media Group. All rights reserved. EIA (2023), [STEO](#).

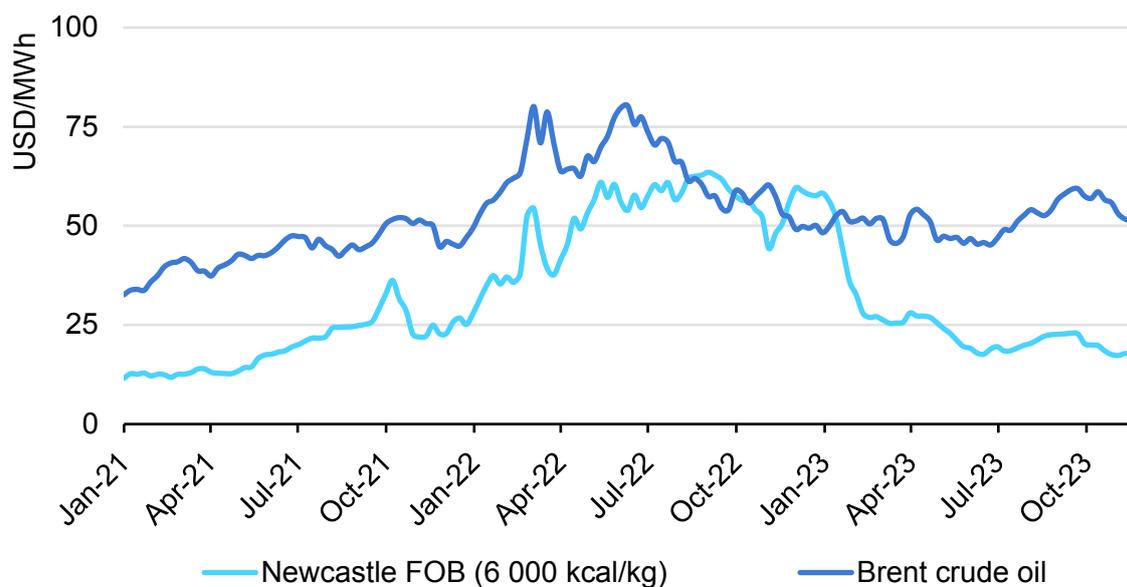
## Different fuel price levels returned to historical norms

Prices of various energy commodities are typically correlated as they are substitutes for one another to a certain extent (e.g. coal and gas in power generation) or they are inputs into the respective supply chains (e.g. oil use in coal transport). In 2021 and 2022, however, the energy market witnessed significant turmoil, temporarily reducing the link in the prices of coal, gas and oil.

In terms of energy equivalency, during 2021, Brent crude oil traded at an average premium of about USD 20/MWh over coal, while prices for both increased at a similar pace. In 2022, the spread narrowed due to coal supply shortages and strong demand for Australian high-CV thermal coal. When Brent crude oil prices decreased in mid-2022 amid lukewarm economic prospects, high-CV coal traded above it in equivalent energy terms between August and the beginning of October, before the price for Australian high-CV thermal coal dipped. In the scarcity situation, coal prices were driven by demand rather than by marginal supply costs, which are tied to oil through its use for fuel and explosives production.

With increasing coal demand at the beginning of the 2022/23 heating season (end of October), high-CV thermal coal again traded above oil, which stabilised in the last quarter of 2022. This lasted until mid-January 2023, when prices for Australian high-CV thermal coal plummeted. In the first half of 2023, Brent crude oil traded at a premium of USD 23/MWh over Australian high-CV thermal coal.

### Price markers for Newcastle FOB coal and Brent crude oil, 2021-2023



IEA. CC BY 4.0.

Note: FOB = free on board.

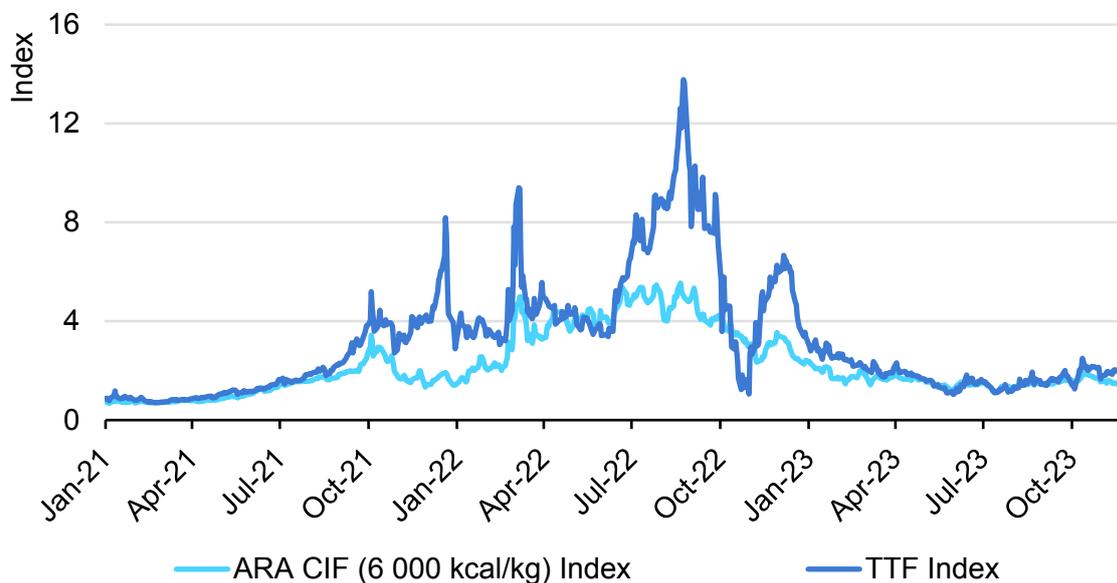
Source: IEA analysis based on Argus Media Group. All rights reserved.

Prices for thermal coal and natural gas are historically strongly correlated, especially outside the heating period, as both commodities are substitutes for each other in power generation. However, during the energy crisis in 2022 with severe gas shortages, the commodities decoupled temporarily.

During the heating season of winter 2021/22, the price of coal stood at around twice that seen in January 2021 after China and India had boosted domestic coal supply to reduce their exposure to high coal prices. Meanwhile, gas prices increased further. With the onset of Russia's war against Ukraine, prices for gas and coal peaked again, with gas showing a more pronounced swing. Between March and June 2022, prices for gas and coal stabilised at a level four times higher than in January 2021. Their prices were linked again, as many countries switched to coal-fired power generation to save gas. In June, tight markets, EU storage level requirements and the war premium led to gas prices increasing much more than coal prices, despite which, coal prices reached all-time highs. In view of close-to-full gas storage sites and expectations of a mild winter, prices for gas dipped in October 2022, just to peak again shortly after when a cold spell reached Europe.

After the end of the heating period, the prices of gas and coal coupled again at levels around 50% above January 2021.

### Trajectories of ARA CIF coal and TTF gas prices, 2021-2023



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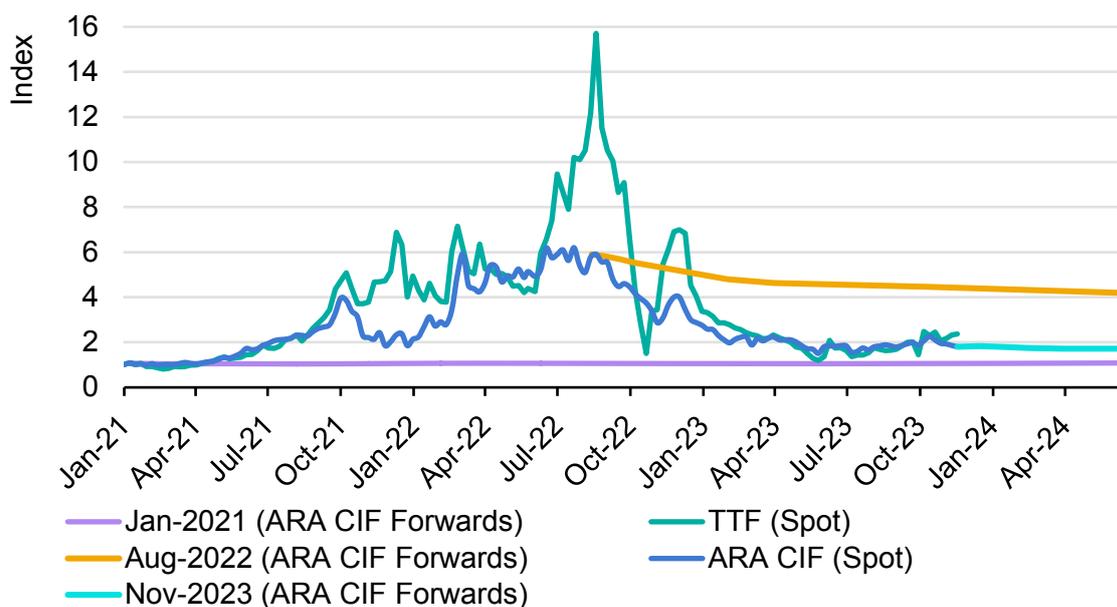
Notes: ARA = Amsterdam Rotterdam Antwerp. CIF = cost, insurance, and freight. TTF = Title Transfer Facility.  
Source: IEA analysis based on Argus Media Group. All rights reserved.

## The coal market did not anticipate such high prices

After a phase of strong backwardation, indicating the expectation of falling coal prices, during the high-price period in 2021 and 2022, the forward curve of API2 (a price index for coal deliveries to Europe) had returned to a flat trajectory by mid-2023. The development of the forward curves, but also price forecasts by different players, compared to the spot prices show that the market did not expect the strong price increase in 2021 and 2022, nor the speed of the return to more normal prices. Whereas the cost of the marginal supplier can be a good indicator for a longer-term price forecast, the short-term trends in an undersupplied market mostly follow the substitution source, in this case, gas as the main substitution for coal in power generation. Every event with the potential of disrupting the gas market has been bullish for coal markets.

At the beginning of 2021 the forward curve was flat, indicating that the market did not expect the tightening of the market in the following months. In August 2022, the forward curve showed an expectation of continued elevated prices throughout 2024 and underestimated the pace at which prices would decrease until mid-2023. Within the six months from August 2022 until February 2023, prices declined by two-thirds, while the market expected a decline of only about 14%. By mid-2023, coal prices reached a level just below twice the price seen in January 2021.

### API2 (ARA CIF) spot prices and forward curves, 2021-2024



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Notes: API2= Argus/McCloskey's Coal Price Index. ARA = Amsterdam, Rotterdam, Antwerp. CIF = cost, insurance, and freight

Source: IEA analysis based on Argus Media group. All rights reserved.

## Costs

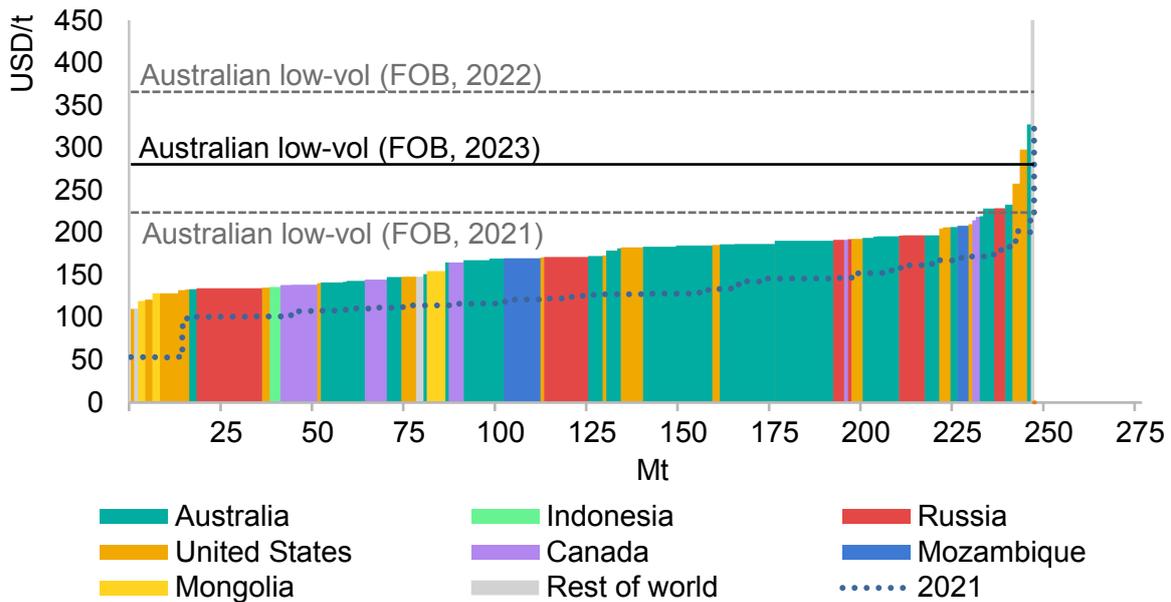
### Coal price surges in 2022 were significantly higher than cost increases, driving up margins

In 2022, the supply curve for hard coking coal shifted upward compared to the year before due to cost increases in input factors such as fuel, steel products, and labour. Weighted average costs increased by about 36%, while average prices for hard coking coal in Australia increased by 64%, indicating exceptionally high profitability gains. High margins attracted new exporters, compensating for declines in major exporting countries.

Among other factors, the further ramping up of production at Russia's<sup>13</sup> low-cost Elga mine, led to an increase in Russian hard coking coal exports. Driven by the high prices, Mozambique doubled its exports. Conversely, exports from Australia, the largest supplier in this segment, decreased by about 7% as coal mining was severely affected by adverse weather condition. Chinese Covid restrictions at the border hindered Mongolia's ability to profit fully from high prices.

<sup>13</sup> Analysis of Russian supply costs should be considered with caution given the circumstances of Russia's war against Ukraine.

**Indicative hard coking coal FOB supply curve 2022 and average FOB price markers**



IEA. CC BY 4.0.

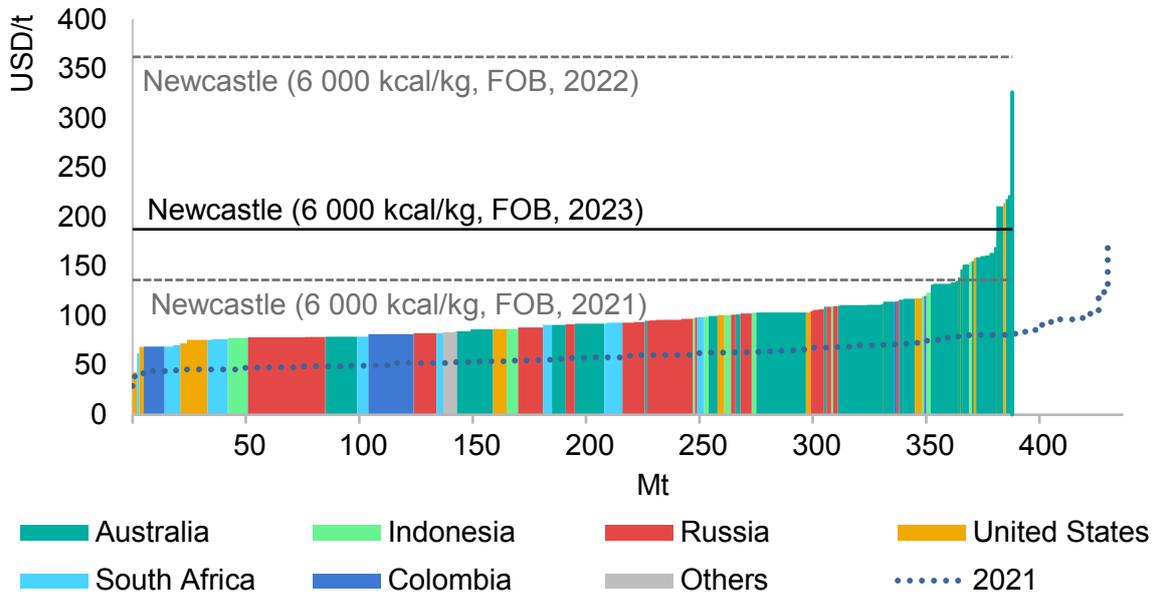
Notes: low-vol = low-volatile. FOB = free on board. Cost curves account for variable production costs, overburden removal, royalties, inland transport, and port usage fees. The annual average FOB marker price is based on the monthly average index for Australian prime hard coking coal. The 2023 price is based on the average from January to September.

Sources: IEA analysis based on Argus Media Group. All rights reserved. IEA, adapted from CRU (2023), Metallurgical Cost Model (database).

The supply costs for met coal are higher than those for thermal coal on average. This is because met coal is more often mined underground and, on average, comes from smaller coal mines than thermal coal. In addition, the preparation costs for met coal are typically higher than for thermal coal. However, compared to thermal coal, higher-cost projects are economically viable due to the generally higher value of met coal.

In the segment of high-CV thermal coal, the weighted average cost increased by about 56% in 2022. Coal prices however, outpaced cost increases considerably. Average prices at the port of Newcastle in Australia, a common benchmark in this segment, rose by approximately 165%. Despite a considerable uptick in profitability, the supply curve contracted compared to 2021, further tightening the market and pushing up prices. The contracting of the supply curve was driven by supply disruptions caused by various factors, with Australia and South Africa being most affected in this segment in 2022. In total, the supply curve for high-CV coal contracted by about 42 Mt.

**Indicative high-CV (> 5 700 kcal/kg) thermal coal FOB supply curve 2022 and average FOB marker prices**



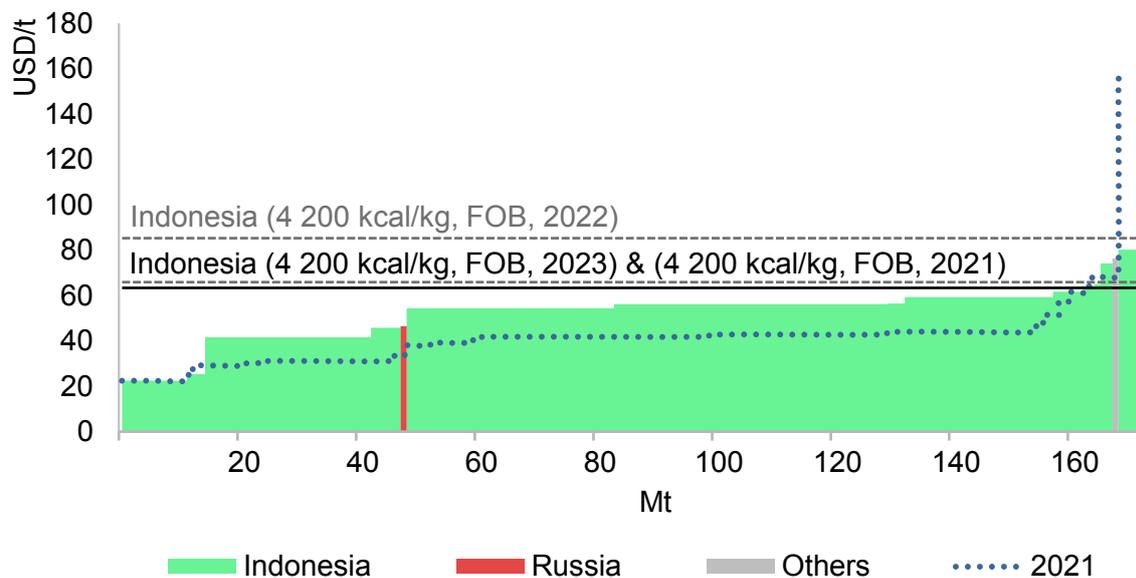
IEA. CC BY 4.0.

Notes: The cost curves account for variable production costs, overburden removal, royalties, inland transport, and port usage fees. The cost curve is not adjusted for different qualities of coal. The transport costs given are to the closest port, so the FOB costs of Russian producers in Asia can be somewhat higher than shown in the figure. Russian costs have been adjusted according to IEA estimates. The annual average FOB marker price is based on the monthly average index of Newcastle/Indonesian steam coal. The 2023 prices are based on the monthly average from January to November.

Sources: IEA analysis based on Argus Media Group. All rights reserved. IEA, adapted from CRU (2023), Thermal Cost Model (database).

In the segment of low-CV thermal coal, which is dominated by Indonesia, the supply curve extended by about 9 Mt as Indonesia ramped up production in 2022. Once again, Indonesia proved to be the most flexible coal supplier. Weighted average costs and average prices of Indonesian coal rose by about 31% and 29% respectively.

### Indicative low-CV (< 4 500 kcal/kg) thermal coal FOB supply curve 2022 and average FOB marker prices



IEA. CC BY 4.0.

Notes: The cost curves account for variable production costs, overburden removal, royalties, inland transport, and port usage fees. The cost curve is not adjusted for different qualities of coal. The transport costs given are to the closest port, so the FOB costs of Russian producers in Asia are somewhat higher than shown in the figure. Russian costs have been adjusted according to IEA estimates. The annual average FOB marker price is based on the monthly average index of Newcastle/Indonesian steam coal. The 2023 prices are based on the monthly average from January to November.

Sources: IEA analysis based on Argus Media Group. All rights reserved. IEA, adapted from CRU (2023), Thermal Cost Model (database).

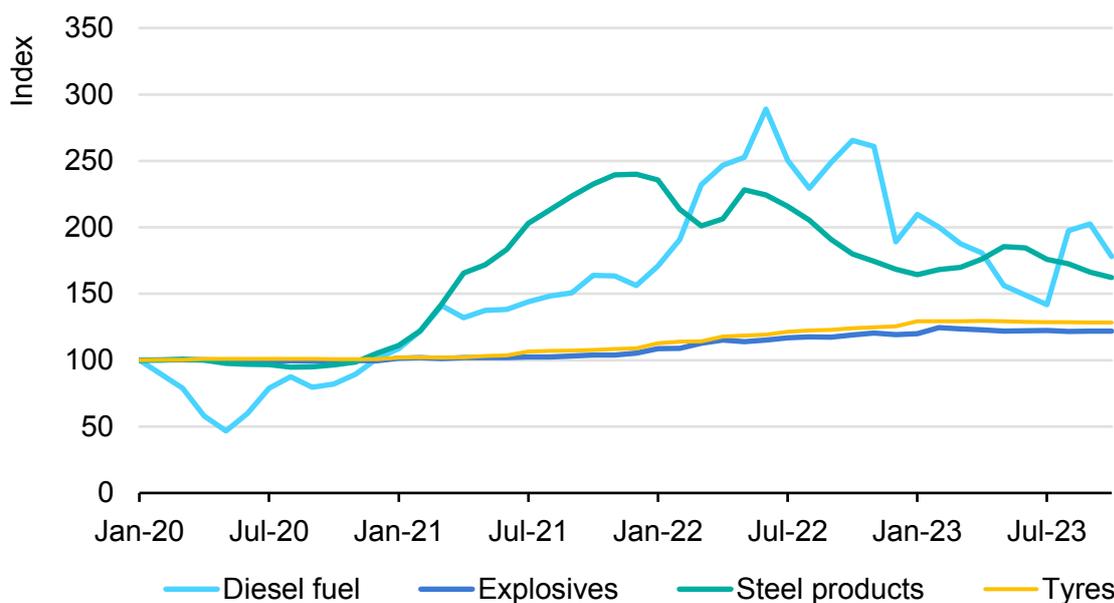
## Input costs of coal mines vary in their volatility

The cost structure of coal mines is determined mainly by operating expenses such as labour and fuel costs, taxes and royalties, as well as transport costs (e.g. for inland transport, port fees and seaborne freight). The cost proportion depends on the mining method (surface or underground) and can vary considerably depending on the producer, country and specific mine site.

Input factors such as fuel, explosives, tyres and steel products are traded internationally, and prices follow global trends. Prices for tyres and explosives have been more stable than fuel and steel prices in recent years. Driven by inflation, their prices have steadily increased by about 29% and 22%, respectively, since the beginning of 2021. In contrast, fuel and steel, which are traded in more liquid global markets, have been subject to more fluctuations. In June 2020, demand destruction during the Covid-19 pandemic drove fuel prices to their lowest level since 2003, only to reach record levels two years later in mid-2022. One year on, prices returned to levels last seen in January 2021, albeit still about 37% above levels at the beginning of 2020.

Prices for steel products hardly changed during the Covid-19 pandemic. However, as steelmaking is an energy-intensive industry, rising energy prices took their toll in 2021: they more than doubled in 2021 before a deteriorating economic outlook sent prices on a downward trend, which lost momentum at the beginning of 2023. By mid-2023, prices for steel products were still 70% above their level at the beginning of 2021.

### Nominal prices of selected commodities and input factors used in coal mining, 2020-2023



IEA. CC BY 4.0.

Source: IEA Analysis based on US Bureau of Labour Statistics (2023), [Producer Price Indexes](#).

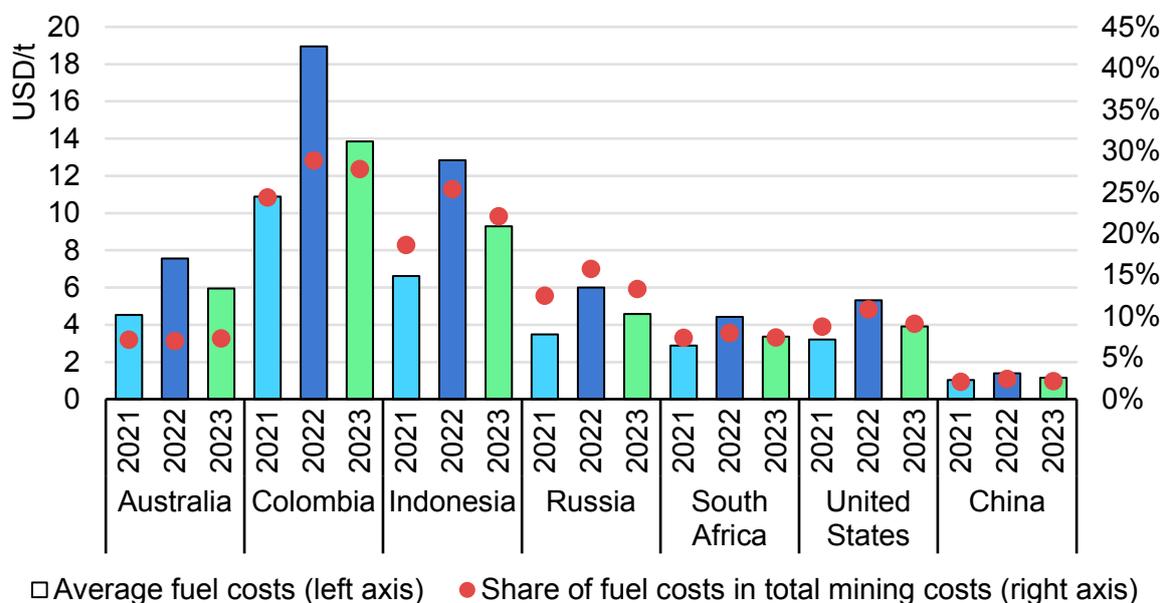
## Fuel costs decrease with easing energy markets

Diesel fuel costs are an important cost factor in coal mining. This is especially true for opencast mines, which rely heavily on diesel-fuelled vehicles and other equipment. Consequently, fuel costs have a greater influence on overall mining costs in those countries with a higher share of opencast mining (e.g. Colombia and Indonesia). In countries such as China, where opencast mining accounts for only a minor share of overall mining, fuel costs play a minor role in the profitability of a mine. Nevertheless, oil prices are always a factor when coal is transported.

In 2022, fuel prices increased in many countries, and so did fuel as a share of overall mining costs, as its cost grew more strongly than other cost factors. At about five percentage points each, Colombia and Indonesia recorded the strongest increase in fuel's share of mining costs. In Australia, driven by a substantial increase in royalties, the share remained constant. In 2023, fuel prices

declined, and so did fuel’s share of overall mining costs in most countries. The only exceptions to this are China, Australia and South Africa, where the share remained constant.

**Average fuel costs and share of total coal mining costs in selected countries, 2021-2023**



IEA. CC BY 4.0.

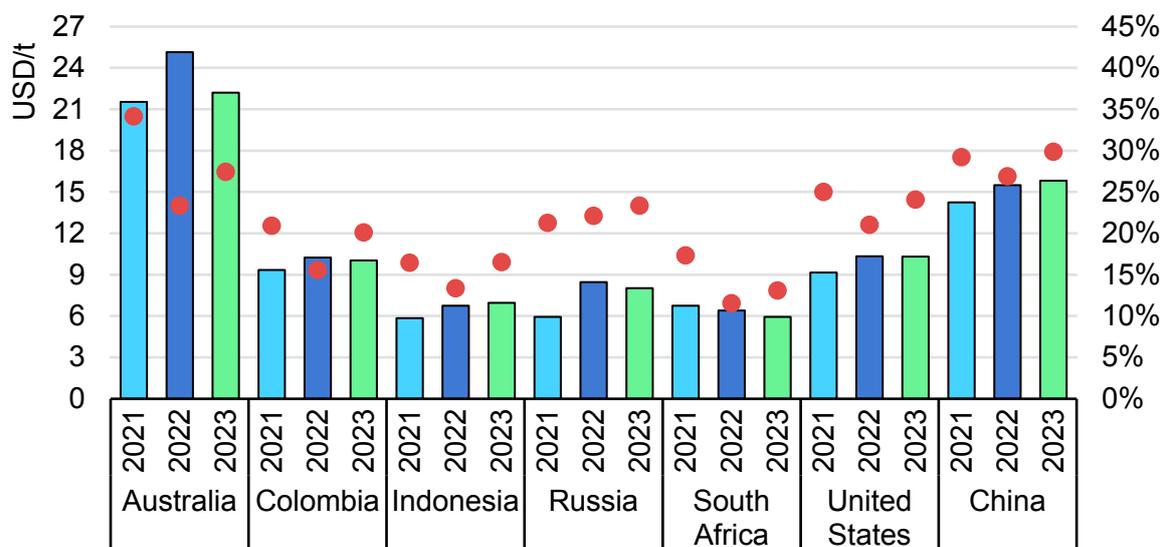
Source: IEA, adapted from CRU (2023), Thermal Cost Model (database).

## Labour costs increased in absolute terms but fell as a share of total costs

Labour costs vary significantly among coal-producing countries and affect the competitiveness of exporters.<sup>14</sup> Except for South Africa, where labour costs slightly decreased as a result of a depreciating rand, labour costs marginally rose in 2022. Consequently, as other cost factors such as royalties and fuel costs increased more strongly, the share of labour costs in total mining costs decreased. In 2023 labour costs further increased in most countries except for South Africa, as the willingness to pay higher wages to attract workers remains high in coal industries. With other cost factors – predominantly royalties – decreasing, the share of labour costs rose in most countries. In Russia and China, the share of labour costs even rose above 2021 levels.

<sup>14</sup> China is included because its domestic coastal coal trade of more than 800 Mt is comparable with global trade.

### Average labour costs and share of total coal mining costs in selected countries, 2021-2023



□ Average labour costs (left axis) ● Share of labour costs in total mining costs (right axis)

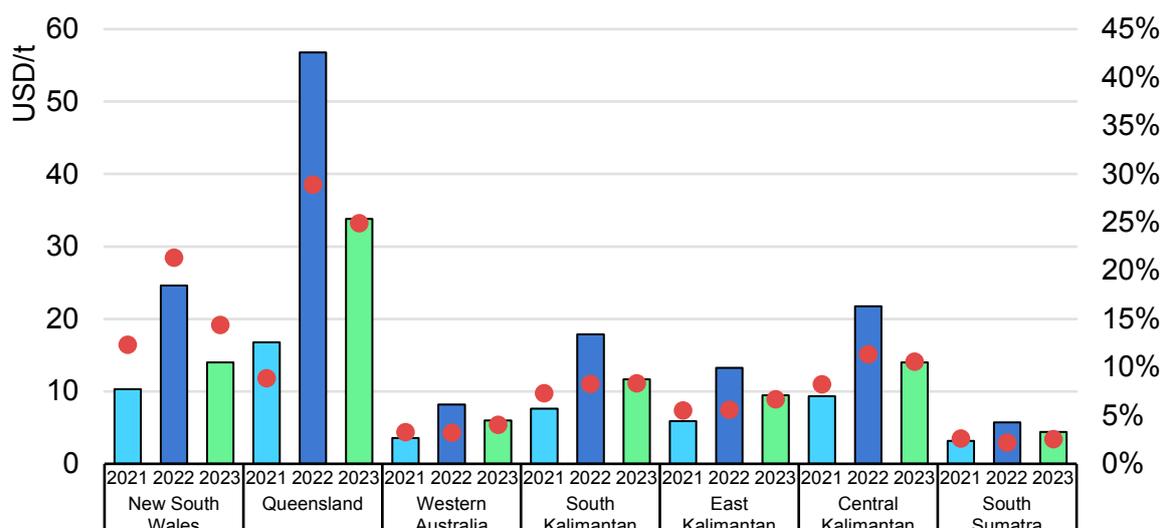
IEA. CC BY 4.0.

Source: IEA, adapted from CRU (2023), Thermal Cost Model (database).

## Governments increased royalties to benefit from high prices

National and regional governments levy royalties on each tonne of coal produced in return for granting mining licences. The level of royalties varies from country to country and from region to region and has been subject to adjustments in response to the high price phase in recent years. During the high-price phase in 2021 and 2022, some governments increased royalties significantly to benefit from the exceptionally high prices. In 2022, royalties roughly doubled. In Queensland, Australia, royalties grew the most – by approximately 134%. Consequently, royalties’ share of overall mining costs increased in 2022. Royalty costs in Queensland accounted for almost 30% of total mining costs. In 2023, as prices softened, royalties declined as they are linked to coal prices, albeit remaining above 2021 levels. Correspondingly, their share of total costs decreased significantly in the Australian states of New South Wales and Queensland. In Indonesia and Western Australia, royalties’ share of total mining costs remained constant. In other major exporting countries, such as Russia, the United States, South Africa, and Colombia, royalties have been less of a factor in recent years.

### Average royalties and share of total coal mining costs in selected areas, 2021-2023



□ Average royalty costs (left axis) ● Share of royalty costs in total mining costs (right axis)

IEA. CC BY 4.0.

Source: IEA, adapted from CRU (2023), Thermal Cost Model (database).

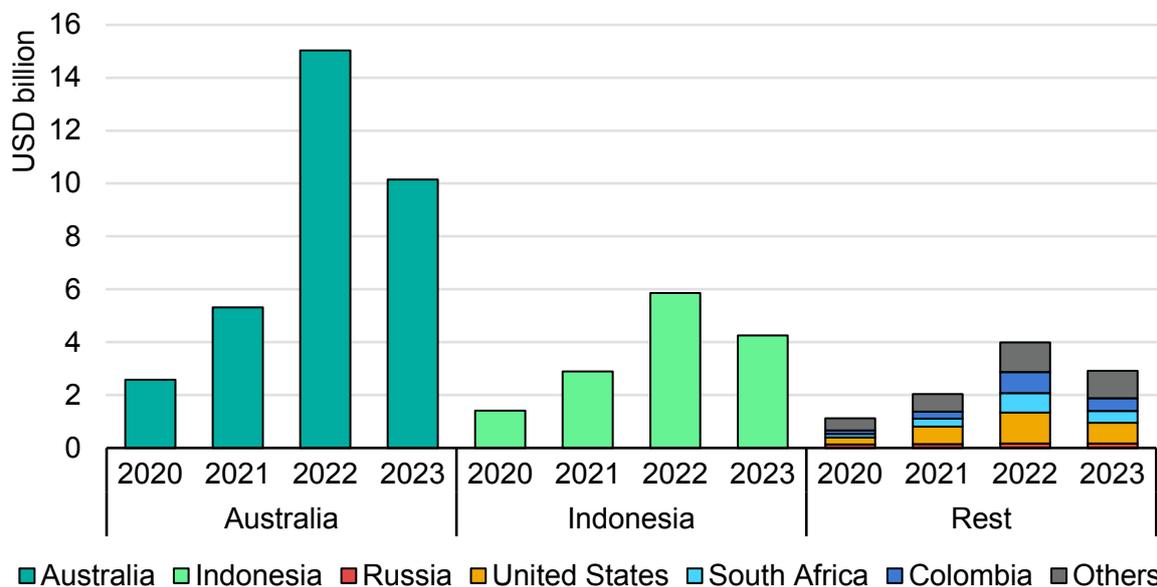
## Governments, especially Australia, benefit from record royalty payments

In total, the high-price phase in global coal markets, paired with royalty adjustments in some countries, has put considerable amounts of money into public coffers in recent years. Based on our assessment of costs and realised prices, in Australia, royalties on coal exports rose from a pandemic-related low of USD 2.6 billion in 2020 to about USD 15 billion in 2022, doubling in 2021 and tripling in 2022, according to our estimates. In Indonesia, total royalties on exports rose from USD 1.4 billion to about USD 5.9 billion. In 2023, due to overall price decreases, royalties declined, amounting to USD 10 billion in Australia and USD 4.3 billion in Indonesia.

In other exporting countries, export-related royalties are much lower compared to Australia and Indonesia, the world's largest exporters. The combined royalties of other exporters grew from about USD 1.1 billion in 2020 to about USD 4 billion in 2022, a little more than a quarter of the Australian royalties. However, incentivised by the high prices in recent years, smaller exporting countries have sought to benefit more by adjusting royalty and tax schemes. For example, Russia imposed an export duty on coal, which is linked to currency exchange rates, starting from October 2023. Furthermore, Colombia issued a tax reform in 2023, restricting coal mining firm's ability to deduct royalty payments from their income tax liabilities.

Despite this decision having been overruled by the constitutional court in November 2023, the initial reform underlines Colombia’s endeavour to increase coal mining duties.

**Total royalties for exported coal in selected countries, 2020-2023**



IEA. CC BY 4.0.

Source: IEA estimates based on CRU (2023), Thermal Cost Model and Metallurgical Cost Model (database).

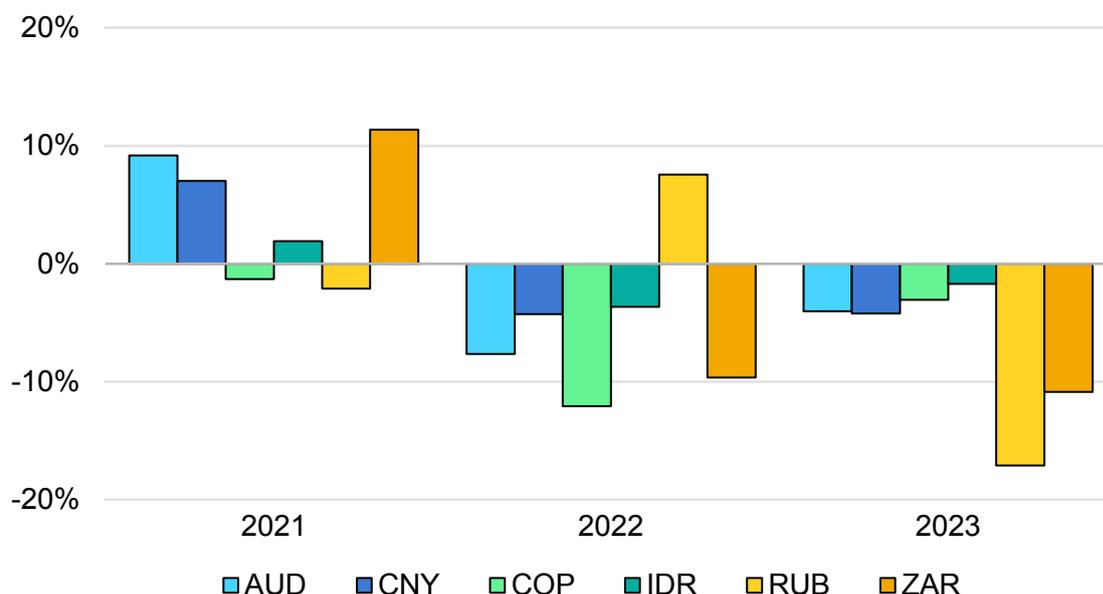
## Rising US dollar contributes to other exporters’ competitiveness

Currency exchange rates affect the competitiveness of exporters. While coal trading contracts are mainly in US dollars, operating costs are settled in local currencies to a larger extent. Consequently, a local currency depreciation against the US dollar implies a reduction in operating costs and an increase in producers’ competitiveness.

Between the beginning of 2022 and mid-2023, the US Federal Reserve raised interest rates 11 times, making investments in US dollars comparably more attractive and, therefore, luring investors and capital.

Except for the Russian rouble, which appreciated against the US dollar in 2022 due to extraordinarily high revenue streams from energy exports, the currencies of major exporting countries and China depreciated compared to the year before. In 2023, the depreciation continued, but slowed for most currencies except the South African, which continued to devalue at the same rate. The Russian rouble recorded a notable reversal, seeing substantial losses of about 17% in 2023, driven by softening energy prices.

### Year-on-year development of China's and exporting countries' currencies against the US dollar, 2021-2023



IEA. CC BY 4.0.

Notes: AUD = Australian dollar; CNY = Chinese yuan renminbi; COP = Colombian peso; IDR = Indonesian rupiah; RUB = Russian rouble; ZAR = South African rand. The chart displays the y-o-y average exchange rate development of the selected currencies expressed in change from the previous year. 2023 represents average exchange rates to September 2023 for all currencies except the AUD and COP, which is to October 2023.

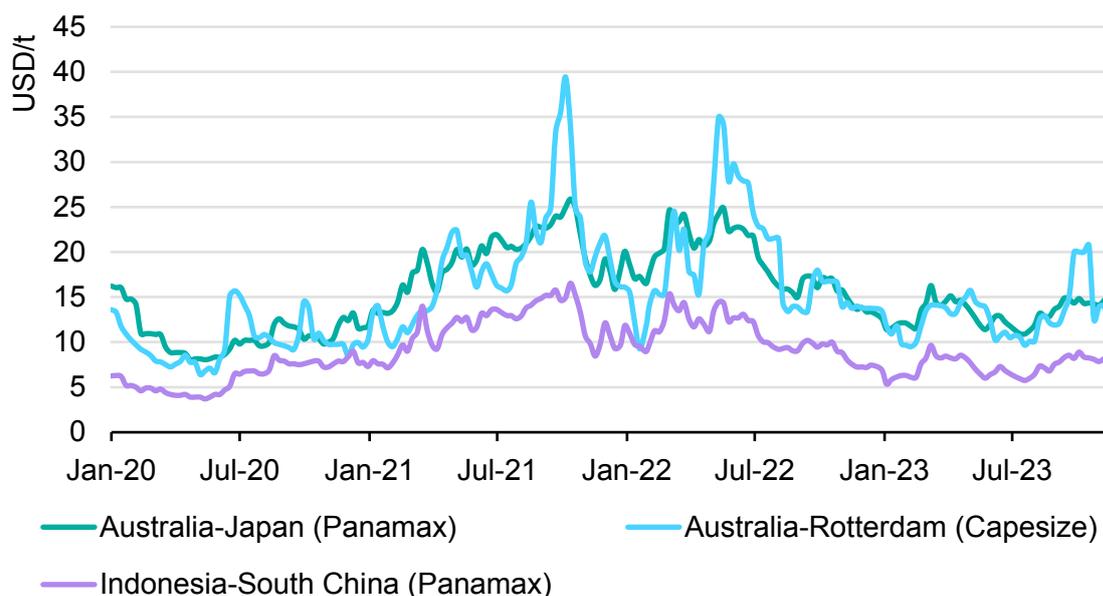
Source: OECD (2023), [Monthly Monetary and Financial Statistics \(MEI\): Exchange rates \(USD monthly averages\)](#).

## Freight rates return to pre-crisis levels

The vast majority of the global coal trade (more than 90%) is seaborne and shipped by dry bulk vessels of different sizes, categorised by their deadweight tonnage (dwt). The four main vessel types are Capesize, Panamax, Handymax/Supramax and Handysize, with the most used being Panamax (60 000-80 000 dwt) and Capesize (over 80 000 dwt). Freight rates differ between vessel types and routes, and depend on demand and supply for freight. Fuel costs are an important determinant of freight rates. Comprising almost a quarter of the total, seaborne coal trade has the second-largest share of the overall dry bulk trade by mass, following iron ore with a share of about 30%.

After peaking in October 2021, freight rates temporarily softened, driven by seasonal variations and a deterioration of the economic outlook, before ticking up again in the first half of 2022 when, among other factors, Russia's war against Ukraine unsettled energy markets and high gas prices drove up the demand for coal as a dry bulk commodity. With easing demand for dry bulk carriers towards the end of 2022 due to a deteriorating economic outlook and decreasing congestion in ports, which had been caused by pandemic containment measures, freight rates began to fall in the second half of 2022. By mid-2023, freight rates had returned to levels last seen in mid-2022.

### Freight rates on selected routes, 2020-2023



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Source: IEA analysis based on Argus Media Group. All rights reserved.

## High profitability of coal exporters in 2022

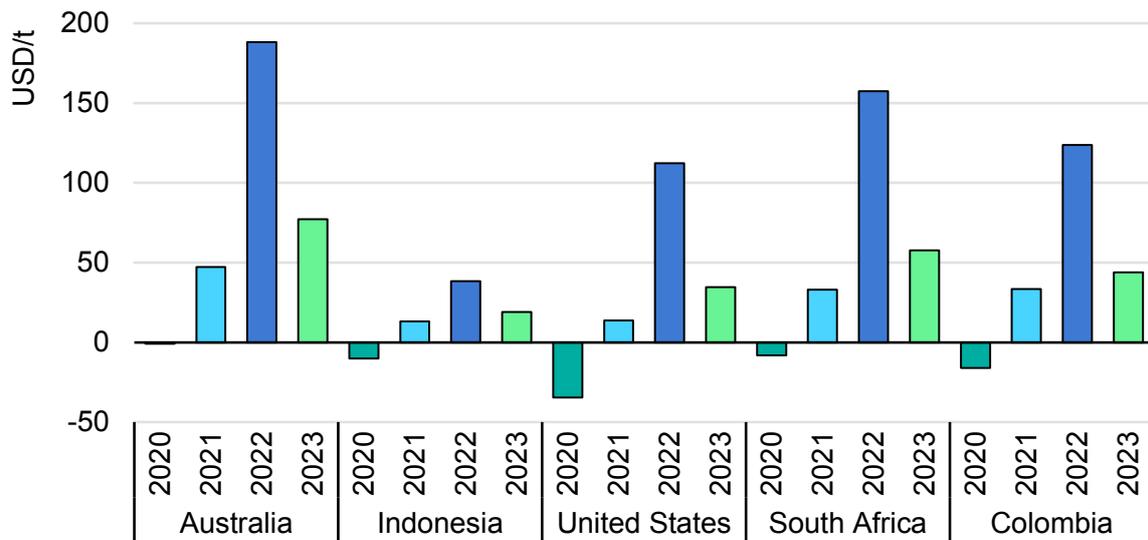
The recent market turmoil has also affected the profitability of coal trade. In 2020, driven by low prices, average profits for high-CV thermal coal trades were negative in most major exporting countries.

During the high-price phase in 2021 and 2022, the profitability of high-CV thermal coal trades rose sharply around the globe. Surging prices outweighed cost increases, which rose mainly due to an increase in royalties and turned high-CV thermal coal trade into a profitable business. In 2022, Australia recorded profit margins of almost 200 USD/t, with average prices levelling at about three times the average costs. Australia and Colombia reached margins of more than twice the costs. Unlike Australia and Indonesia, South Africa and Colombia did not adjust royalties during the high-price phase in 2021 and 2022.

In 2023, driven by the strong price decrease, the average profitability of high-CV thermal coal trades decreased globally but still remained profitable. Margins decreased to values above those seen in 2021, as prices were still well above 2021 levels.

We have excluded Russia from the profitability analysis as precise costs and prices are affected by uncertainty under current wartime circumstances. Nonetheless, it seems that in 2023 some Russian coal miners found themselves on the verge of unprofitability. Additional transport expenses and the export duty that came into effect in October may further weigh on the profitability of Russian coal exports.

### Indicative profitability of high-CV thermal coal trade by country, 2020-2023



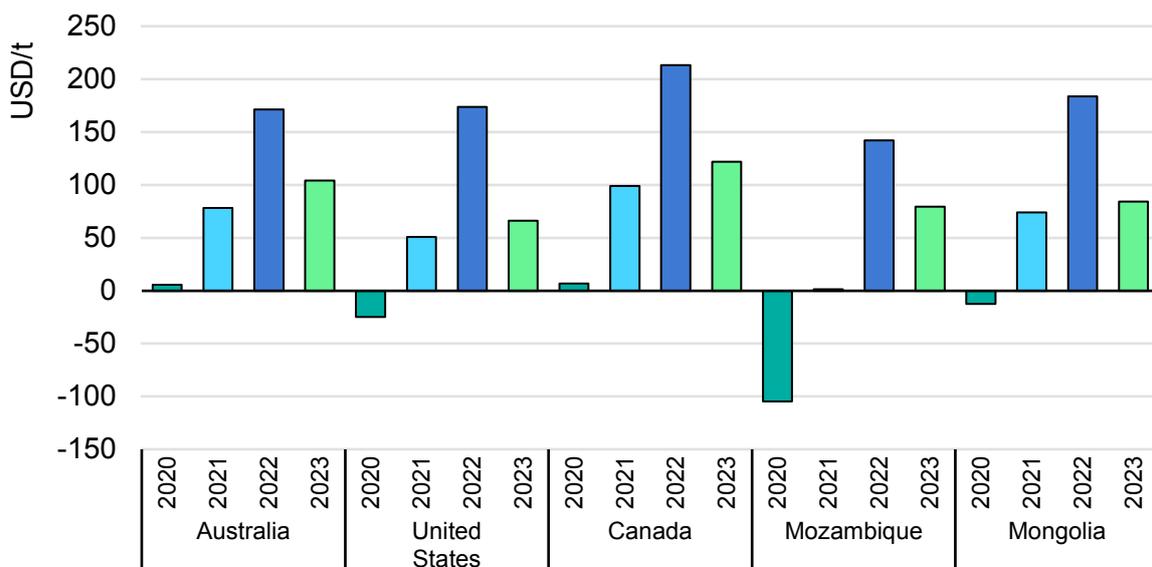
IEA. CC BY 4.0.

Note: The profit margin is defined as the difference between weighted average prices and weighted average costs. Values below zero indicate unprofitability as costs exceed potential profits.

Source: IEA, own calculations based on CRU (2023).

The profitability of hard coking coal exports witnessed similar developments, albeit with some nuances. Compared to thermal coal, profitability decreased less in 2023 as prices and costs decreased at similar rates. In Mozambique, continuous cost decreases between 2020 and 2023, paired with high global prices, made hard coking coal a profitable business with margins of more than 50%.

### Indicative profitability of hard coking coal trade by country, 2020-2023



IEA. CC BY 4.0.

Notes: The profit margin is defined as the difference between weighted average prices and weighted average costs. Values below zero indicate unprofitability as costs exceed potential profits.

Source: IEA, own calculations based on CRU (2023).

The profitability of coal producers contrasted with the difficulties of coal mining contractors, who often suffered from the surge in costs, especially in 2022. The degree to which contractors have been affected by high input prices depends on the specifics of the agreements with the mine operator, and in particular, on the contractor's cost-indexation. Contractors who had no or minor cost-indexed prices, bore the brunt of the cost escalation of input factors.

## Certain countries rely heavily on coal exports for their economies

Examining the proportion of coal export revenues as a percentage of Gross Domestic Product (GDP) highlights the economic role of coal in a selection of major coal-exporting nations. A significant level of coal exports as a proportion of GDP underlines the extent of a country's reliance on coal-related activities, which is all the more important as the imperative to achieve climate neutrality looms large. This analysis provides valuable insights into the unique challenges encountered by countries as they navigate the path toward a sustainable, low-carbon future.

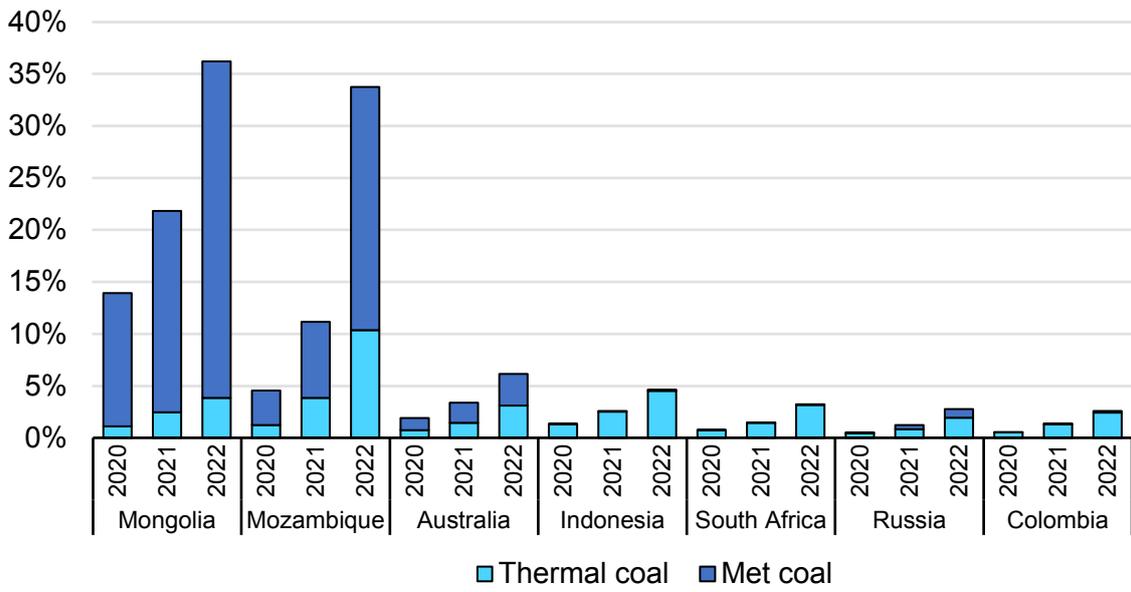
The overall GDP share of coal export revenues varies significantly between the major coal exporting nations and between the years considered. The increases seen from 2020 to 2022 generally follow the development of coal prices, from a low in 2020 due to the Covid-19 pandemic, and then a strongly increase towards 2022 when prices skyrocketed amid the energy crisis. Compared to changes in energy price levels, changes in GDP between 2020 and 2022 were less extreme, with the highest increase in Colombia (up 19%) and the lowest increase in Russia (up 3.4%), according to Oxford Economics. Due to the development of coal prices, the GDP share of coal export revenues on average more than quadrupled across the countries considered from 2020 to 2022.

Comparing major coal exporting countries, most exhibit low single-digit coal export revenues as a share of GDP. This suggests that, on a macroeconomic scale, the significance of the coal trade seems relatively moderate. However, considering the nominal GDP of countries like Indonesia, Australia and Russia, it is essential to underscore the substantial aggregate budget generated by coal exports. These countries amass considerable financial gains from coal exports, thus reinforcing coal's enduring role in their economic landscapes. In Mongolia and Mozambique, coal export revenues represent a markedly higher share of GDP, underlining the profound importance of coal exports for these countries.

A notable difference arises when we consider the different coal grades involved in exports. Thermal coal, as opposed to met coal, appears poised for a more rapid phase-out in the medium to long term. A variety of substitutes in power generation already exist, such as renewables. In contrast, alternatives to met coal, such as

hydrogen in steel production, appear not to be market ready in the short to medium term. In light of these dynamics, coal exporting nations such as Indonesia, South Africa and Colombia, with high shares of thermal coal in their coal exports, may confront significant hurdles in sustaining their long-term coal export endeavours.

**Coal export revenues as a share of GDP by country, 2020-2022**



IEA. CC BY 4.0.

Note: Calculation based on mine-specific exports and realised prices per mine.

Sources: IEA, own calculations based on Oxford Economics (2023) and CRU (2023).

# Coal mining projects: Export

## High cash of producers trigger M&A activity rather than new mining projects

The profitability of coal exports has shown great variability in recent years and thus exemplifies an uncertain investment landscape. The need to comply with ESG standards, as well as political ambitions to phase out coal in several regions, weighs on the attractiveness of new mining projects. Moreover, financing new coal investments is becoming increasingly challenging as banks try to decarbonise their portfolios. Similar developments are occurring in insurance. As insurers are often restricting their cover for the coal industry, especially for new projects, premium prices have been surging significantly, or coverage has even been unavailable. Therefore, some miners have recently launched self-insurance programmes, often backed by the high cash inflows seen in recent years. In Australia, coal companies have recently set up a mutual insurance fund to procure insurance at a reasonable cost. After a two-year period of extremely high margins for producers, following the widely unprofitable year 2020, margins are expected to decrease with falling prices in 2023. Considering the prevailing investment cycles of decades, the high price phase has not lasted long enough to trigger significant additional investment. The investment environment might be further tightened by worldwide inflation and uncertain economic outlooks.

Instead of proposing new mining projects, high profits during 2021 and 2022 drove major players with less ambitious CO<sub>2</sub> targets in the industry to extend their portfolios. Acquisitions of high-profile mining companies indicate there are still investors betting on the future profitability of coal. Sellers, on the contrary, often seek to divest coal assets in view of their ESG targets, pushed by shareholders or the financial sector, resulting in a remarkable number of transactions worldwide and a higher concentration of coal assets under single management. To name a selection of the examples, Czechia-based firm Sev.en Global Investments is acquiring a 51% stake in Coronado Global Resources, which owns mostly met coal mines in Australia and the United States. The deal's volume amounts to USD 1.6 billion and follows the acquisition of the Chain Valley mine for several hundred million dollars in 2022. Bathurst Resource is buying the assets of the Canadian 0.75 Mtpa Tenas met coal project, which is expected to receive environmental approval in 2025. Furthermore, Whitehaven Coal recently announced sale agreements with the BHP Group and Mitsubishi Development Pty Ltd for the Daunia and Blackwater coal mines in Queensland. The deal's volume total about USD 4.1 billion and turns Whitehaven into a company with managed run-of-mine production of 40 Mtpa. Johannesburg-based Thungela has completed

its acquisition of an 85% stake in the Australian Ensham coal mine, which is expected to produce 2.7 Mtpa of high-CV thermal coal. The latest example of M&A activity is Teck Resources, which has announced a deal to sell Elk Valley Resources to a group of companies for USD 9 billion. Elk Valley Resources is Teck's coal arm, and the largest coking coal producer in Canada. Glencore, which paid USD 6.9 billion for 77% of the shares, is leading that group of companies.

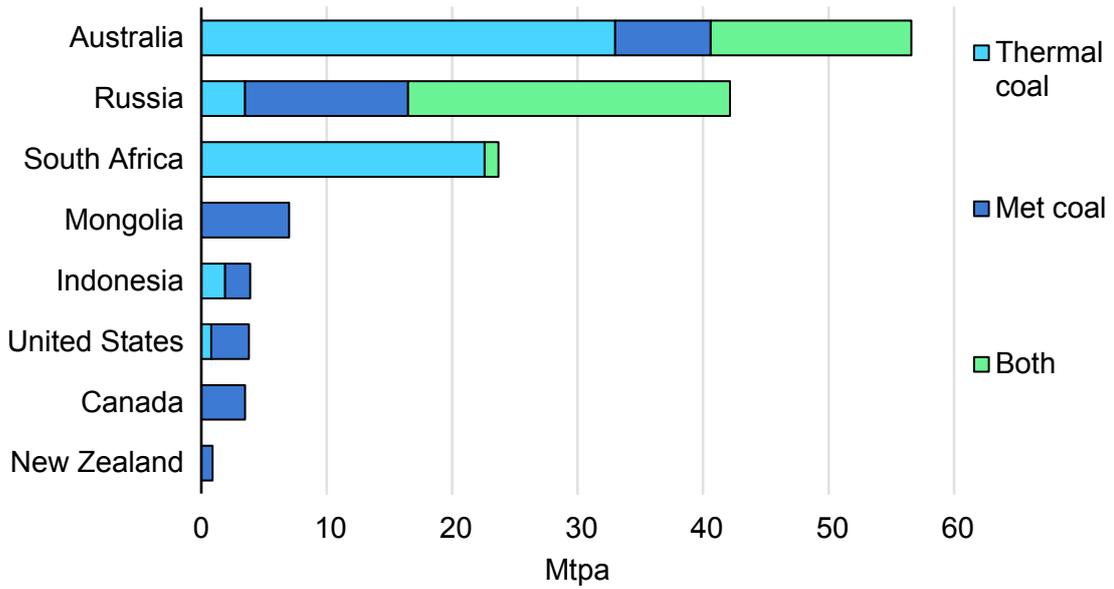
This report monitors new, expanding, and extending coal mining projects dedicated to exports and differentiates between those at more-advanced and less-advanced stages<sup>15</sup>. The current project pipeline amounts to an aggregate capacity of about 456 Mtpa under consideration, with more than two-thirds being less-advanced. However, less-advanced projects have plunged remarkably by about 293 Mtpa compared to our previous analysis. This has come about for three reasons. First, many projects have not seen any progress in years and can be considered shelved. Second, against the background of advancing climate policies, some countries have restricted the progress of coal mining projects or even imposed a ban. Generally, early-stage projects are more endangered by interventions as government influence on these is greater. Lastly, a few projects have also progressed from the less-advanced to the more-advanced stage. The more-advanced projects have gained around 70 Mtpa, now totalling an expected capacity of about 142 Mtpa, with similar shares of thermal coal, met coal and combined coal types. Overall, projects under consideration are mostly located in Australia (61%), followed by Russia (10%) and South Africa (10%). However, some countries such as export-oriented Indonesia lack transparency, and thus the numbers should be interpreted with caution.

Besides the development of new coal mining capacity, there has also been notable advancement in infrastructure investments. Against the backdrop of imposed Western sanctions, Russia is actively expanding its terminal infrastructure in its eastern region, thereby reinforcing its commitment to the Asian market. This strategic move is fuelled by the fracturing of relations with Western countries following its invasion of Ukraine as well as a more general shift of coal markets towards Asia. Meanwhile, Mongolia is also strengthening its ties with the East by constructing two cross-border railways and concurrently planning another link with China.

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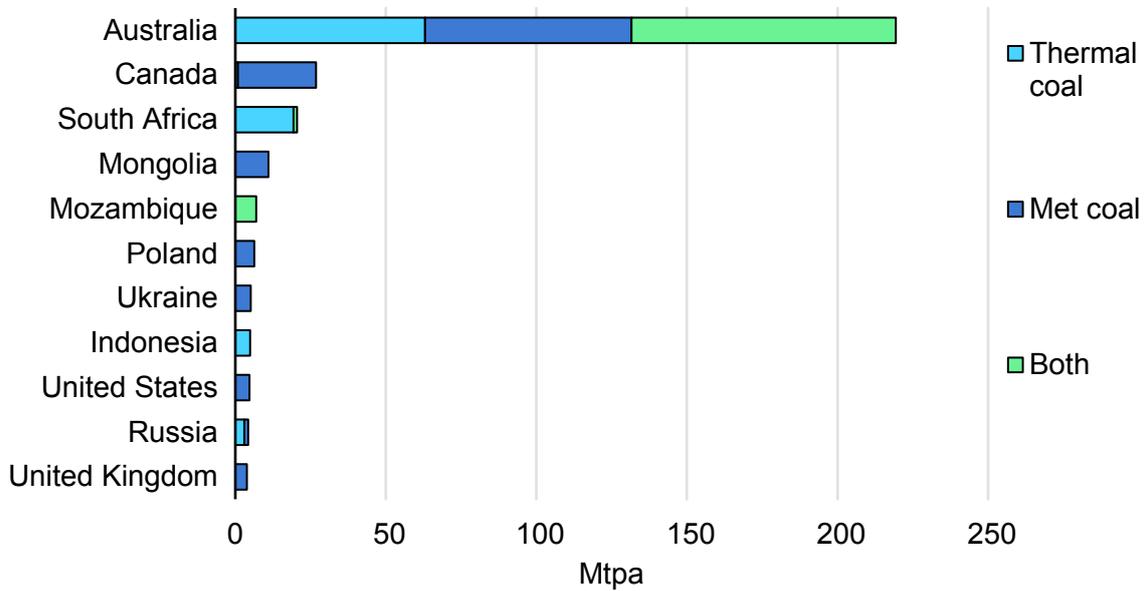
<sup>15</sup> More-advanced projects have been approved and obtained a final investment decision or are under construction, while less-advanced projects are at the feasibility or environmental assessment stage, or are awaiting approval.

### Capacity of more-advanced export coal mining projects



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### Capacity of less-advanced export coal mining projects



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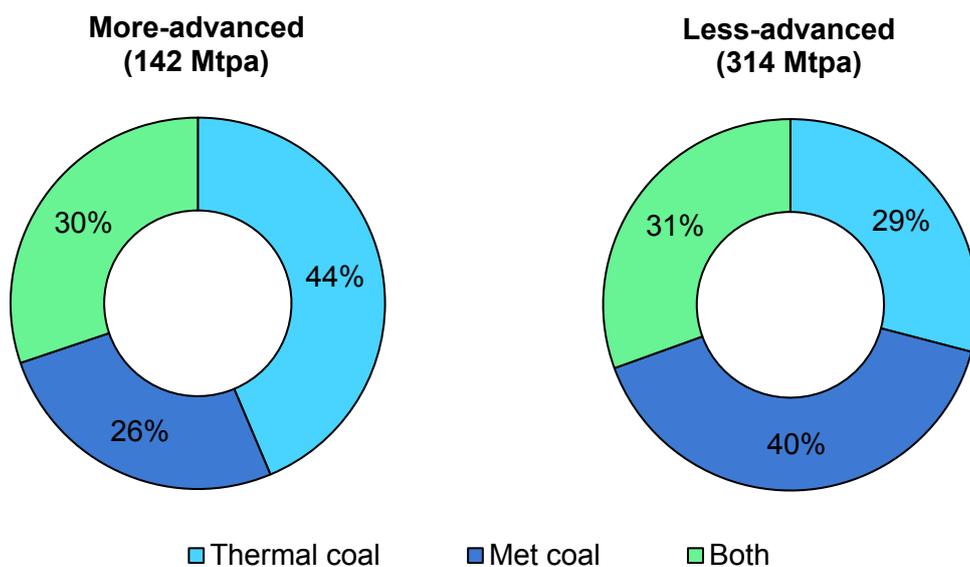
## Met coal projects look more attractive to investors than thermal coal projects

In the short and medium term, steel production from iron ore will continue to be based on met coal, as it does not appear as if alternative inputs such as hydrogen will be market-ready in the coming years. In contrast, substitution of coal is already happening in the thermal coal segment, as renewables in the power sector are on the rise. This is also reflected in a decrease in thermal coal's share of new mining projects. In the last two years, the share of thermal coal in less-advanced coal projects has plunged from half to less than one-third of projects under consideration. Simultaneously, the share of met coal projects at both less- and more-advanced stages has slowly increased.

Currently, the less-advanced project pipeline is almost equally distributed between thermal coal, met coal, and a combination of them. However, climate goals and environmental movements are putting pressure on the development of coal projects. As early-stage projects are more exposed to government policies and alternatives to the use of thermal coal widely exist, the progress of thermal mining projects seems highly uncertain.

Although thermal coal's market share of overall coal exports is about three times the size of met coal, its share of more-advanced projects only stands at 44%. This also underlines investors' preference for met coal or combined coal over pure thermal coal projects. Moreover, recent reorganisations resulting from high levels of M&A activity might further affect corporate strategic decisions and shift the balance between met coal and thermal coal projects.

### Coal grades in hard coal export mining projects



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## Australia still leads the project pipeline, but is recording significant cancellations

In international comparisons, Australia still dominates the market when it comes to new or expanding coal mining projects dedicated to exports. The total number of projects at the less-advanced and more-advanced stage amounts to 51 in Australia, most of them aiming to produce met coal or a mixture of met and thermal coal. Australia's share of new or expanding projects in the pipeline is 61%, but that share should be treated with caution, as the list of projects in Australia is completely transparent, unlike in other geographies. As the development of mining projects usually takes multiple years, few projects changed status from less- to more-advanced between 2022 and 2023. Whitehaven Coal approved investment for the Vickery extension project in April 2023, expanding its production capacity to 10 Mtpa. Stanwell is currently starting ground works at its Meandu King 2 East expansion, which is expected to commence mining in 2024. The 5 Mtpa thermal coal Dartbrook mine is likely to restart operation by end of 2023 or in 2024. Conversely, less-advanced projects plunged from almost 400 Mtpa last year to 219 Mtpa currently, some of them being cancelled or considered shelved. This significant reduction includes Waratah Coal's China Stone Project with an estimated capacity of 40 Mtpa, whose environmental permission has been rejected, and Stanmore Coal's Range Project with 5 Mtpa, as the application has not been updated in three years. Another cancellation is the 2 Mtpa Central Queensland Coal Project (Styx mine), which was rejected due to the unacceptable risk it posed to the Great Barrier Reef. The reduction in less-advanced projects underlines the heightened complexity involved in approving new coal investments in Australia, which is fuelled by environmental concerns.

In 2023, Australian mining companies began operations at a handful of expansion projects, as well as new. Among the new projects is the Maxwell Mine located in the Upper Hunter Valley, with an annual capacity of 3.6 Mtpa. The newly established mines extract both thermal and met coal, whereas the expansions mostly involve met coal. A significant expansion that entered operation is the Carborough Downs project, with an estimated capacity of 5 Mtpa. Furthermore, after 16 years, the 7.5 Mtpa New Acland Stage three expansion was finally able to deliver its first coal in September 2023.

Given robust financial reserves, 2023 witnessed noteworthy M&A developments in the Australian mining sector. Mining entities such as Whitehaven Coal and TerraCom both announced their intentions to embark on the acquisition trail. This strategic shift towards M&A, rather than the initiation of new projects, has its rationale in the growing challenges associated with environmental compliance and regulatory constraints, which pose considerable barriers to project realisation. In addition, difficulties in financing and insuring projects cast a shadow over the

investment environment. Instead of greenfield projects, stakeholders appear to be putting cash aside for tighter market conditions.

## Russian investment follows the coal market's shift towards Asia

As Russia's war against Ukraine has continued, so have European sanctions. In response, Russia has accelerated the expansion of its infrastructure links to the East with the aim of expanding exports to the Asia Pacific region. It has decided to electrify two major routes, on the Baikal-Amur Mainline (BAM) and on the Trans-Siberian Railway, to enable more efficient traffic. These routes have been bottlenecks for Russian exports in the past and can be considered strategically important. Some Russian authorities have even suggested constructing a new railway, BAM-2; however, no investment decision has been made to date. Another new connection, approved in early 2023, is the Mohe-Dzhalinda railway bridge, enabling direct access from the Russian Sakha Republic to China. The bridge will replace the seaborne route via Vladivostok and will mark the beginning of a new corridor, the Mohe-Magadan railway line.

Russia is expanding the infrastructure at its largest coal deposit, the Elga mine in the Sakha Republic, in two ways: during 2023, the second phase of operation at the mine was approved, expanding its capacity from 20 Mtpa to 45 Mtpa. Simultaneously, the construction of a 30 Mtpa coal terminal and railway has begun and is expected to be finished by the end of 2024. This would make the terminal the fifth-largest coal export facility in Russia. Its location in the east at Cap Manorsky underlines Russia's strategic focus on Asia.

Further projects in the East are the 20 Mtpa Sukhodol Terminal in Primorsky Krai, from which the first shipment of coal has departed in November 2023, and the Yenisey coal terminal, which has commenced operation and aims to reach a capacity of 7 Mtpa in 2026. Russian ties with China are also being strengthened with the new rail hub in Hunchun for imported coal. The hub could be in operation in the next two years, handling at least 5 Mtpa.

A-Property's Verkhneteshsky coking coal mine commenced operation in 2022, aiming to produce 1 Mt during 2023; the mine has a total capacity of 5 Mtpa. The mine's location close to the Kiyzassky coal mine allows for the utilisation of existing transport infrastructure serving the Asian market. The uncertainty surrounding coal market development in Russia is reflected in the slow progress of mining projects in the pipeline. The only mine entering the more-advanced stage is Kolmar's Inaglinsky-2 coking coal mine, with a capacity of 8 Mtpa.

## African coal mining projects dedicated to exports shrink

### South Africa

The South African coal sector continues to signal a declining trend in mining capacity, as significant investment and new projects have been lacking for years. An issue associated with new mines concerns the prevalence of polluted lands and waterways in South Africa, as the country already has a few hundred abandoned mines. Against this background, only two projects have entered the more-advanced stage, and one has entered operation. The Arnot thermal coal mine, which historically produced 5 Mtpa, has been reopened and is expected to deliver its first coal soon. Canyon Coal's 1.2 Mtpa Thuso thermal coal mine is currently under construction. The New Largo mine, owned by Seriti, appears to be at more advanced stage as mining operations have commenced; it is currently in the ramp-up phase. The mine's full capacity is stated as 12 Mtpa, partly serving demand from coal-fired power plants and partly serving exports. However, the precise amounts dedicated for export depend on the progress of the Kusile power station, with two additional units yet to be commissioned. Once these units become operational, Kusile will be the fourth-largest coal plant in the world.

The capacity of known less-advanced projects more than halved compared to our previous analysis, down to about 21 Mtpa, indicating a decreasing trend in new South African projects.

### Botswana

In 2022 Botswanan President Mokgweetsi Masisi officially inaugurated a new coal mine at the state-run Morupule Coal Mine (MCM). The mine, with an annual production capacity of 1.4 Mtpa, is poised to augment coal exports from Botswana, primarily to neighbouring countries. The new site boosts MCM's output by 50% to 4.2 Mtpa. In addition, India-based Jindal was reported to have started construction on a new 4.5 Mtpa coal mine in the southeastern Mmamabula coalfields in 2022. The mine is planned to serve the nearby coal plant currently under consideration and the South African market. As the power plant project appears to be making progress, we expect the construction of the mine to have started.

### Mozambique

Investment in coal extraction has stalled in Mozambique, as no project is in the more-advanced stage. Three projects with a combined capacity of more than 40 Mtpa have not progressed in recent years and can be considered shelved. Despite new projects stagnating, a strategically important terminal for Botswanan exports, the Matola Coal Terminal at Matupo Port, is about to increase its capacity

from 7.3 Mtpa to 12 Mtpa. However, in addition to coal, iron oxide and magnetite are also processed at the site.

## Zimbabwe

The only new coal mining project known in Zimbabwe is the Lubu Coking Coal Project owned by Contango Holdings. The mine is currently in the ramp-up phase, producing about 0.24 Mtpa and aiming to produce up to 5 Mtpa in the coming years. The mine will serve the new 0.6 GW coal-fired power plant Hwange, funded by Chinese investors.

## Tanzania

Tanzania increased its mining activity in light of the sustained high prices during the second half of 2022. The country's coal extraction historically served domestic demand and demand from neighbouring countries only. Given the extraordinary market situation in 2022, Tanzanian coal also found its way towards Europe. However, the elevated price level did not trigger new investment in mining projects, and it remains questionable if increased exports will persist while prices follow a downward trajectory in 2023.

## Short project pipelines in the United States, Canada and Europe focus on coking coal

### United States

When making global comparisons, the United States' project pipeline appears to be rather short. Projects under consideration have a combined estimated capacity of about 9 Mtpa, most aimed at producing met coal. The only thermal coal mine, River View Henderson Portal 1, owned by Alliance Coal LLC, recently moved from the less-advanced to the more-advanced stage as construction began in 2023. The 3 Mtpa coking coal mine Longview is expected to have ramped-up operations during the course of 2023, as did Consol Energy's Itmann coking coal mine to its full capacity of 0.9 Mtpa. Supply chain issues and delays in the delivery of equipment caused later than expected start-up at the Itmann mine. Projects with the less-advanced status account for 4.8 Mtpa of coking coal capacity.

In September 2023 the Biden administration decided to invest USD 1.4 billion to improve railway infrastructure. The plan suggests that about half of the amount will be used to enhance freight rail service, potentially increasing the efficiency of coal transport. The planned investment addresses bottlenecks that have caused supply disruptions in recent years.

## Canada

Canada's decision to ban thermal coal exports no later than 2030 is reflected in the tiny thermal coal project pipeline. The only significant thermal coal investment under consideration is Coalspur Mines' Vista Expansion Project, which aims to expand the mines' capacity by 7 Mtpa. Despite statements by Canadian authorities in 2021 that new projects would no longer be approved, the project currently seems to be undergoing an impact assessment. In contrast, the coking coal segment is showing more activity. The aggregate capacity of projects under consideration adds up to about 28 Mtpa, with most projects at the less-advanced stage. The long-mothballed 3 Mtpa Quintette mine has now been purchased from Teck Resources by newcomer Conuma Resources, which plans to restart the mine in late 2023.

Despite the decision to end thermal coal exports, investment in Westshore Terminals in British Columbia has significantly increased. The terminal is of strategic importance, as new terminals in Washington State and Oregon have been rejected due to environmental concerns; therefore, Westshore essentially serves as the sole route for accessing Asian markets via the Pacific Northwest. The terminal recently saw a remarkable uptick in thermal coal exports, almost doubling from around 9 Mt in 2020 to 16 Mt in 2022.

The global M&A trend is also evident in Canada, with Glencore acquiring a 77% share of Elk Valley Resources for USD 6.9 billion (see section above). Another successful acquisition has been performed by Bathurst Resources, purchasing the assets of the 0.75 Mtpa Tenas coking coal project from Telkwa Coal.

## Europe

Due to the commitment to phase out coal-fired power generation, low levels of activity have been recorded in European coal mining projects. However, a mine in Poland is currently attracting public interest. The Turów coal mine, supplying lignite to the nearby Turów power station in Bogatynia, has applied for a lifetime extension from 2026 to 2044. A court ruling suspended the environmental permit in May 2023. Nonetheless, the final decision by the Polish government is yet to be known.

The only new met coal project under consideration exists in the United Kingdom. The 2.5 Mtpa coking coal project at the Woodhouse Colliery was approved in late 2022, after which environmental movements began to challenge the decision. They have taken legal action, and a final decision is currently pending. However, West Cumbria Mining is still planning to start construction in 2024.

## Indonesia and Mongolia exhibit growing export potential, while the government halts new projects in Colombia

### Indonesia

In the turbulent coal market of the past two years, Indonesian mining showed substantial flexibility in reaction to volatile market conditions. However, lacking transparency might complicate the investigation of new mining projects. The total capacity of projects in the pipeline is estimated at 9 Mtpa, which is somewhat low compared to the country's market share. Most of projects under consideration aim to produce thermal coal. One of these projects is IATA's Arthaco Prima Energy project. It is expected to begin commercial operations in 2023 and contribute to achieving IATA's production plans to increase output from 4.2 Mt in 2022 to 7 Mt in 2023. In addition to this, Geo Energy has acquired a majority stake in the TRA mine with coal reserves of almost 300 Mt, owned by Golden Eagle Energy. A loan recently secured by Geo Energy helps fund its expansion plans for TRA, as well as ramping up to the mine's production target of 25 Mtpa. Further details have not been specified.

### Mongolia

Investment in Mongolia indicates a strengthening of ties to China, as railway infrastructure between the countries is gradually expanding. A new 7 kilometre rail link connecting the Mongolian border point Shivee Khuren and the Chinese border point Ceke is under construction and expected to be completed by the end of 2023. The project will enable an increase in Mongolian coking coal exports as it replaces somewhat inefficient transport by truck. Further railway projects are under construction. The border crossing between Gashuunsukhait and Ganqimaodu has been improved with a rail link on the Mongolian side, although a connection on the Chinese side is yet to be completed. The other link is about to connect Khangai in Mongolia with Mandula in China; however, official approval as a cross-border line is still pending.

Regarding new mining investment, around 18 Mtpa of coking coal capacity is currently under consideration in Mongolia. At the more-advanced stage, Aspire Mining's Ovoot coal project with an estimated capacity of 4 Mtpa received regulatory approval at the end of 2022, with further progress in 2023. The largest among the projects is the possible extension of the Tavan Tolgoi complex, where Erdenes Tavan Tolgoi is currently seeking capital to increase coking coal production by 10 Mtpa.

## Colombia

Colombia's president, Gustavo Petro, has issued a set of decrees aimed at protecting the environment in the coal-producing region of La Guajira. These decrees include measures to prevent the establishment of new coal mines, to restrict the life extension of existing mines, and to disallow the physical enlargement of new extraction zones within existing coal projects. The decision effectively prevents the progress of three new thermal coal projects with starting dates between 2024 and 2026: San Juan (16 Mtpa), Canaverales (2.5 Mtpa) and Papayal (2.4 Mtpa), all controlled by Yildirim Holding. The constitutional court made a ruling on the legality of the decrees, which lifts the ban imposed by the decrees calling them unconstitutional. However, the environmental ministry is about to issue another decree that will delimit open pit coal mines, which would lead to another U-turn for Colombian coal projects in the pipeline.

In light of the socio-political upheaval surrounding coal mine activity, Ronin Resources has also postponed its exploration drillings. The company's planned Vetas Thermal Coal Project, located along the Colombia-Venezuela border near La Gabarra, is set to resume exploration when circumstances allow. In the meantime, the company now intends to focus on obtaining an environmental licence and drafting a mining plan.

Finally, the La Francia and El Hatillo thermal coal mine (2 Mtpa) restarted operations at the end of 2022.

# General annex

## Tables

**Table 1: Total coal consumption (Mt), 2022-2026**

Region/country	2022	2023	2026	2021-22	2022-23	CAAGR 2023-2026
<b>Asia Pacific</b>	6639	6971	6967	5.3%	5.0%	0.0%
China	4520	4740	4535	4.6%	4.9%	-1.5%
India	1162	1260	1397	9.1%	8.4%	3.5%
Japan	185	171	157	1.2%	-7.7%	-2.8%
<b>ASEAN</b>	413	444	528	13.2%	7.5%	6.0%
<b>North America</b>	489	392	304	-6.9%	-19.7%	-8.1%
United States	455	360	276	-7.6%	-20.9%	-8.4%
<b>Central and South America</b>	48	38	35	-11.5%	-20.6%	-2.4%
<b>Europe</b>	671	561	456	4.3%	-16.5%	-6.7%
European Union	461	354	278	3.9%	-23.3%	-7.7%
<b>Eurasia</b>	368	378	379	1.0%	2.9%	0.1%
Russia	249	258	250	4.5%	3.3%	-1.0%
<b>Africa</b>	187	183	193	-2.3%	-2.2%	1.8%
<b>Middle East</b>	13	13	8	2.2%	-2.2%	-13.8%
<b>World</b>	<b>8415</b>	<b>8536</b>	<b>8344</b>	<b>4.0%</b>	<b>1.4%</b>	<b>-0.8%</b>

Notes: CAAGR = compound average annual growth rate. Data for 2022 are preliminary; 2023 are estimated; 2024 to 2026 are forecasts.

**Table 2: Thermal coal and lignite consumption (Mt), 2022-2026**

Region/country	2022	2023	2026	2021-22	2022-23	CAAGR 2023-2026
<b>Asia Pacific</b>	5739	6047	6028	6.0%	5.4%	-0.1%
China	3801	4002	3819	5.1%	5.3%	-1.5%
India	1090	1180	1293	9.1%	8.2%	3.1%
Japan	65	66	64	0.6%	1.7%	-0.8%
<b>ASEAN</b>	392	422	445	15.2%	7.7%	5.2%
<b>North America</b>	471	375	288	-6.6%	-20.3%	-8.4%
United States	440	345	263	-7.6%	-21.5%	-8.6%
<b>Central and South America</b>	32	24	20	-15.8%	-26.5%	-4.8%
<b>Europe</b>	604	501	397	5.2%	-17.0%	-7.5%
European Union	404	303	228	4.8%	-24.9%	-9.1%
<b>Eurasia</b>	292	301	300	5.0%	3.1%	-0.1%
Russia	181	188	179	8.2%	3.9%	-1.7%
<b>Africa</b>	182	178	188	-2.8%	-2.4%	1.8%
<b>Middle East</b>	9	9	4	3.2%	-3.1%	-22.4%
<b>World</b>	<b>7329</b>	<b>7435</b>	<b>7226</b>	<b>4.6%</b>	<b>1.4%</b>	<b>-0.9%</b>

Notes: CAAGR = compound average annual growth rate. Data for 2022 are preliminary; 2023 are estimated; 2024 to 2026 are forecasts.

**Table 3: Metallurgical coal consumption (Mt), 2022-2026**

Region/country	2022	2023	2026	2021-22	2022-23	CAAGR 2023-2026
<b>Asia Pacific</b>	900	923	939	1.5%	2.6%	0.6%
China	718	738	716	2.0%	2.7%	-1.0%
India	72	81	104	9.6%	11.6%	8.8%
Japan	43	40	38	-2.4%	-7.6%	-1.3%
<b>ASEAN</b>	21	21	37	-15.0%	3.7%	20.3%
<b>North America</b>	18	17	16	-14.6%	-4.7%	-3.2%
United States	15	14	13	-8.9%	-5.4%	-3.5%
<b>Central and South America</b>	16	14	15	-1.1%	-8.5%	1.4%
<b>Europe</b>	68	60	59	-3.0%	-11.8%	-0.6%
European Union	57	51	50	-2.0%	-11.5%	-0.4%
<b>Eurasia</b>	76	77	80	-11.7%	2.0%	1.0%
Russia	68	70	72	-4.1%	2.0%	0.9%
<b>Africa</b>	5	5	5	22.0%	2.7%	1.2%
<b>Middle East</b>	4	4	4	0.0%	-0.2%	0.7%
<b>World</b>	<b>1086</b>	<b>1101</b>	<b>1118</b>	<b>-0.1%</b>	<b>1.4%</b>	<b>0.5%</b>

Notes: CAAGR = compound average annual growth rate. Data for 2022 are preliminary; 2023 are estimated; 2024 to 2026 are forecasts.

**Table 4: Total coal production (Mt), 2022-2026**

Region/country	2022	2023	2026	2021-22	2022-23	CAAGR 2023-2026
<b>Asia Pacific</b>	6587	6842	6742	9.0%	3.9%	-0.5%
China	4374	4429	4249	8.7%	1.3%	-1.4%
India	922	1027	1183	12.2%	11.4%	4.8%
Australia	443	439	408	-3.7%	-1.0%	-2.4%
Indonesia	687	725	661	20.3%	5.6%	-3.1%
<b>North America</b>	592	539	391	2.5%	-8.9%	-10.1%
United States	539	484	346	3.0%	-10.2%	-10.6%
<b>Central and South America</b>	61	68	55	-3.4%	11.5%	-6.6%
<b>Europe</b>	498	434	358	2.8%	-12.8%	-6.2%
European Union	349	276	221	5.0%	-21.1%	-7.2%
<b>Eurasia</b>	585	606	599	1.6%	3.6%	-0.4%
Russia	444	457	439	0.3%	2.9%	-1.4%
<b>Africa</b>	257	250	246	3.1%	-2.9%	-0.5%
<b>Middle East</b>	2	2	2	-0.4%	0.7%	-0.5%
<b>World</b>	<b>8582</b>	<b>8741</b>	<b>8394</b>	<b>7.3%</b>	<b>1.8%</b>	<b>-1.3%</b>

Notes: CAAGR = compound average annual growth rate. Data for 2022 are preliminary; 2023 are estimated; 2024 to 2026 are forecasts.

**Table 5: Thermal coal and lignite production (Mt), 2022-2026**

Region/country	2022	2023	2026	2021-22	2022-23	CAAGR 2023-2026
<b>Asia Pacific</b>	5735	5974	5859	10.5%	4.2%	-0.6%
China	3723	3780	3600	10.1%	1.5%	-1.6%
India	915	1020	1173	12.2%	11.4%	4.8%
Australia	275	282	250	-5.0%	2.8%	-4.0%
Indonesia	681	719	654	20.5%	5.6%	-3.1%
<b>North America</b>	509	452	309	3.2%	-11.1%	-11.9%
United States	484	428	292	3.5%	-11.6%	-12.0%
<b>Central and South America</b>	55	62	50	-5.1%	13.0%	-7.2%
<b>Europe</b>	484	420	345	3.1%	-13.2%	-6.3%
European Union	336	263	208	5.5%	-21.9%	-7.5%
<b>Eurasia</b>	460	481	475	0.0%	4.5%	-0.4%
Russia	324	336	320	-2.3%	3.8%	-1.7%
<b>Africa</b>	246	238	234	2.6%	-3.1%	-0.6%
<b>Middle East</b>	0	0	0	-0.4%	2.0%	1.8%
<b>World</b>	<b>7489</b>	<b>7628</b>	<b>7272</b>	<b>8.4%</b>	<b>1.9%</b>	<b>-1.6%</b>

Notes: CAAGR = compound average annual growth rate. Data for 2022 are preliminary; 2023 are estimated; 2024 to 2026 are forecasts.

**Table 6: Metallurgical coal production (Mt), 2022-2026**

Region/country	2022	2023	2026	2021-22	2022-23	CAAGR 2023-2026
<b>Asia Pacific</b>	853	868	883	0.0%	1.8%	0.6%
China	651	649	649	1.1%	-0.3%	0.0%
India	6	7	10	1.0%	11.1%	12.9%
Australia	169	156	159	-1.5%	-7.3%	0.5%
Indonesia	6	7	7	1.3%	9.7%	2.6%
<b>North America</b>	83	86	82	-1.6%	4.2%	-1.7%
United States	55	56	54	-1.6%	2.2%	-1.3%
<b>Central and South America</b>	6	6	5	17.8%	-3.2%	-0.2%
<b>Europe</b>	14	14	13	-5.7%	-0.8%	-1.7%
European Union	13	13	13	-6.1%	-0.8%	-1.2%
<b>Eurasia</b>	125	125	124	8.0%	0.3%	-0.3%
Russia	120	121	119	7.8%	0.3%	-0.5%
<b>Africa</b>	12	12	12	14.8%	2.9%	0.8%
<b>Middle East</b>	1	2	1	-0.4%	0.6%	-0.8%
<b>World</b>	<b>1094</b>	<b>1113</b>	<b>1122</b>	<b>0.9%</b>	<b>1.8%</b>	<b>0.3%</b>

Notes: CAAGR = compound average annual growth rate. Data for 2022 are preliminary; 2023 are estimated; 2024 to 2026 are forecasts.

**Table 7: Total coal imports (Mt), 2022-2026**

Region/country	2022	2023	2026	2021-22	2022-23	CAAGR 2023-2026
China	301	451	314	-11.2%	49.9%	-11.4%
India	228	241	230	16.6%	5.8%	-1.6%
Japan	184	171	157	0.2%	-7.2%	-2.8%
Korea	125	120	112	-0.4%	-4.2%	-2.2%
<b>ASEAN</b>	137	150	180	-4.1%	9.9%	6.3%
<b>North America</b>	21	21	20	27.1%	-4.2%	-0.4%
<b>Central and South America</b>	30	28	26	-25.4%	-8.7%	-2.2%
<b>Europe</b>	176	139	110	16.2%	-21.0%	-7.5%
<b>Eurasia</b>	34	32	27	-32.0%	-5.2%	-4.9%
<b>Africa</b>	17	20	20	-6.5%	18.9%	-0.4%
<b>World</b>	<b>1367</b>	<b>1468</b>	<b>1292</b>	<b>-0.5%</b>	<b>7.4%</b>	<b>-4.2%</b>

Notes: CAAGR = compound average annual growth rate. Data for 2022 are preliminary; 2023 are estimated; 2024 to 2026 are forecasts.

**Table 8: Thermal coal and lignite imports (Mt), 2022-2026**

Region/country	2022	2023	2026	2021-22	2022-23	CAAGR 2023-2026
China	237	351	242	-16.6%	48.1%	-11.7%
India	161	163	136	22.0%	1.3%	-5.9%
Japan	140	131	119	0.2%	-6.3%	-3.3%
Korea	91	88	80	1.8%	-3.9%	-3.0%
<b>ASEAN</b>	117	128	144	-1.9%	10.3%	4.0%
<b>North America</b>	16	17	17	37.6%	4.1%	-0.5%
<b>Central and South America</b>	18	17	14	-35.3%	-9.6%	-5.1%
<b>Europe</b>	120	90	61	27.2%	-25.6%	-12.1%
<b>Eurasia</b>	28	27	22	-23.4%	-6.1%	-5.9%
<b>Africa</b>	16	19	19	-8.3%	19.9%	-0.5%
<b>World</b>	<b>1050</b>	<b>1116</b>	<b>938</b>	<b>-0.5%</b>	<b>6.3%</b>	<b>-5.6%</b>

Notes: CAAGR = compound average annual growth rate. Data for 2022 are preliminary; 2023 are estimated; 2024 to 2026 are forecasts.

**Table 9: Metallurgical coal imports (Mt), 2022-2026**

Region/country	2022	2023	2026	2021-22	2022-23	CAAGR 2023-2026
China	64	100	72	16.7%	56.4%	-10.3%
India	66	78	94	5.4%	16.8%	6.5%
Japan	44	40	38	0.3%	-10.0%	-1.3%
Korea	34	32	32	-5.9%	-5.0%	-0.2%
<b>ASEAN</b>	20	22	36	-15.3%	7.9%	18.5%
<b>North America</b>	5	4	4	3.5%	-29.3%	0.1%
<b>Central and South America</b>	12	11	12	-2.1%	-7.4%	2.0%
<b>Europe</b>	56	50	49	-2.1%	-10.9%	-0.3%
<b>Eurasia</b>	5	5	5	-57.5%	0.0%	0.0%
<b>Africa</b>	1	1	1	43.8%	-0.1%	1.6%
<b>World</b>	<b>317</b>	<b>352</b>	<b>354</b>	<b>-0.8%</b>	<b>10.9%</b>	<b>0.2%</b>

Notes: CAAGR = compound average annual growth rate. Data for 2022 are preliminary; 2023 are estimated; 2024 to 2026 are forecasts.

**Table 10: Total coal exports (Mt), 2022-2026**

Region/country	2022	2023	2026	2021-22	2022-23	CAAGR 2023-2026
Australia	344	348	327	-5.7%	1.2%	-2.0%
Indonesia	471	500	394	7.6%	6.2%	-7.6%
United States	77	84	75	-0.4%	9.1%	-3.5%
Canada	36	37	32	14.6%	1.5%	-4.6%
Colombia	56	57	45	1.7%	1.3%	-7.4%
Russia	224	221	206	-7.5%	-1.2%	-2.4%
South Africa	68	70	57	7.3%	2.9%	-6.6%
<b>World</b>	<b>1376</b>	<b>1466</b>	<b>1294</b>	<b>1.0%</b>	<b>6.6%</b>	<b>-4.1%</b>

Notes: CAAGR = compound average annual growth rate. Data for 2022 are preliminary; 2023 are estimated; 2024 to 2026 are forecasts.

**Table 11: Thermal coal and lignite exports (Mt), 2022-2026**

Region/country	2022	2023	2026	2021-22	2022-23	CAAGR 2023-2026
Australia	181	196	172	-6.2%	7.9%	-4.2%
Indonesia	465	494	388	7.7%	6.2%	-7.7%
United States	35	40	32	-4.5%	14.3%	-6.8%
Colombia	54	55	43	0.4%	0.9%	-7.7%
Russia	173	170	158	-9.2%	-2.2%	-2.4%
South Africa	67	69	56	7.7%	3.0%	-6.7%
<b>World</b>	<b>1056</b>	<b>1118</b>	<b>941</b>	<b>1.6%</b>	<b>5.9%</b>	<b>-5.6%</b>

Notes: CAAGR = compound average annual growth rate. Data for 2022 are preliminary; 2023 are estimated; 2024 to 2026 are forecasts.

**Table 12: Metallurgical coal exports (Mt), 2022-2026**

Region/country	2022	2023	2026	2021-22	2022-23	CAAGR 2023-2026
Australia	163	152	155	-5.1%	-6.3%	0.6%
Mongolia	14	48	57	2.0%	242.2%	5.6%
United States	42	44	43	3.2%	4.8%	-0.6%
Canada	28	29	27	7.1%	2.5%	-2.2%
Russia	50	51	48	-1.0%	2.2%	-2.4%
Mozambique	7	7	7	30.0%	2.9%	0.5%
<b>World</b>	<b>320</b>	<b>348</b>	<b>353</b>	<b>-1.0%</b>	<b>8.7%</b>	<b>0.5%</b>

Notes: CAAGR = compound average annual growth rate. Data for 2022 are preliminary; 2023 are estimated; 2024 to 2026 are forecasts.

## Coal mining projects: Export

Country	Project	Company	Type	Earliest start-up	Full capacity (Mtpa)	Resource	Status
Australia	Angus Place West	Centennial Coal	N	2024+	2	TC	LA
Australia	Belview	Stanmore Coal	N	..	2.6	TC, CC, PCI	LA
Australia	Broadmeadows East	Bowen Coking coal	N	..	0.6	CC	MA
Australia	Bulga (Mod 3 & Mod 7)	Glencore	E	2026+	6.6	TC	LA
Australia	Byerwen Coal Project Stage 2	Qcoal/JFE Steel	E	2028+	4	TC, CC	LA
Australia	Carmichael Coal Project Stage 2	Adani	E	..	18	TC	LA
Australia	Caval Ridge Extension		E	2026+	15	CC	LA
Australia	Chain Valley Extension	Delta Coal	E	2023+	2	TC	MA
Australia	Bengalla mine	New Hope	E	..	3.4	TC	MA
Australia	Comet Ridge	Springsure Creek Coal	N	2028+	0.4	TC, CC	LA
Australia	Colton		N	2024+	0.5	CC	LA
Australia	Cooroorah	Bowen cokin coal	N	..	..	CC, PCI	LA
Australia	Curragh Extension	Coronado Global	E	2023	3	TC, CC	MA
Australia	Dartbrook	Australian Pacific Coal	R	2023	5	TC	MA
Australia	Dysart East	Bengal Energy	N	2025	1.2	CC	LA
Australia	Ensham Life of Mine Extension Project		E	2028	4.5	TC	LA
Australia	Gemini Coal Mine	Magnetic South	N	2025+	1.9	CC	LA
Australia	Gorman North Coal Project	Whitehaven Coal	N	..	..	TC	LA
Australia	Grosvenor Phase 2	Anglo American	E	2026+	6	TC, CC	LA
Australia	Hillalong	Shandong Energy Group	N	2023+	4.2	TC, CC	MA
Australia	Hunter Valley Operations Continuations Project	Yancoal / Glencore	E	2025+	42	TC, CC	LA
Australia	Integra UG	Glencore	E	2024+	4.5	TC, CC	LA
Australia	Ironbark No. 1 (Ellensfield)	Fitzroy Australia Resources	N	2023+	2.7	TC, CC	MA
Australia	Isaac River	Bowen Coking Coal	N	2024	0.6	TC, CC	MA
Australia	Isaac Plains Complex - Underground extension	Stanmore Coal	E	2028	1.2	TC, CC	LA
Australia	Kevin's Corner	GVK	N	2028+	10.6	TC	LA
Australia	Lake Vermont Meadowbrook Project	Lake Vermont Joint Venture	E	2027+	5.5	CC	LA
Australia	Mangoola Coal Continued Operations Project	Glencore	E	2025	5	TC	MA

Country	Project	Company	Type	Earliest start-up	Full capacity (Mtpa)	Resource	Status
Australia	Mavis Downs - Millenium	MetRes	E	2025+	1.2	CC, PCI	LA
Australia	Meandu King 2 East Project	Stanwell	E	2024	5	TC	MA
Australia	Moorlands	Cuesta Coal	N	2027+	1.9	TC	LA
Australia	Moranbah South	Anglo American / Exxaro	N	2025+	18	CC	LA
Australia	Mount Owen (Glendell Mine) Continued Operations Project	Glencore	E	2025+	7	TC, CC	LA
Australia	Mt Pleasant Optimisation Project	MACH Energy Australia	E	2026+	10.5	TC	LA
Australia	Narrabri Stage 3	Whitehaven Coal	E	2026+	9	TC	MA
Australia	Newstan Mine Extension Project	Centennial Coal	E	2027+	1.6	TC, CC	LA
Australia	New Wilkie	New Wilkie Energy	N	2024	2.4	TC	MA
Australia	Olive Downs South	Pembroke Resources	N	2023	6	CC	MA
Australia	Olive Downs South Stage 2	Pembroke Resources	E	2027+	9	CC	LA
Australia	Rolleston Expansion Project	Glencore	E	2026+	5	TC	LA
Australia	Russell Vale Underground Expansion Revised Project	Wollongong Coal	E	2025+	1	CC	MA
Australia	Saraji East	BHP Billiton / Mitsubishi Alliance	N	2025	7	CC	LA
Australia	Spur Hill Underground Coal Project	Malabar Coal	N	2026+	6	TC, CC	LA
Australia	Stratford extension	Yancoal Australia	E	2023	1.2	TC	MA
Australia	Vickery Extension Project	Whitehaven	N	2025	5.5	TC, CC	MA
Australia	Wallaharah 2 Coal Project	Korea Resources Corp	N	2027+	4	TC	LA
Australia	Walton	Aquila Resources	N	2025+	1.6	PCI	LA
Australia	Wards Well	BHP Billiton / Mitsubishi Alliance	N	2028	5	CC	LA
Australia	Washpool	Aquila Resources	N	2025	2.6	CC	LA
Australia	Willunga/Vermont East	Pembroke Resources	E	2028	4	TC, CC, PCI	LA
Australia	Winchester South	Whitehaven Coal	N	2027+	8.5	TC, CC	LA
Botswana	Boomslang Project	Tlou Energy	N	..	..	TC	LA
Canada	Crown Mountain	Jameson Resources	N	2025	1.9	CC, PCI	LA
Canada	Elko	Pacific American Coal	N	..	1.25	CC	LA
Canada	Fording River Extension Project	Teck Coal	E	2027	10	CC	LA
Canada	Chinook	Montem Resources	N	..	..	CC	LA

Country	Project	Company	Type	Earliest start-up	Full capacity (Mtpa)	Resource	Status
Canada	Grande Cache	CST	N		1.7	CC	LA
Canada	Summit Mine 14	Summit Coal Inc.	N	2024	1.3	CC	LA
Canada	Groundhog	Atrum Coal	N	..	0.9	TC	LA
Canada	Murray River	HD Mining	N	..	6	CC	LA
Canada	Michel Coal Project	North Coal	N	2026	2	CC	LA
Canada	Quintette	Conuma resources, earlier Teck Resources	N	2023	3.5	CC	MA
Canada	Tenas	Allegiance Coal / Itochu	N	2026	0.75	CC	LA
Canada	Wolverine-Hermann Amendment Project	Conuma Coal Resources Ltd.	N	2022	1	CC	LA
Indonesia	Adaro MetCoal Companies (AMC) Concessions	Adaro	N	..	..	CC	LA
Indonesia	Arthaco Prima Energi	IATA	N	2023	1.9	TC	MA
Indonesia	Bukit Enim Energi	Adaro	N	..	..	TC	LA
Indonesia	Tambang Benua Alam Raya (TBAR) project	Cokal	N	2024	2	CC, PCI	MA
Indonesia	Tekno Orbit Persada	MEC Coal	N	..	5	TC	LA
Mongolia	Nuurstei Coking Project	Aspire Mining	N	..	1	CC	LA
Mongolia	Ovoot	Aspire Mining	N	2021	4	CC	MA
Mongolia	Shinejinst	Saker Resources	N	2021	3	CC	MA
Mongolia	Tavan Tolgoi Extension	Erdenes Tavan Tolgoi	E	2026+	10	CC	LA
Mozambique	Revuboe	Talbot Group, Nippon Steel and POSCO	N	..	7	TC, CC	LA
New Zealand	Escarpment	Bathurst Resources	R	..	0.9	CC	MA
Poland	Jan Karski Project	Prairie Mining	N	..	6.3	CC	LA
Russia	Amaam North Project F coal mine	Tigers Realm Coal Limited	N	2023	0.65	TC, CC	MA
Russia	Chernogorsky	SUEK	E	2024	3.5	TC	MA
Russia	Elga Expansion	A-Property	E	2023	25	TC, CC	MA
Russia	Inaglinsky-2	Kolmar	E	..	8	CC	MA
Russia	Pravoberezhny	SUEK	E	2025	3	TC	LA
Russia	West-Taymyr Industrial Cluster	AEON	N	2023	5	CC	MA
Russia	Tikhova Stage 2	Industrial Metallurgical Holding	E	2026	1.3	CC	LA
South Africa	Arnot coal mine	Wescoal/Arnot Opco	E	2023	5	TC	MA
South Africa	Argent Colliery	Glencore/Shanduka	N	..	1.2	TC	LA

Country	Project	Company	Type	Earliest start-up	Full capacity (Mtpa)	Resource	Status
South Africa	Umzila coal mine	Canyon Coal	N	2023	3.6	TC	MA
South Africa	Eloff coal project	Universal Coal	E	..	2.4	TC	MA
South Africa	Gila coal mine	Canyon Coal	N	..	1.8	TC	LA
South Africa	Gugulethu coal mine	Canyon Coal	N	2023	3.6	TC	MA
South Africa	Khwezela extension	Thungela Resources Limited	E	2030	4.6	TC	LA
South Africa	Koornfontein OC	Black Royalty Minerals	E	..	3	TC	LA
South Africa	Makhado Phase 1	MC Mining	N	2023	1.1	TC, CC	MA
South Africa	Makhado Phase 2	MC Mining	E	2026	1.2	TC, CC	LA
South Africa	Ukwenama coal mine	Canyon Coal	N	..	0.6	TC	LA
South Africa	Weltevreden coal project	Seriti	E	..	8	TC	MA
South Africa	Sukuma coal mine	Canyon Coal	N	2025	7	TC	LA
South Africa	Thuso coal project	Canyon Coal	N	2024	1.2	TC	LA
Ukraine	Lubel	Lubel Coal Company	N	..	5.2	CC	LA
United Kingdom	Lochinvar	New Age Exploration	N	2025	1.4	CC	LA
United Kingdom	Woodhouse Colliery	West Cumbria Mining	N	2025	2.5	CC	LA
United States	Blue Creek No. 1	Warrior Met Coal	E	2025	4.3	CC	LA
United States	Longview	North Central Resources, LLC	N	2023	3	CC	MA
United States	RAM Mine	Ramaco Resources, Inc.	N	2025	0.5	CC	LA
United States	River View Henderson Portal 1	Alliance Coal LLC	N	2024	0.8	TC	MA

Notes: N = New project. E = Expansion. R = Reopening. TC = Thermal coal. CC = Coking Coal. PCI = Pulverised coal.

## Definitions

**Coal:** A solid, combustible fossil sedimentary rock. Coal comes from buried vegetation transformed by the action of strong pressure and high temperatures over millions of years.

**Coal rank:** The degree of transformation from the original plant source. It is loosely related to the age of the coal and is mainly determined from random reflectance of the vitrinite, one of coal's organic components. The ranks of coal, in decreasing order of transformation from high to low, are: anthracite, bituminous coal, sub-bituminous coal, lignite and peat. This report distinguishes between hard coal (anthracite, bituminous and sub-bituminous coal) and lignite, while peat is not considered.

**Coal classification:** Refers to a range of coal age, composition and other properties. Many classifications are used around the world with the main parameter being the coal rank, supplemented by its intended use, i.e. thermal or metallurgical applications.

**Coal quality:** Represents a variety of properties exhibited by coal when it is used. Calorific value and impurity content are the main parameters defining the quality of thermal coal, whereas caking properties, resistance and impurity content are the distinguishing characteristics for coking coal.

**Thermal (or steam) coal:** Refers to hard coal used for purposes other than metallurgy in this report.

**Coking coal:** High-quality coal to produce coke used in blast furnaces to make pig iron. Coking coal and metallurgical coal are terms sometimes used interchangeably.

**Semi-soft coal:** High-quality steam coal mixed with coking coal to produce coke for blast furnaces.

**Pulverised coal injection (PCI) coal:** A high-quality steam coal injected into a blast furnace to reduce coke consumption.

**Metallurgical coal:** Refers to coking coal, semi-soft coal and pulverised coal Injection coal in this report. Although anthracite is often used for metallurgical purposes, it is classified as thermal coal in this report.

**Run-of-mine coal:** Raw coal as it is mined before any processing.

**Tonne of coal equivalent (tce):** A unit of energy widely used in the international coal industry. It is defined as 7 million kilocalories (kcal). Therefore, the relationship between tce and physical tonnes depends on the net calorific value of

the coal. One tonne of coal with a net calorific value of 7 000 kcal per kilogramme (kcal/kg) represents 1 tce.

**Coal mining:** A technique used to remove coal from a natural deposit. Coal deposits in the Earth's crust occur at various depths and seam configurations, which determine the mining method used. Generally, deep deposits are mined underground and shallow deposits are exploited through opencast mines. The strip ratio largely determines whether an opencast mine is profitable or not.

**Strip ratio:** The overburden or waste material removed, usually expressed as cubic metres per tonne of coal extracted. High strip ratios make opencast mining unprofitable.

**Opencast mining:** A method in which the overburden is first drilled, then blasted, and when the deposit is accessible, coal is removed in a similar way to the overburden. To remove the coal, power shovels, conveyor belts and trucks may be used, as well as some extremely large machinery such as draglines and bucket wheels. Opencast mining is usually less labour-intensive than underground mining, but has higher consumable costs, e.g. for tyres, diesel and explosives. Generally, opencast methods imply greater environmental impact than underground mining.

**Underground mining:** A method in which access to coal seams is gained through underground shafts, galleries and tunnels. Although there are many ways to mine an underground deposit, coal is usually stripped by automatic shearers or continuous mechanical miners using either short/long walls or room-and-pillar exploitations. Underground mining is generally more labour-intensive and requires higher capital investments than opencast mining.

**Coal washing/upgrading:** A process in which impurities (i.e. ash, moisture) are partially removed from raw coal to produce a higher-quality coal.

## Regional groupings

**Africa:** Algeria, Angola, Benin, Botswana, Cameroon, Republic of the Congo (Congo), Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Eritrea, Ethiopia, Gabon, Ghana, Kenya, Libya, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Senegal, South Africa, South Sudan, Sudan, United Republic of Tanzania (Tanzania), Togo, Tunisia, Zambia, Zimbabwe and other African countries and territories.

**Asia Pacific:** ASEAN regional grouping and Australia, Bangladesh, the People's Republic of China and Hong Kong (China), Chinese Taipei, India, Japan, Korea, Democratic People's Republic of Korea (North Korea), Mongolia, Nepal, New Zealand, Pakistan, Sri Lanka, and other Asian countries and territories.

**Central and South America:** Argentina, Plurinational State of Bolivia (Bolivia), Brazil, Chile, Colombia, Costa Rica, Cuba, Curaçao, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, Suriname, Trinidad and Tobago, Uruguay, Bolivarian Republic of Venezuela (Venezuela), and other Central and South American countries and territories.

**China:** The People's Republic of China and Hong Kong.

**Eurasia:** Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Russian Federation (Russia), Tajikistan, Turkmenistan, Ukraine and Uzbekistan.

**Europe:** European Union regional grouping and Albania, Bosnia and Herzegovina, Iceland, Gibraltar, Kosovo, Montenegro, Norway, Republic of North Macedonia, Serbia, Switzerland, Republic of Türkiye and the United Kingdom.

**European Union (EU):** Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden.

**Middle East:** Bahrain, Islamic Republic of Iran (Iran), Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic (Syria), the United Arab Emirates and Yemen.

**North America:** Canada, Mexico and United States.

**ASEAN:** Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic (Lao PDR), Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam.

## Abbreviations

API	Argus/McCloskey's Coal Price Index
ARA	Amsterdam, Rotterdam and Antwerp
ASEAN	Association of Southeast Asian Nations
BAM	Baikal-Amur Mainline
CCGT	combined-cycle gas turbine
CCS	carbon capture and storage
CFR	cost and freight
CIF	cost, insurance and freight
CIL	Coal India Ltd
CPEC	China-Pakistan Economic Corridor
CTX	coal-to-chemicals
CV	calorific value
EIA	Energy Information Administration (United States)
ESG	environmental, social, and governance
EUA	EU Allowance
FeNi	ferronickel
FOB	free on board
GDP	gross domestic product
HPAL	high-pressure acid leach
IEA	International Energy Agency
JETP	Just Energy Transition Package
M&A	mergers and acquisitions
MDO	Mine Developer cum Operator
met	metallurgical
MHP	mixed hydroxide precipitate
MSP	mixed sulphide precipitate
OECD	Organisation for Economic Co-operation and Development
PCI	pulverised coal injection
PRC	peak rated capacity
PV	photovoltaic
RKEF	rotary kiln-electric furnace
SCCL	Singareni Collieries Company Ltd
SNG	synthetic natural gas
TTF	Title Transfer Facility (Netherlands)
VAT	value-added tax
y-o-y	year-on-year

## Units of measure

Bt	billion tonnes
GW	gigawatt
kcal	kilocalorie
kg	kilogramme
km	kilometre
kt	kilotonne
kW	kilowatt
Mt	million tonnes
Mtpa	million tonnes per annum
MW	megawatt
MWh	megawatt hour
t	tonne
TW	terawatt
TWh	terawatt hours

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