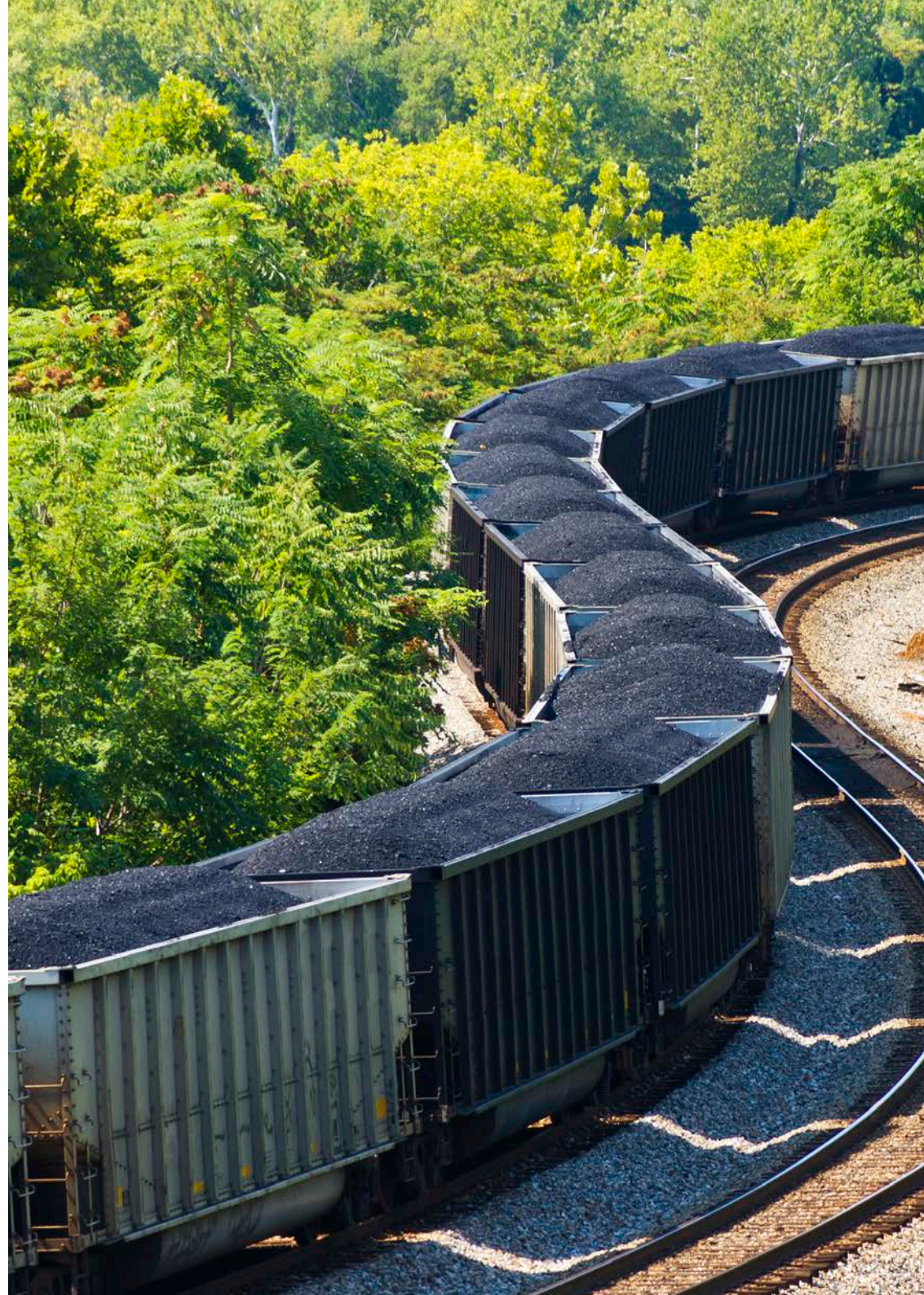


Coal 2022

Analysis and forecast to 2025



INTERNATIONAL ENERGY AGENCY

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Abstract

Coal sits in the centre of climate and energy discussions because it is the largest energy source globally for electricity generation and for the production of iron and steel and of cement, as well as the largest single source of carbon dioxide (CO₂) emissions. The current energy crisis has forced some countries to increase their reliance on coal in spite of climate and energy targets.

Coal 2022 offers a thorough analysis of recent trends in coal demand, supply, trade, costs and prices against a backdrop of rising concern about energy security and geopolitical tensions. It also provides forecasts to 2025 for demand, supply and trade – by region and by coal grade. The report contains a deep analysis of China, whose influence on the coal market is unparalleled by any other country and in any other fuel.

The IEA's *Coal Market Report* has been published every December since 2011, becoming the global benchmark for coal demand, supply and trade forecasts. It is essential reading for anyone with an interest in climate and energy.

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Executive summary

Executive Summary

Global coal demand is set to rise in 2022 amid the upheaval of the energy crisis

Coal markets have been shaken severely in 2022, with traditional trade flows disrupted, prices soaring and demand set to grow by 1.2%, reaching an all-time high and surpassing 8 billion tonnes for the first time. In last year's annual market report, *Coal 2021*, we said that global coal demand might well reach a new peak in 2022 or 2023 before plateauing thereafter. Despite the global energy crisis, our overall outlook remains unchanged this year, as various factors are offsetting each other. Russia's invasion of Ukraine has sharply altered the dynamics of coal trade, price levels, and supply and demand patterns in 2022.

Fossil fuel prices have risen substantially in 2022, with natural gas showing the sharpest increase. This has prompted a wave of fuel switching away from gas, pushing up demand for more price-competitive options, including coal in some regions. Nonetheless, higher coal prices, strong deployment of renewables and energy efficiency, and weakening global economic growth are tempering the increase in overall coal demand this year. In China, which accounts for 53% of global coal consumption, prolonged and stringent Covid-19 lockdowns have weighed heavily on economic activity, undermining coal demand. At the same time, droughts and heat waves in China this summer accelerated coal burning to meet a surge in power demand for air conditioning.

Coal used in electricity generation, the largest consuming sector, is expected to grow by just over 2% in 2022. By contrast, coal consumption in industry is expected to decline by over 1%, mainly driven by falling iron and steel production amid the economic crisis.

Global coal power generation rises to record levels

In 2022, high natural gas prices led to significant fuel switching to coal in electricity generation in Europe, although both gas and coal generation increased as the growth of wind and solar was insufficient to fully offset lower hydro and nuclear power output. In China, low hydropower output in the summer amid a big heat wave pushed coal power generation significantly higher. In August, coal power generation in China increased by around 15% year-on-year to over 500 terawatt-hours (TWh). This monthly level of generation is higher than the total annual coal power generation of any other country, except India and the United States. In India and China, where coal is the backbone of electricity systems and gas accounts for just a fraction of power generation, the impact of steeper gas prices on coal demand has been limited. Nevertheless, increased coal use in these countries has replaced some gas, which has been purchased by other regions willing to pay more for it. Coal power generation will rise to a new record in 2022, surpassing its 2021

levels. This is driven by robust coal power growth in India and the European Union (EU) and by small increases in China – and it comes despite a decline in the United States.

Europe's U-turn on coal is temporary

Europe – and the European Union in particular – has been one of the regions hardest hit by the energy crisis, given its reliance on Russian pipeline supplies of natural gas. Lower hydro and nuclear power output due to weather conditions, combined with technical problems in French nuclear power plants, put additional strains on the European electricity system. In response, some European countries have increased their use of coal power generation while also accelerating the deployment of renewables and, in some cases, extending the lifetimes of nuclear plants.

Under the threat of gas shortages and potential issues ensuring sufficient power system adequacy, some coal plants that had closed down or been left in reserve have re-entered the market. In most countries, this involved a limited amount of coal power capacity. Only in Germany, with 10 gigawatts (GW), is the reversal at a significant scale. This has increased coal power generation in the European Union, which is expected to remain at these higher levels for some time. But redoubled efforts to improve energy efficiency and expand renewables will see EU coal generation and demand return to a downward trajectory as soon as 2024 in our forecast.

Global coal demand is set to plateau through 2025, but much depends on developments in China

In our forecast, global coal demand plateaus around the 2022 level of 8 billion tonnes through 2025. However, given the current energy crisis with all its uncertainties, a lurch into growth or contraction is possible. This could be driven by changes in global economic activity, weather conditions, fuel prices or government policies – among many other potential variables.

Developments in China may well have the largest impact on the outlook for global coal demand, since China accounts for more than half of it. China's power sector alone accounts for one-third of global coal consumption. Coal consumption in China grew strongly in 2021, but growth is expected to remain relatively stagnant at an average of 0.7% a year to 2025, largely because of the increase in renewable power generation. In the 2022-2025 period, we expect China's renewable power generation to increase by almost 1 000 TWh, equivalent to the total power generation of Japan today. Meanwhile, India's coal consumption has doubled since 2007 at an annual growth rate of 6% – and it is set to continue to be the growth engine of global coal demand.

By contrast, coal use is forecast to maintain its downward trajectory in the United States, and to fall considerably in the European Union by 2025. At a global level, we expect new renewable generation to cover almost 90% of additional electricity demand through 2025. With a modest increase in nuclear power generation and high gas

prices prevailing, coal power generation increases slightly to 2025. Therefore, in the absence of low-emissions alternatives that can replace coal at scale in the iron and steel sector in the near term, global coal demand is set to remain flat through our forecast period.

An all-time high for coal production in 2022

China and India, the world's largest coal consumers, are also the biggest producers and, in addition, the top two coal importers. In response to price rises and supply shortages, China and, to a lesser extent, India, pushed up domestic coal production after summer 2021. In March 2022, Chinese production reached a new monthly high and it is set to rise to a new annual record, with expected growth of 8% for the full year, reducing the need for imports and replenishing stocks. In India, the government has tried to increase production for a long time to reduce imports. In 2021, coal production reached 800 million tonnes for the first time. In our forecast, India's production surpasses 1 billion tonnes by 2025. Indonesia, the world's third-largest producer, is also expected to expand production to reach a new high in 2022, with exports playing a more important role than domestic demand. With minor growth in the United States and even in Europe, global coal production will rise above 8 billion tonnes in 2022, its highest level ever.

International coal trade is reshuffling as a result of Russia sanctions

Russia's invasion of Ukraine has triggered a series of bans and sanctions on Russia by many countries and companies. Russia is

the third largest coal exporter in the world and the sanctions have as a result given rise to a reshuffling of global trade flows as buyers, especially in Europe, seek alternative supplies. In addition, owing to the lack of rail capacity, part of the Russian coal volumes previously sent by rail to Europe or shipped from northwestern Russian ports towards Europe cannot be redirected to the east or the south. This has resulted in a decline of Russian exports and a tightening of the market. The gap left by Russian coal supplies in Europe has been largely filled by South Africa, Colombia and other smaller producers such as Tanzania and Botswana. Indonesia, which started the year banning coal exports in order to meet its own domestic demand, once again demonstrated its flexibility as it shifted its exports to Europe to help offset the Russian shortfall. By contrast, the United States is not a swing supplier anymore. Struggling with investment, workforce shortages and transport bottlenecks, US coal exports are set to decline marginally despite high prices. Meanwhile, rains and floods in Australia have curtailed production, contributing to the tight market.

Tight markets and war premium propelled coal prices to record levels in 2022

Supply and demand imbalances combined with high gas prices pushed thermal coal prices to unprecedented highs in October 2021. Almost immediately, China and India accelerated production in order to ease the market, and prices soon fell back to lower levels. When Indonesia banned exports in January 2022, international prices rose again while Chinese prices remained more

stable, as the local market was well supplied. Russia's invasion of Ukraine in late February, however, sparked a surge in gas prices, which in turn pushed coal prices up to new records in March and during the summer. Further support for prices came from a war premium and an increasing perception of a risk of physical energy shortages. Prices have moderated since the summer as supply worries have eased. Rains in Australia further exacerbated market tightness during the year, exceptionally pushing prices for high-quality thermal coal above those for high-value coking coal. With the EU ban on Russian coal phased in from April to early August, prices for Russian coal have been sharply discounted.

Despite record profits for producers, there is little appetite for more investment in coal mining assets

The record highs for coal prices seen since October 2021 and a renewed focus on energy security since Russia's invasion of Ukraine might have been expected to drive an uptick in investment in coal mine assets. However, outside China and India, where domestic production has been ramped up to reduce external reliance, there are no strong signs of reversal of the investment trends. Governments, banks and investors – as well as mining companies – continue to show, in general, a lack of appetite for investment in coal, particularly thermal coal.

Demand

Global coal demand breaches 8 billion tonnes threshold despite slow growth in 2022

Global coal consumption rebounded by a strong 6% to 7 929 million tonnes (Mt) in 2021, after a sharp decline the previous year due to the onset of the Covid-19 pandemic. A robust economic recovery, especially in countries that rely heavily on coal, such as the People's Republic of China (hereafter "China") and India, while higher natural gas prices prompted a wave of fuel switching to coal, with power generation up 8% to 5 344 Mt. Increased industrial activity boosted coal use for non-power applications by 2.2% to 2 585 Mt.

China is by far the largest coal-consuming country, accounting for 53% of global demand. Overall, China's coal consumption increased by 4.6% to 4 232 Mt in 2021, with the strongest growth in the first half of the year before slowing in the second half.

Coal demand in India, the second-largest consumer, increased by an even sharper 14%, or 128 Mt, in 2021. Other countries reporting significant gains were the United States (+15%/+66 Mt), Germany (+19%/+26 Mt) and Poland (+12%/+13 Mt). Only a few countries recorded declines last year, with South Africa posting the largest fall at -5% (-9 Mt).

By contrast, global demand growth for coal is expected to slow markedly in 2022, rising by just 1.2% but still reaching a new record of 8 025 Mt, slightly above the 2013 level (7 997 Mt). The lower growth largely reflects the weaker global economy, with GDP

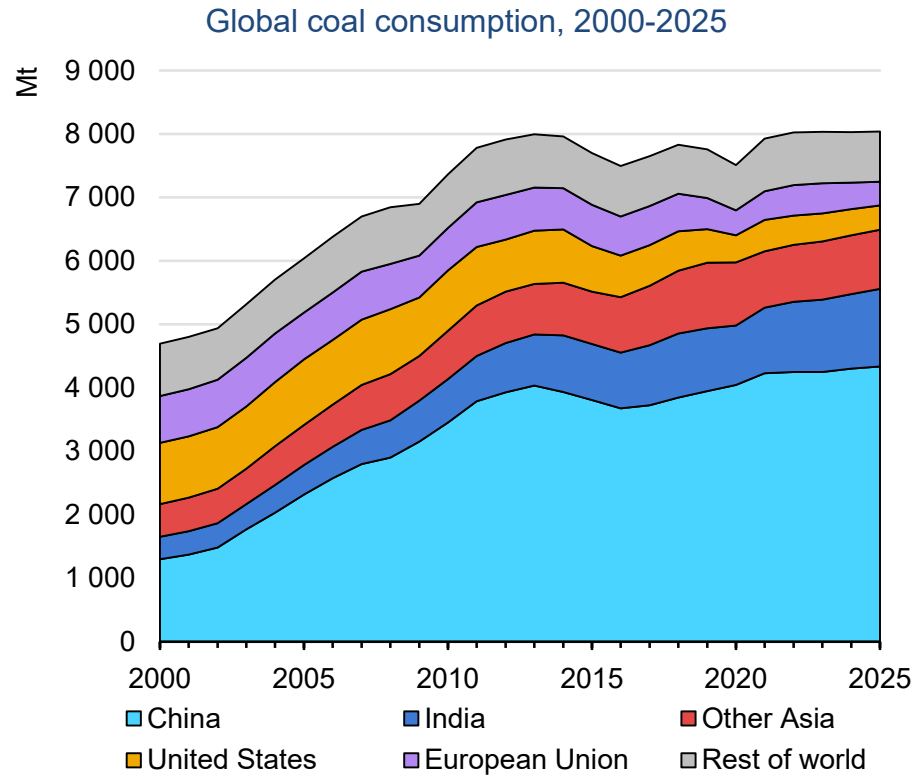
forecast to average 3.2% in 2022 as it struggles with the energy crisis, rising inflation and strained supply chain disruptions.

Nevertheless, a convergence of factors is supporting an increase in coal demand. First, tight natural gas supplies and the resulting high gas prices are driving some countries and companies to turn to relatively cheaper coal. Second, heat waves and droughts in some regions of the world drove up electricity demand and reduced hydropower generation, creating a gap that had to be filled by mostly dispatchable thermal power plants. Last, nuclear power generation was exceptionally weak in 2022, especially in Europe, where France had to shut down a significant portion of its nuclear capacity for maintenance.

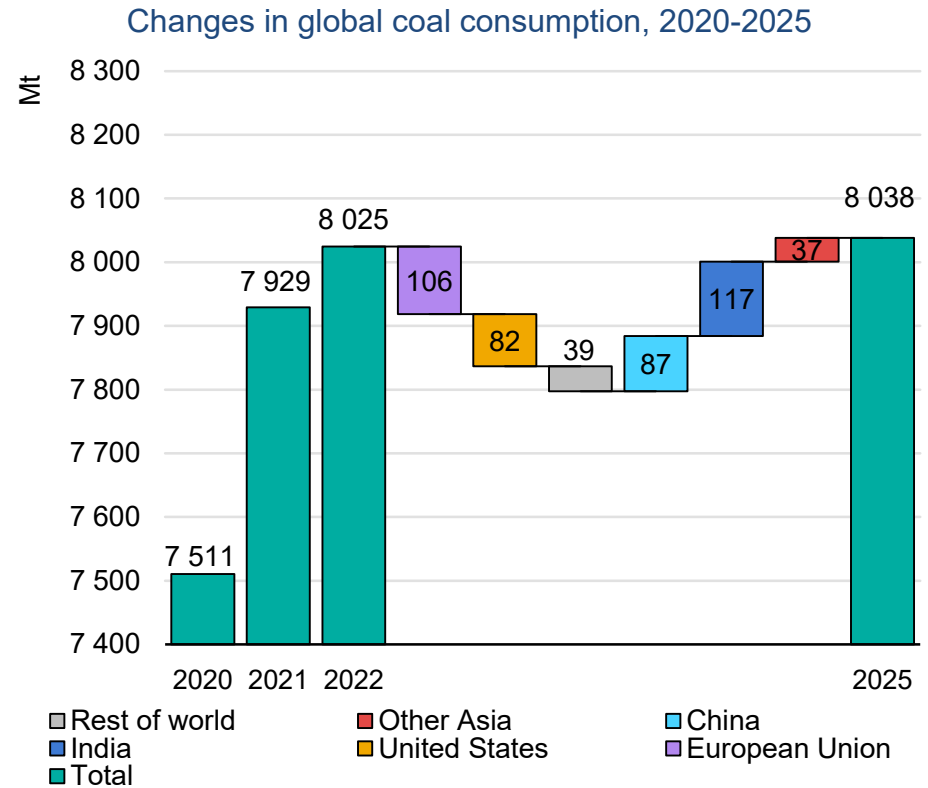
The largest increase in coal demand this year is expected in India (+7%/+70 Mt), followed by the European Union (+6%/+29 Mt) and China (+0.4%/+18 Mt), mainly led higher by stronger power sector use. Still, while coal-fired power generation in China and India is rising to keep pace with stronger demand, some European countries have been temporarily switching to coal due to record-high prices for natural gas, low hydropower generation, and maintenance-related closures at nuclear plants.

A significant decline in coal consumption is seen in the United States (-6%/-31 Mt), where the shift from coal- to gas-fired power generation continues and coal producers struggle after years of underinvestment.

Global coal consumption set to plateau through 2025



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Global coal power generation hits another record in 2022

Total electricity demand rebounded by 5.2% in 2021 as the strong recovery in the global economy and adverse weather conditions boosted consumption. In response to low hydropower generation and weak wind conditions in some regions, coal-fired generation rose by 8% (+762 TWh), in tandem with an 8% increase (+392 Mt) in coal consumption in the power sector.

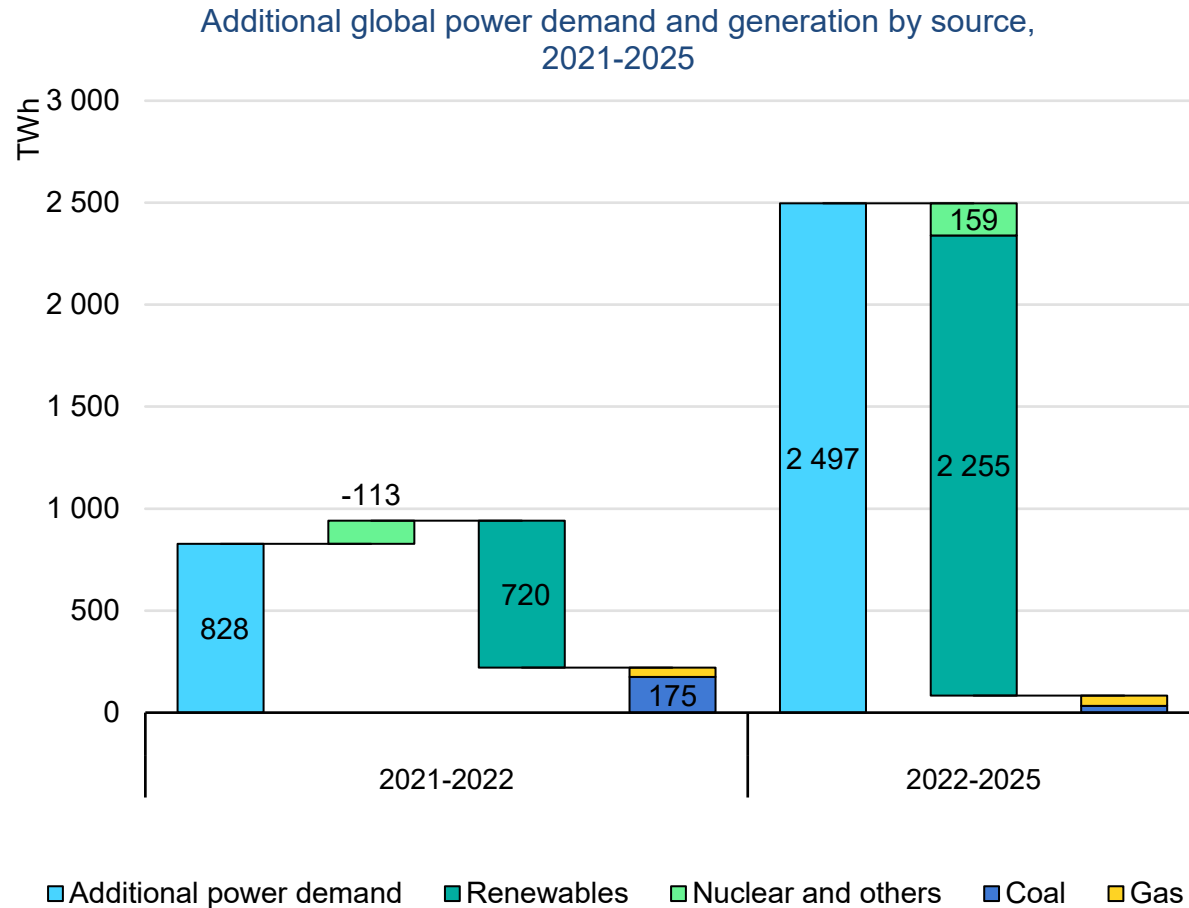
Growth in electricity demand has moderated to an estimated 3% in 2022, tempered by the slow down in the world economy, which offset increased power use due to exceptional heat waves in some regions. Electricity demand growth in China and India is above trend, and forecast to rise by 4% and 7%, respectively.

Renewable energy will meet approximately 88% of the additional demand in 2022, while the residual of ~221 TWh will be covered by coal and natural gas. The current gas shortage and resulting higher prices are supporting coal-based power generation worldwide, notably in the European Union, where natural gas is particularly expensive due to the Russian Federation (hereafter “Russia”) cutting supplies. In China and India, where gas does not play a big

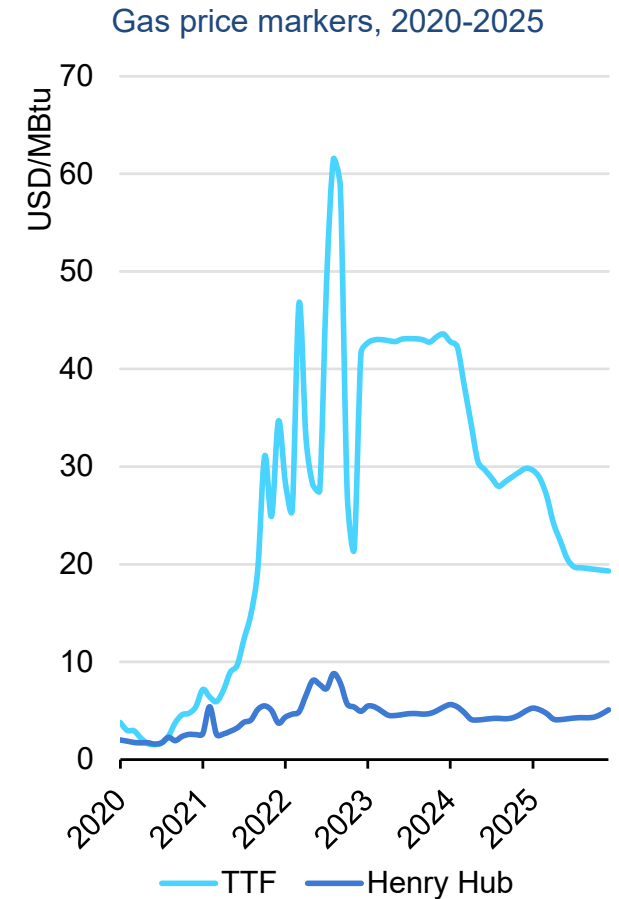
role in power, the impact of high gas prices on coal demand is more muted. Consequently, some European countries postponed scheduled closures of coal power plants and activated coal-fired reserve capacity to limit gas usage in the power sector. In total, we forecast coal power generation to increase by 1.8% to 10 339 TWh, a new all-time high. Overall, we expect coal demand for power generation to rise by 2.4% to 5 472 Mt, with China consuming more than half of the increase.

From 2022 to 2025, global electricity demand is forecast to grow 2.8% annually on average, or by an absolute of ~2 496 TWh. Renewable energy will provide the majority share of additional demand at 90%. The remaining gap of ~83 TWh will be covered by coal- and gas-fired power generation. The largest increases in coal burn are forecast for China (+5%), India (+7%) and Southeast Asia (+14%). Meanwhile, coal-fired power generation will continue to contract in the United States (-18%) while a return to a declining trajectory is expected for the European Union (-29%).

Strong growth in renewables will supply lion's share of additional power demand, with coal and gas filling the remaining modest gap



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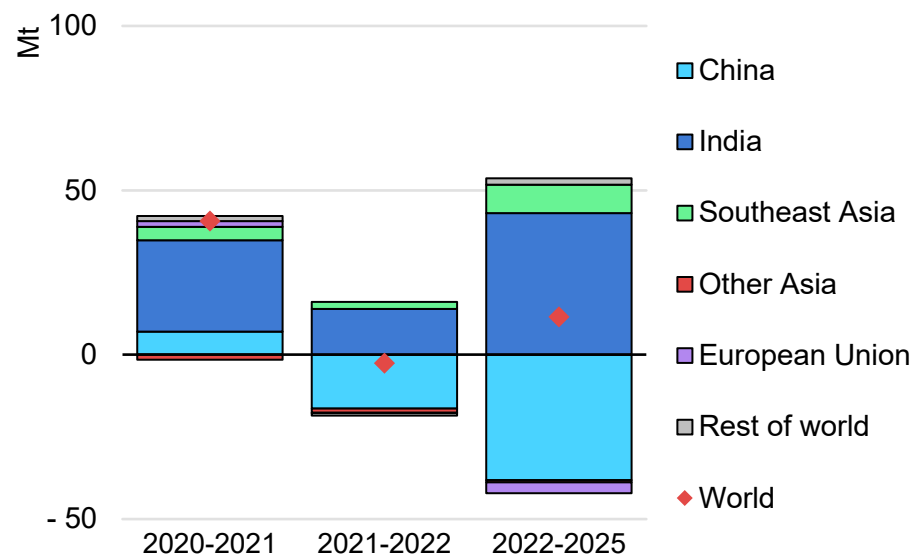
Non-power thermal coal consumption stable in 2022-2025

Outside the power sector, thermal coal is used in various other operations, such as cement production or industrial and residential heat applications. In 2021, non-power thermal coal consumption increased by 2.8% to 1 475 Mt, accounting for 22% of total thermal coal use. India posted the largest increase in thermal coal demand for non-power uses, up 16% in 2021, mainly due to strong growth in industrial production. In China, demand rose only marginally (+0.8%), driven by the country's efforts to reduce thermal coal use in the residential sector but also by a thermal coal shortage in the second half of 2021, which weighed on industrial consumption, e.g. cement production.

In 2022, thermal coal demand for non-power purposes is expected to remain stable as growth in India offsets a decline in China. An overall weak economic performance is behind the downturn in China's demand. In particular, lower cement production weighed on thermal coal demand as did ongoing efforts to reduce coal consumption for residential heating and small industries. By contrast, thermal coal consumption in the conversion sector (i.e. coal-to-liquids and coal-to-gas) rose as part of China's strategy to increase energy security by producing feedstocks such as hydrogen from domestic coal. India's thermal coal demand outside the power sector is expected to rise 7% in 2022 because of higher industrial output.

From 2022 to 2025, thermal coal demand for non-power use is forecast to rise 0.3% per year as industrial production continues to expand, especially in India. However, non-power use in China is set to continue contracting, with increased demand from the conversion sector more than offset by lower consumption in high energy-intensive industries and sustained efforts to reduce coal in heating and small industries.

Changes in thermal coal consumption for non-power purposes by region, 2020-2025



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After a drop in 2022, global metallurgical coal demand to remain stable through 2025

Metallurgical (met) coal, which includes coking coal (hard, medium and semi-soft) and pulverised coal injection (PCI) coal, is a primary ingredient in steelmaking. Furthermore, coke (produced by heating coking coal in the absence of oxygen) is used to produce carbides, ferroalloys and other compounds. Therefore, our forecast is based on steel production projections from organisations such as the [World Steel Association](#) as well as outlooks for industrial production, GDP growth, among other factors.

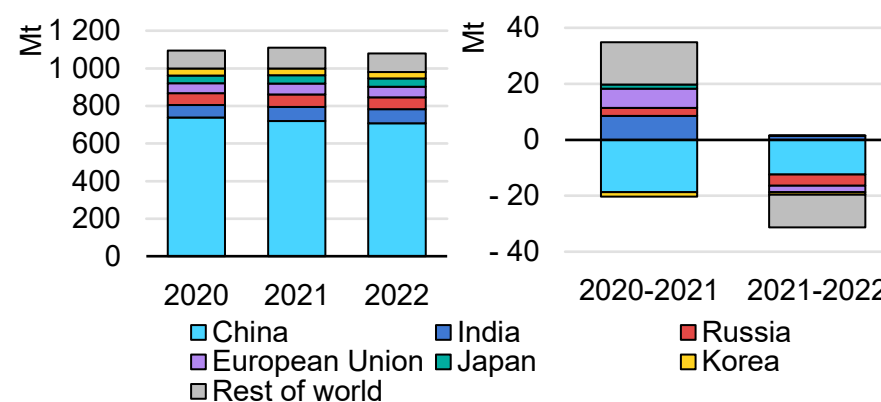
Global met coal consumption increased 1.3% to 1 110 Mt in 2021, as steel production recovered from a pandemic-related decline in most major steel-producing regions, including India (+13%/+9 Mt), the European Union (+13%/+7 Mt) and the United States (+28%/+4 Mt). However, in China, the world's largest steel producer, met coal demand fell by 2.5% (-19 Mt) as energy shortages and a weaker construction sector curbed steel output.

By contrast, in 2022 total met coal consumption is expected to decline by 2.7%, or 30 Mt, largely due to high energy prices and slower global economic growth. The largest decline is expected in China (-1.7%/-12 Mt), followed by Russia (-6%/-4 Mt) and the European Union (-3.9%/-2.3 Mt).

From 2022 to 2025, met coal consumption is forecast to be stable. At 1 078 Mt by 2025, demand for metallurgical coal is forecast to be well below the pre-pandemic level, as China's steel production is expected to remain muted. In total, lower use in the European

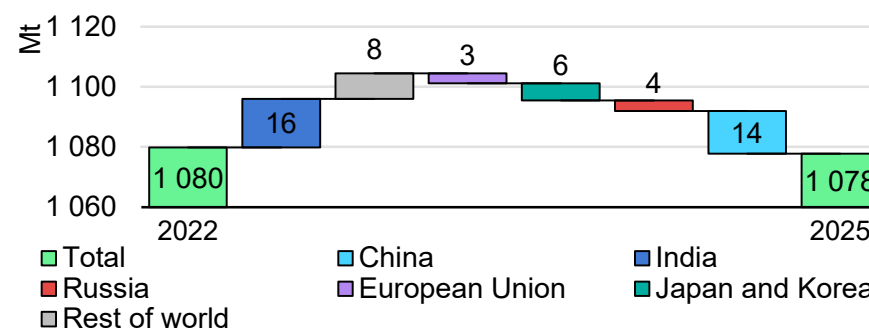
Union, Japan, Korea, Russia, and China is offset by a strong demand increase in India and the rest of the world, mainly Southeast Asia.

Met coal consumption and annual changes, 2020-2025



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Changes in metallurgical coal consumption, 2022-2025



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China's coal consumption rebounded in 2021 but thereafter plateaus through 2025

China's economy grew strongly in the first half of 2021, driving the country's coal demand higher. Coal supply could not keep pace with demand growth in the first six months of the year, however, leading to severe shortages starting in the second half of 2021, even as economic growth slowed. China's coal use rose 4.6% for the full year to 4 232 Mt, the highest ever. Whereas thermal coal consumption increased 6.2% to 3 511 Mt, mainly for power generation, metallurgical (met) coal demand declined by 2.5% to 720 Mt, hampered by energy shortages and a sluggish construction sector.

After posting strong growth last year, in 2022 China's economy weakened, in large part due to the government's zero-Covid policy that has led to severe lockdowns and weighed heavily on domestic consumption, industrial production and supply chain bottlenecks. In addition, the collapse of China's real estate market has sharply reduced new construction activity, which has upended demand for cement and steel.

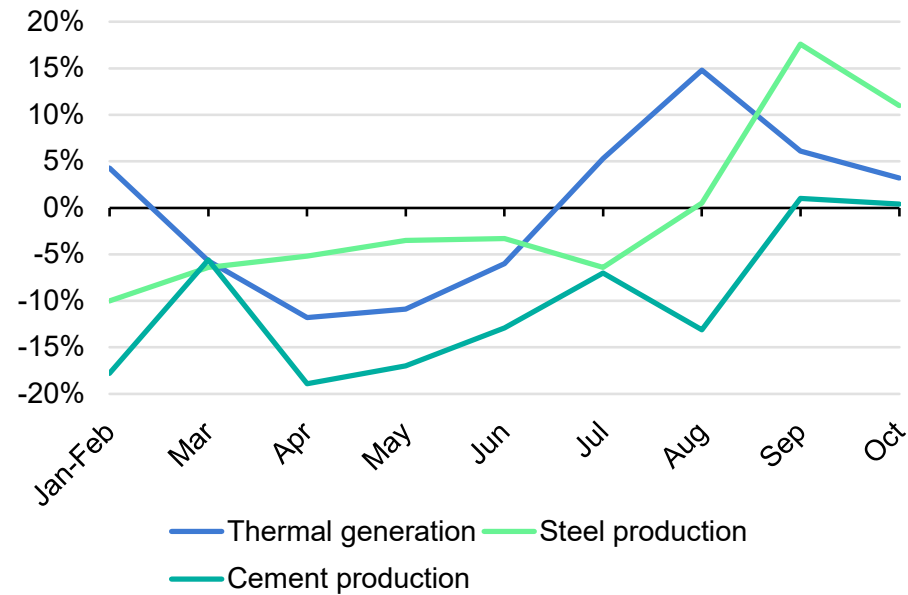
China's economy is expected to expand by only 3.1% in 2022. Except for the pandemic year 2020, this is the lowest economic growth since 1977. For 2022, we expect coal-fired power generation to increase modestly (+1.8%), resulting in coal demand of 2 664 Mt. Thermal coal demand for non-power uses is expected to decline by

1.8%, and metallurgical coal consumption, primarily for steel production, by -1.7%. Overall, the power sector's growth dominates, and China's coal demand will reach a new all-time high of ~4 250 Mt in 2022, slightly above the 2021 level (+0.4%).

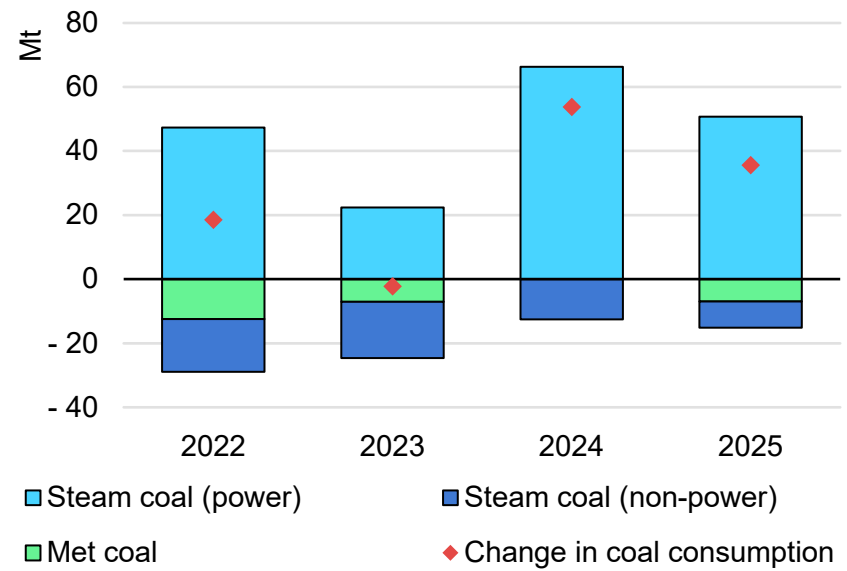
Our forecast for China's coal demand through 2025 is underpinned by two key assumptions: growth in GDP and industrial production. We assume annual growth of ~4.7% on average for GDP and ~5% for industrial production. China's electricity demand is forecast to increase by ~5%.

Based on these assumptions, we expect China's coal consumption will rise at a slower rate of 0.7% annually, though it will still reach a new high of 4 337 Mt by 2025. Growth will be driven mainly by the power sector, despite intense efforts to expand nuclear and renewable energy capacity. Thermal coal demand in non-power sectors will maintain the declining trend of recent years as small, inefficient coal boilers are continuously replaced by gas, district heating, and electric solutions. China's met coal consumption appears to have already reached a peak in 2021, and will stabilise and slightly decline until 2025. Outside of power, the only sector with increasing coal demand is coal conversion, e.g. the production of liquid fuels, synthetic methane and chemicals from coal.

Year-on-year percentage changes for various economic indicators in China, January-October 2022



Annual changes in coal consumption by grade and use in China, 2022-2025



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Note: Coal-fired power generation values are not available on a monthly basis.
 Source: National Bureau of Statistics of China (2022), [Statistical Database](#).

Coal-fired power generation – the backbone of China’s electricity system

China is by far the largest coal-consuming country, accounting for 53% of the world’s demand. Coal amounts to more than 60% of the country’s primary energy consumption¹, making it the backbone of China’s economy. The power sector² was responsible for ~62% of China’s total coal demand in 2021, or 2 617 Mt.

In the first half of 2022, coal consumption in China’s power sector fell by an estimated 3% due to a combination of weaker demand and a sharp year-on-year rise in hydropower generation. However, in the second half of the year, a severe heat wave led to higher electricity demand for cooling while a drought in central and southwest China reduced hydropower generation. As a result, electricity shortages developed in some hydropower-reliant regions, such as Sichuan. Meanwhile, coal-fired power generation reached a historic high of ~530 TWh in August amid soaring temperatures. As a result, coal demand for power generation is expected to partially recover in H2 2022 and increase by 1.8% for the year as a whole.

China commissioned a total of ~26 GW of new coal-fired power plants in 2021. By contrast, coal-fired capacity additions are

expected to remain at a low level in 2022, with only 7.5 GW recorded in the first six months of the year.

In 2021, construction started on 33 GW of coal-fired power plants, the most since 2016. In anticipation of further power shortages, which first emerged in December 2020 and returned again in summer 2021, the government plans to build more coal-fired plants to ensure adequate capacity in the future. New permits for coal-fired power plants increased again in the first half of 2022, with China approving a total capacity of 15 GW coal-fired power plants. In 2021, China accounted for ~55% of the global coal power capacity under development and the share is expected to grow in 2022. In Guangdong province, 14 GW of new capacity was approved this past summer – the first new coal power plant approvals in five years.

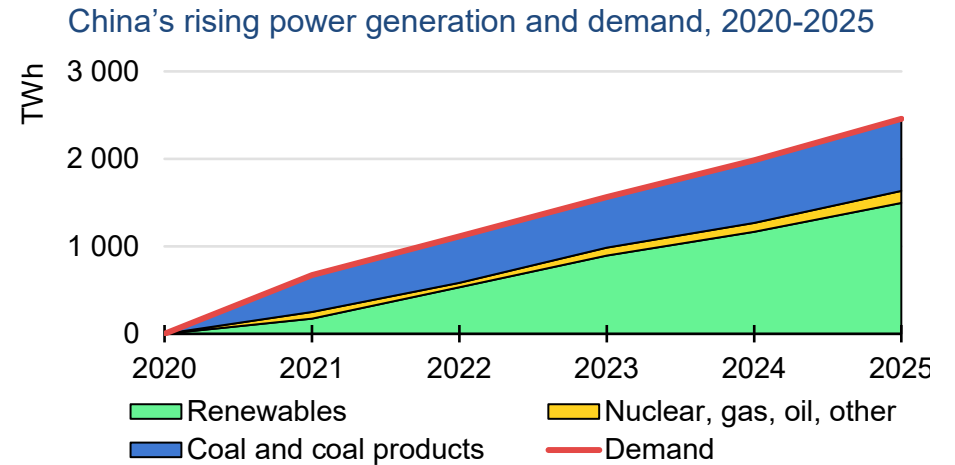
Electricity demand is expected to grow by an average of ~4.8% annually until 2025. Although we forecast electricity generation from renewables and nuclear to increase by 11% and 4.4%, respectively, per year, this is insufficient to meet demand growth. Following the power shortages in 2020 and 2021 and the draught in 2022, national and local governments intend to further issue more permits

¹ In accordance with Chinese statistics, which uses different metrics, it is 56%.

² Includes district heating

for new coal power plants, with a potential of up to 270 GW coal-fired power plant capacity by 2025, according to forecasts by China Energy. If these plans are realised, the additional capacity would total more than any other country in the world currently has installed. However, it is unlikely that the additional coal-fired power plants will be operated at full capacity, as they are largely intended to ensure energy security and are therefore not expected to directly increase coal consumption in China's power sector. Moreover, the additional capacity is not anticipated to be commenced to a significant extent before 2025, so it does not impact the generation capacity included in this report. Overall, we assume coal-fired power generation will increase by 2.3% per year to ~5 731 TWh by 2025, corresponding to projected consumption of ~2 803 Mt.

However, uncertainty about China's actual coal-fired generation output remains as cold snaps and heat waves can suddenly and significantly increase demand for electricity. As coal-fired power generation is largely the default electricity supplier in China, volatile electricity demand directly translates into fluctuations in coal consumption. Moreover, as renewable generation capacity increases, weather conditions will have a greater impact on the supply of electricity and, thus, on demand for thermal power plants to fill the generation gap. Of particular concern, rainfall and wind conditions can vary significantly from year to year.



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China's non-power thermal coal demand decreases slightly, despite growth in coal conversion

Thermal coal consumption in non-power applications rose to 895 Mt (+0.8%) in 2021, accounting for ~21% of China's coal use. This is similar to the total coal demand in Asia, outside of China and India.

Heavy, energy-intensive industries consume about half of the non-power thermal coal, of which ~50% is used in cement production. The substitution of coal with other energy sources for cement and building material manufacture, seen in recent years, is expected to continue slowly. More importantly, the slump in the real estate sector and construction activity are currently adding downward pressure on cement production. Cement output fell by 11% from January to October this year compared to 2021. In September, China announced that emissions from its cement industry would peak before 2023. However, based on the latest production numbers, we do not expect the sector to recover quickly. Given the declining share of the cement industry in overall coal consumption, we believe China's cement industry's demand for coal already peaked in 2021. As a result, thermal coal consumption in heavy industries is forecast to decline in 2022 by about 1.8% to 878 Mt. Until 2025, it is expected to continue declining to 840 Mt (-4%).

Approximately one-quarter of non-power thermal coal demand has been used for residential heating and light as well as non-energy-intensive industries in 2021. This share has declined in recent years thanks to efforts to reduce air pollution by replacing small, inefficient coal boilers with gas and electric options. Although high gas prices

are slowing the process, provinces and cities are expected to continue with efforts for substitution.

A growing niche of China's non-power thermal coal consumption is coal conversion (coal-to-liquids, coal-to-gas, coal-to-chemicals). The direction of this sector has been unclear in recent years, as the goal of increasing energy security by reducing oil and gas imports and China's climate goals have conflicted. The current focus on energy security and high oil and gas prices is an incentive for coal conversion projects, generally using local, even stranded, coal. China Energy Group commissioned a 400 000 tonnes (t) coal-to-ethylene glycol conversion project in November 2021 and a 350 000 t coal-to-hydrogen conversion project in Yulin, Shaanxi in September 2022. Until 2025, we forecast the coal conversion sector to grow by just above 10% per year.

China's metallurgical coal consumption declined slightly in 2021 to 720 Mt (-2.5%), accounting for about 17% of the country's coal demand and ~65% of the global met coal demand. The decline reflected the weakness of the construction sector, which weighs on the country's steel demand. Because of Covid-19 restrictions, in 2022 scrap collection has been poor and therefore the pig iron/steel ratio increased. Once the pandemic is under control, we expect the trend to reverse. China's met coal demand is forecast to decline by 1.7% in 2022 and fall by 2% in total until 2025 as the economic outlook is mixed and the share of scrap metal is expected to increase.

Robust economic growth fuels India's appetite for coal in 2022

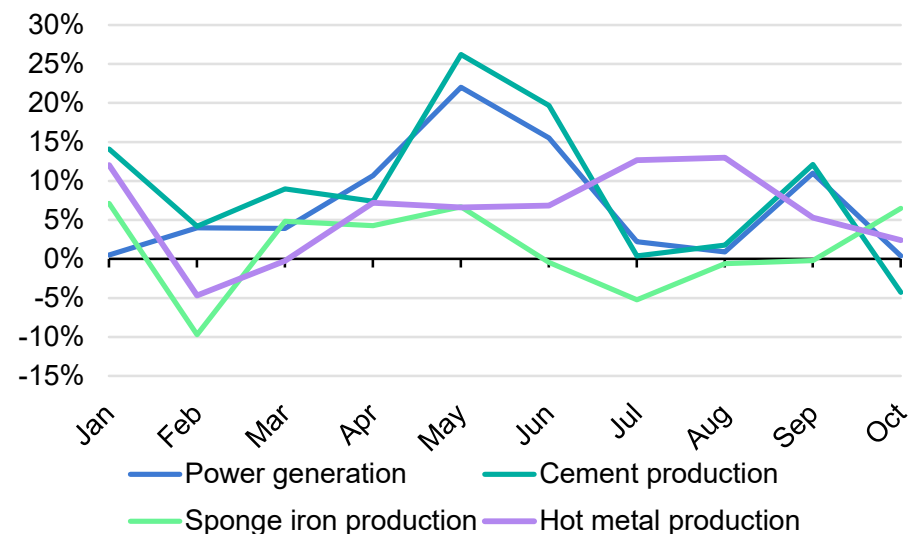
India's coal consumption surged to 1 033 Mt in 2021, a 14% rebound from a pandemic low in 2020. About 93% (~959 Mt) of the country's coal demand was thermal coal (including lignite), mainly for electricity generation (757 Mt). The rest was met coal used primarily in steel production (75 Mt). Demand for both types of coal increased strongly: by 14% for thermal coal and 13% for met coal.

For 2022, we expect a 7% increase in coal demand. Despite the slowdown in global growth, the Indian economy is doing exceptionally well, with GDP forecast to expand by 7.3% this year. Coal demand is largely being led higher by a sharp increase in electricity consumption, of which around 73% will be generated by coal-fired power plants in 2022. We expect electricity demand to grow by 7% due to robust economic growth. Demand was also supported by the severe heatwave from March to early May. In April, the daily power deficit amounted to ~5% of overall supply on national level and up to 15% in a few states. With such tight electricity markets, we expect coal consumption in the power sector to increase by 7% in 2022.

Coal-intensive industries, such as the cement and steel sectors, continued to grow in 2022. From January to September, monthly cement production averaged 11% higher year-on-year. The growth rate peaked in May before slowing in July when the onset of the monsoon season curbed construction activity. Monthly sponge iron and hot metal production increased by an average of about 1% and

6%, respectively. Overall, we expect 2022 thermal coal consumption outside the power sector to rise by 7% and met coal by 2%.

Year-on-year percentage changes for various economic indicators in India, January-October 2022



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Source: IEA based on McCloskey (2022). [McCloskey Coal, Metals and Mining Service](#)

India's coal demand continues to increase through 2025

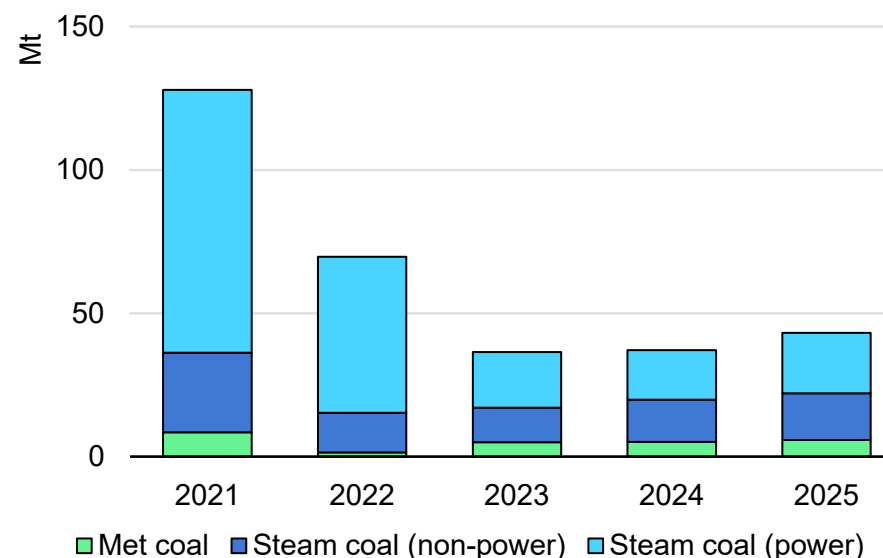
Coal-fired electricity generation accounts for about 73% of India's overall power needs and will remain the most important source of electricity in the foreseeable future. Coal-fired power plants make up 50% of the overall installed capacity of 404 GW connected to grids, with another 25 GW currently under construction.

We expect India's coal demand to rise steadily to ~1 220 Mt in 2025, with a share of 8% for metallurgical coal and 92% for thermal coal. Nevertheless, by targeting a share of 50% renewables in its power mix by 2030, India seeks to alleviate the electricity sector's dependency on coal and reduce the cost of energy generation. India facilitates investment in renewables by mandating 81 coal-fired power plants to reduce power generation by a total of about 58 TWh over the next four years, however, without shutting down any of its 172 power plants connected to the grid. Additionally, India plans to establish a carbon market, consolidating existing certificate markets related to energy efficiency and renewable energy obligations. India is targeting an emission reduction of 45% of its GDP's emission intensity from 2005 to 2030.

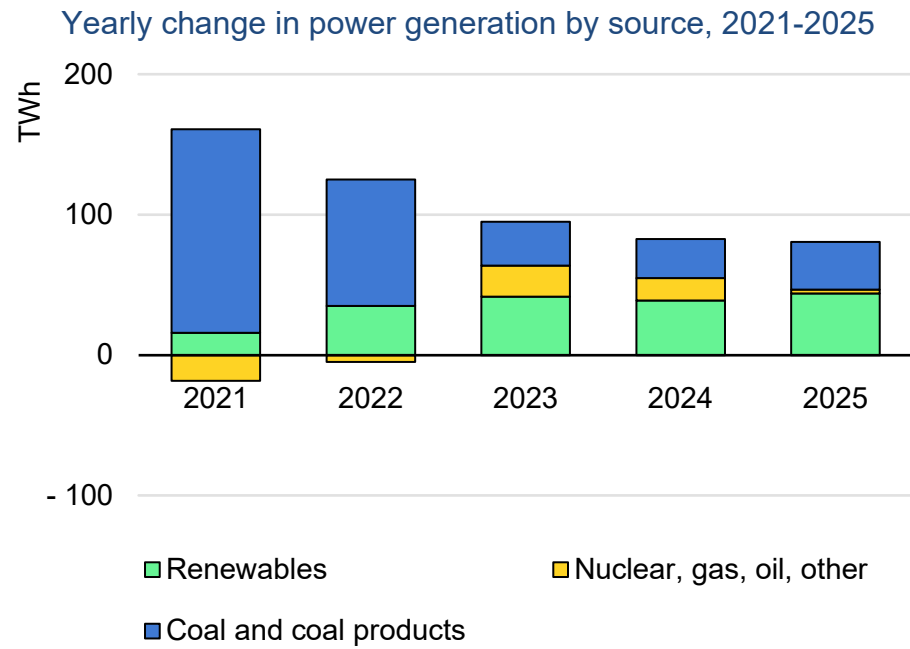
With production of about 344 Mt, India accounted for about 8% of global cement production in 2021, ranking second after China, which has a share of ~55% of the world's production. Production in India is expected to grow substantially until 2025 and beyond. India's cement producers, such as Dalmia Bharat, Ultratech and Adani, plan to almost double their production capacity from

~225 Mtpa to about 425 Mtpa in total by the end of the decade, which implies increasing capacity through 2025. Together with higher steel production, we forecast the country's coal demand for non-power purposes to grow ~20% by 2025. At the same time, the government of India has confirmed its target to gasify 100 Mtpa of coal by 2030.

Annual changes in coal consumption by type and use in India, 2021-2025



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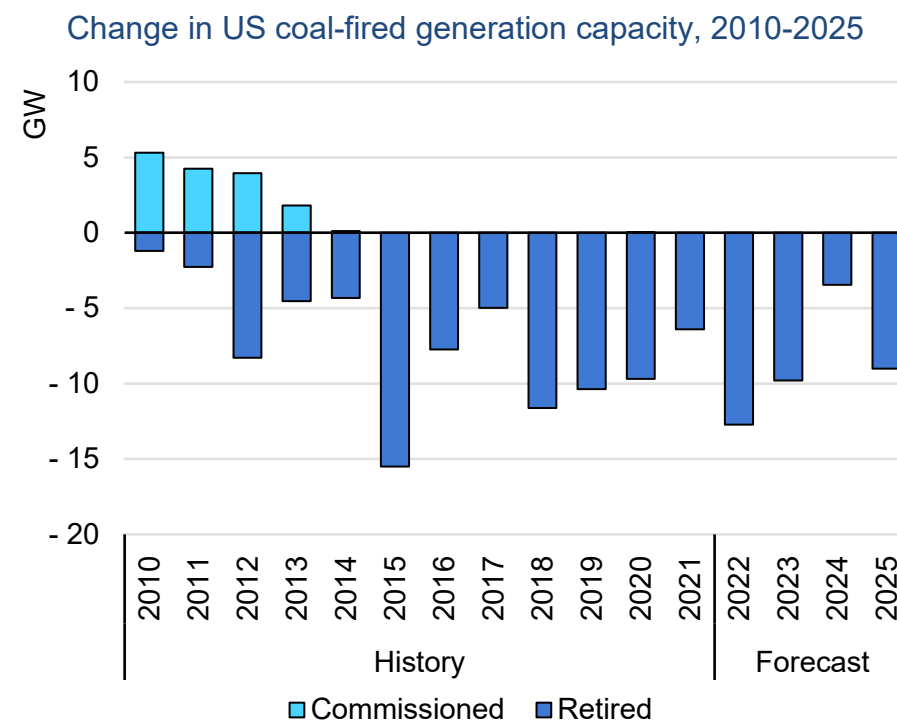
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US coal demand continues its downward trajectory

In the United States (US), coal-fired power generation remains on downward trend after a brief but strong recovery of 15% in 2021. Expansion of renewables is accelerating while the coal power fleet continues to contract. More than 6 GW of coal-fired capacity was retired or converted in 2021 and almost 13 GW is scheduled to be closed in 2022. Limited access to coal due to logistical issues and high prices in global markets have put additional pressure on coal-fired generation, increasing the share of renewables and natural gas, despite the higher prices, in electricity generation. Coal's share in electricity generation is expected to ease from 23% in 2021 to 20% in 2022. Overall, we forecast a 6.3% decline in coal consumption in the United States, to 465 Mt, in line with shut-in coal-fired electricity generation, which accounts for 92% of total coal consumption.

Coal-fired power generation will continue to decline in the coming years, with total capacity of 22 GW either retired or plants converted by 2025. Moreover, we expect the US Inflation Reduction Act to accelerate the transition to clean energy, further reducing US coal demand. The Act will fund almost USD 400 billion in energy and climate change spending, and includes more spending on clean energies and expansion of energy infrastructure. Although the Act includes carbon capture and storage projects (CCUS) that could potentially use coal, we do not expect this to impact coal demand until 2025. As a result, coal's share in the electricity mix is projected

to fall to just 16%, corresponding to an 18% drop in coal use from the 2022 level. The decline could be even steeper if the economic situation worsens.



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Notes: Capacity values for 2022 to 2025 are based on announced retirements.
Sources: EIA (2022), [Electric Power Monthly](#) and [EIA \(2022\)](#), Coal Data.

EU coal demand rebounds amid high gas prices before declining in 2024-2025

The European Union's (EU) coal demand steadily declined for a decade until it reached a low point in 2020 amid the Covid-19 pandemic and extraordinarily low gas prices undercut coal-fired power generation. However, in 2021, tighter gas markets and the resulting rise in gas prices saw coal-fired power generation become competitive again, despite higher European Union Allowance (EUA) prices for carbon emissions.³ Overall, coal consumption in the European Union surged by 14% in 2021, led mainly by a resurgence in the power sector in response to the post-Covid economic recovery and higher gas prices.

Russia's invasion of Ukraine in February 2022 has upended both coal and gas markets and forced European countries to implement a series of measures to replace Russian supplies to meet coal demand this year and in 2023. The loss of Russian gas imports significantly exacerbated already tight supplies in Europe and propelled prices to record highs. Also, available nuclear capacity and weak hydropower have limited alternative sources in the EU's electricity mix. Given the acute gas supply shortages and resulting unprecedented high gas prices, countries and utilities throughout the region are turning toward coal, which remains more price

competitive than gas despite the EU's implementation of sanctions on coal imports from Russia on 10 August. The European Union used to import around 45% of its coal from Russia, or about 52 Mt, in 2021. Germany, Poland and the Netherlands are the EU's largest importers of Russian coal.

In addition to securing alternative supplies, EU countries have implemented a series of policy measures to reduce gas use. A number of EU countries (Germany, Finland, France, the Netherlands, Spain, Italy, Denmark, Greece, the Czech Republic, Hungary and Austria) are extending the lifetime of coal-fired power plants, restarting closed plants or lifting existing caps on generation. In most of these countries, this affects small generation capacity, with Germany the exception. Germany created a "gas replacement reserve" with a total capacity of 11.6 GW. It includes 1.9 GW of lignite and 4.3 GW of hard coal power plants, that are now allowed to return to the market until April 2024. The decommissioning of 2.6 GW of hard coal power capacity and 1.2 GW of lignite capacity has been postponed. The remaining 1.6 GW is from oil-fired power plants. By contrast, in Poland, the second-largest coal consumer in Europe, we expect only a slight increase in coal-fired power

³ In some cases, such as co-generation plants, additional revenue streams have to be considered when assessing the profitability of generation units.

generation this year given limited capacity. Previously, Russia supplied 20% of Poland's domestic coal needs.

Amid these challenges, coal consumption by the EU's power sector is expected to increase 9%, or by 31 Mt, to a total of 377 Mt in 2022, which would be close to pre-pandemic demand levels in 2019. Non-power industrial coal demand is expected to decline by ~2.3% because of high energy prices.

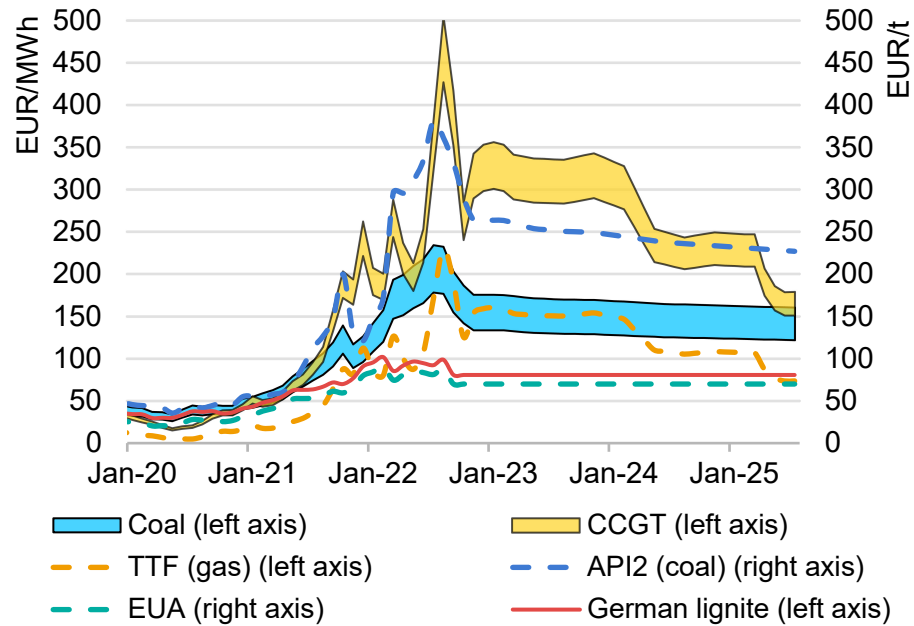
The current forward markets indicate that the marginal costs of coal-fired power plants will be far below those of gas-fired power plants in the next few years. This would only change in 2025 when forward gas prices are low enough to place efficient gas-fired power plants ahead of inefficient coal-fired ones. However, lignite-fired power plants are expected to remain very competitive until 2025.

Although European electricity markets are expected to remain tight due to ongoing gas shortages and the German phase-out of nuclear power, we expect EU countries to continue moving forward with their plans to phase out coal-fired power generation from 2024 onwards. Germany, in particular, plans to reduce its power plant fleet by 6.2 GW of hard coal and 2.9 GW of lignite power plant capacity from 2021 to 2025. In view of a firm ramp-up of electricity production from renewables and a recovery in French nuclear power, our models indicate that Germany, the EU's largest coal-fired power generator, will turn from a net exporter of electricity to a net importer in this period. Despite gas prices remaining at a high level, Germany's coal-fired power generation and, thus, the thermal coal demand in the power sector is expected to decrease by 57 Mt

to about 93 Mt in 2025. By contrast, Polish coal-fired power generation is expected to remain relatively firm until 2025, resulting in a decline of thermal coal demand in the power sector by 6%. Overall, coal consumption in the European Union is expected to decrease significantly, from 478 Mt in 2022 to 371 Mt in 2025, although uncertainty surrounding the gas market could affect the outlook for coal demand.

In the Republic of Türkiye (hereafter "Türkiye"), coal consumption is forecast to rebound in 2022 and 2023 before it starts declining due to increased renewable energy outpacing electricity demand. The short-term rise is partially driven by the new 1.3 GW Hunutlu coal power plant, which commenced operation in September 2022 and pushed imported coal-fired generation to an all-time high in November.

European Union marginal coal- and gas-fired power generation costs, 2020-2025



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Notes: TTF = Title Transfer Facility. EUA = European Union Allowance. CCGT = combined-cycle gas turbine. API = Argus/McCloskey's Coal Price Index. JCC = Japan Crude Cocktail. CCGT net efficiency: 49-58%. Coal net efficiency: 35-46%. Lignite net efficiency: 39%.

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

High gas prices support coal demand in mature Asia Pacific economies through 2025

In Japan, coal-fired power generation declined by 1.1% in 2021 due to stagnating electricity demand and increased nuclear power generation. In 2022, Japan's coal demand is forecast to rise by 1.8% as operators shun higher-priced natural gas. The country's large long-term LNG supply contracts have largely shielded operators from current steep gas prices and impacted coal-fired power generation, an essential pillar of Japan's electricity sector, only to a lesser extent. Thermal capacity will increase by about 1.03 GW in total, of which coal-fired capacity will account for a net gain of about 0.7 GW. Forward prices indicate that coal will remain competitive with spot gas for power generation through 2025. In response to higher electricity prices and efforts to reinforce energy security, Japan announced the intention to extend the lifetime of four of its 33 available nuclear power plants to 60 years.

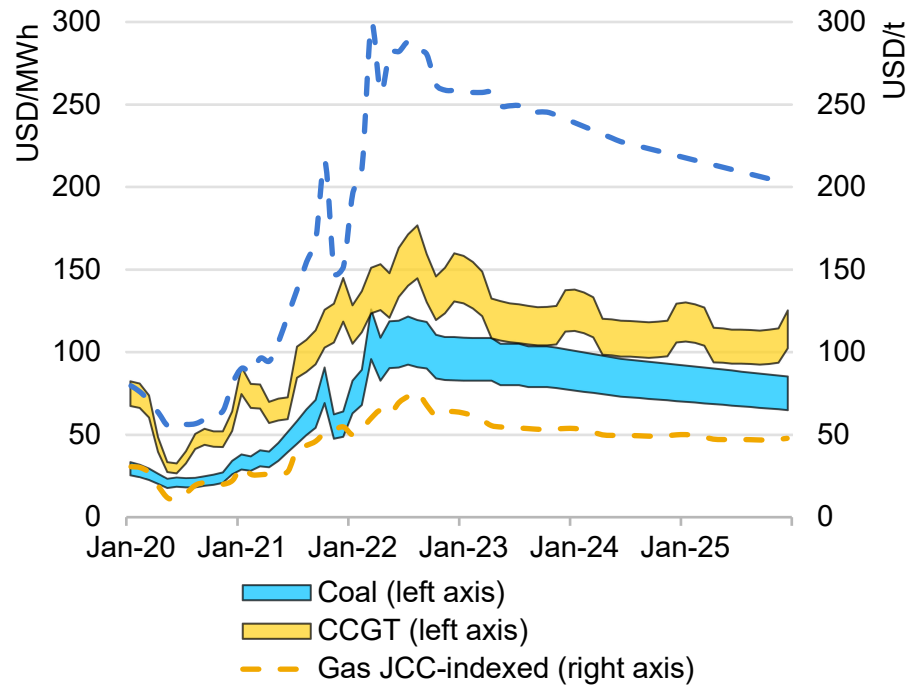
In Korea, coal demand for power generation increased 6.3% in 2021 due to stronger demand and rising LNG prices. Similar to Japan, Korean utilities procure liquefied natural gas through long-term contracts, protecting the country from record-high spot prices this year. However, opportunity costs are high and – at the margin – coal remains cost-competitive with gas. To substitute expensive gas-fired generation, Korea suspended generation caps and temporary shutdowns for coal power plants in 2022. However, coal consumption for power generation is expected to remain unchanged (-0.2%) as some old coal-fired units were closed in 2021, and nuclear and renewable power generation rose. The

restart of the 1.4 GW Shin Hanul 1 nuclear reactor has been announced and is expected to take place before the end of 2022. In 2023, coal-fired power generation is projected to increase as the 2 GW Anin power station is scheduled to become operational and high spot gas prices persist. By 2025, however, Korean coal-fired power generation will decline somewhat and reach about the same level as in 2022, despite the commissioning of another 2 GW coal-fired capacity (Samcheok power station), as old units are decommissioned and power generation from renewables increases.

Chinese Taipei's coal consumption amounted to 63 Mt in 2021, of which 48 Mt was used in power generation. We expect coal consumption to remain relatively constant in 2022. By 2025, coal demand is forecast to increase by ~2.6 Mt, despite the country's plan to reach net-zero emissions in 2050. According to the plan, as of 2025, no coal-fired power plants will be constructed or decommissioned. However, with the phase out of nuclear power generation by 2025, renewable capacity expansion cannot keep pace with growing demand, leading to increased coal-fired generation.

In Australia, coal consumption is forecast to contract as growth in renewable energy outpaces electricity demand. The Australian power plant fleet is in decline in the medium term. The largest coal power plant, the 2.9 GW Eraring power station, is expected to close in mid-2025, seven years ahead of schedule.

Korean marginal coal- and gas-fired power generation costs, 2020-2025



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Notes: JCC = Japan Crude Cocktail. CCGT net efficiency: 40-55%. Coal net efficiency: 35-46%.

Sources: IEA estimates and Argus Media group. All rights reserved.

Coal demand in Southeast Asia on the rise

Coal consumption in Southeast Asia totalled 361 Mt in 2021, up 1.5% from the previous year. The largest coal consumers in the region are Indonesia (41%) and Viet Nam (26%), followed by Thailand (9%), Malaysia (9%) and the Philippines (9%).

For 2022, we expect coal consumption to rise by 3.8% in Southeast Asia, largely driven by strong growth in Indonesia. From 2022 to 2025, we expect coal consumption to grow by ~4% per year on average, pushing total consumption to 422 Mt. The forecast is based on a strong economic outlook for the region, some coal power projects under development (total capacity of 18 GW, of which 7.3 GW was approved in 2021), and Indonesia's abundant coal supply.

Most of Southeast Asia's coal-fired power plant projects are in Indonesia and Viet Nam. This year, Adaro Energy started operations at the new 2 GW Batang coal power plant and Bukit Asam at its 1.32 GW Sumel 8 in Indonesia, and the 1.2 GW Ngho Son 2 power plant commenced operation in Viet Nam. Both governments announced plans to stop the development of new coal-fired power generation, as of 2023 for Indonesia and in the longer term for Viet Nam. The importance of coal-fired generation, however, is about to increase in the foreseeable future as there are still several coal-fired power plants under construction in Indonesia, and in Viet Nam the 1.2 GW Vung Ang 2 is expected to begin generation in 2025. After China's commitment to stop the

construction of coal plants overseas several projects have been cancelled. However, this is not expected to affect coal consumption through 2025.

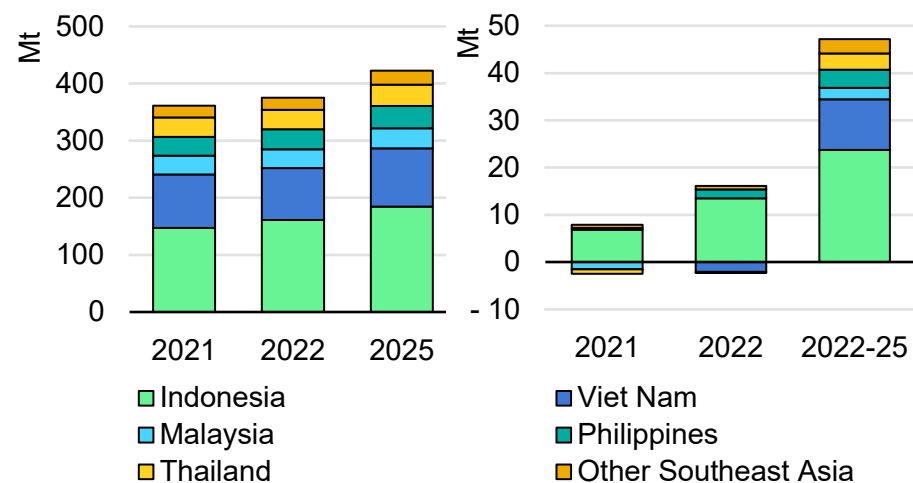
Indonesia's coal demand amounted to 148 Mt in 2021 and will grow by ~9% in 2022. In January 2022, high prices and heavy rainfalls threatened domestic coal supplies and Indonesian utilities ran low on supplies as miners focused on exporting. In response, the government took an unprecedented step to ban all coal exports for a month to ensure supplies to domestic power plants. Until 2025, we expect Indonesia's coal consumption to grow by ~4.7% annually, led by the expansion of the country's coal power plant fleet by up to 10 GW.

Viet Nam recorded consumption of 84 Mt thermal coal and 9 Mt met coal in 2021. In the first half of 2022, the high availability of hydropower and curtailment due to supply shortages of domestic coal reduced the share of coal-fired generation to 40% of the overall electricity generation. The total electricity generation increased year-on-year by about 4.5%. For the second half of 2022, further growth in electricity demand is expected following a heatwave that boosted demand for cooling in northern parts of the country coupled with stronger economic growth of 7.7% in 2022. In view of high renewable and hydropower generation, we expect Viet Nam's coal consumption to decline by 2.1 Mt to ~91 Mt.

The Philippines' coal demand in 2022 is expected to rise to about 35 Mt, up from around 33 Mt. Coal-fired generation makes up for 57% of the country's electricity production and 91% of overall coal demand. About 70% of the coal consumed is imported from Indonesia. Although the Philippines have stopped building new coal power plants, coal demand is expected to increase to about 39 Mt until 2025, mainly driven by rising power consumption.

Malaysian coal demand is expected to remain constant in 2022 at about 33 Mt. Demand is forecast to increase to around 35 Mt by 2025, led by rising electricity demand and higher load factors, even though the state-owned TNB's announced it plans to close 1.4 GW of coal capacity before 2025.

Southeast Asia change in coal consumption by country, 2021-2025



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Coal consumption in South Asia declines in 2022 on higher prices

Tight supply and high prices in international coal markets are hitting emerging economies like Pakistan, Bangladesh and Sri Lanka particularly hard. At current high prices, they cannot afford to buy enough energy, including coal, which is leading to electricity rationing.

Pakistan's coal consumption declined 7% to 23 Mt in 2021 in response to high coal prices. In 2022, Pakistan's coal use is forecast to fall further (-3.8 Mt) because the country cannot afford large seaborne imports so it must depend on supply from domestic coal mines and land-based imports from Afghanistan. Additionally, the heavier-than-usual monsoon season brought severe flooding in June, covering more than one-third of the country's land area and exacerbating the economic crisis. From January to September, coal-fired power generation fell 7%, while coal-intensive cement production declined by 17%. By 2025, Pakistan's coal consumption is projected to increase by 30% to 25 Mt, fuelled by expected economic growth of 5% per year, the commissioning of new coal-fired power plants and more use of existing ones. The country has five coal power plants under construction but we assume that only the first unit of Jamshoro (660 MW) and an additional 1 650 MW running on domestic lignite (Sindh province) will be commissioned

by 2025. In December 2020, Pakistan's prime minister announced that the country would have "no new coal-fired power". While we expect this decision will not affect projects already under construction, others in the planning stage with a total capacity of 3 GW are unlikely to be realised.

Coal consumption in Bangladesh declined by 0.8 Mt to 3.8 Mt in 2021 but is expected to grow by 2.8 Mt in 2022. The sharp growth in coal consumption is due to the commissioning of the two 660 MW blocks of the Payra power station in March and December 2021, respectively. At least six other coal-fired power projects are expected to go ahead, three of which, with a total capacity of 2.8 GW, are anticipated to be completed soon. The future of the seventh project, the 1.2 GW in Marabari, is unclear following Japanese trading house Sumitomo's decision to pull out of the project in February after pledging not to invest in new coal-related businesses. We expect Bangladesh's coal power fleet to increase to ~5 GW by 2025, boosting the country's coal demand to 19 Mt.

Sri Lanka's coal demand will decrease slightly this year as the country struggles with high costs amid a severe domestic economic crisis resulting in a GDP contraction of 7%. For 2025, coal demand is forecast to return to former levels of 2.2 Mt.

African coal consumption likely to remain stable near 2021 levels over forecast period

Total coal demand on the African continent declined by 3.1% to 189 Mt in 2021 amid the economic fallout from the Covid-19 pandemic. Due to continued weak demand from South Africa, the continent's coal demand is forecast to decrease for the third year in succession to 180 Mt (-9 Mt). Until 2025, we expect consumption to rebound to 2021 levels (~190 Mt), which is well below the pre-pandemic level of 2019.

South Africa accounts for about 88% of coal consumption in Africa and was behind the continent's demand decline from 2020 to 2022. In 2022, South African coal consumption is expected to fall from 166 Mt to 157 Mt (-5.5%), in part reflecting the country's very slow economic recovery from the pandemic shock. Economic growth is expected to ease to 1.6% this year, after 4.9% last year and a pandemic-induced slump of 6.3% in 2020. Despite efforts to increase the reliability of the power system, rationing persists in South Africa. In June, a strike at South Africa's state-owned utility Eskom disrupted the operation and maintenance of the power system. Eskom announced stage six of load-shedding at the end of June, which means demand cuts of 6 GW from the grid. The situation eased after the strike ended in July but delayed maintenance and unplanned outages led to continuing load-shedding. In September, the rolling blackouts reached record

levels, forcing a return to stage six of load-shedding. So far, 2022 has been the worst year of load-shedding on record. From January to November, there have been at least 155 days of reported load-shedding. The country has ~46 GW of generation capacity, sufficient to meet a peak demand of just ~32 GW. However, less than 60% of the capacity is available, leading to a gap of ~6 GW.

In response to the current situation, the government announced a plan to attract more private investments in new generation capacities, raise Eskom's maintenance budget and start electricity imports from Botswana and Zambia. We project South Africa's coal consumption to increase by 5.3% from 2022 to 2025 as the coal power plant fleet's performance increases. A proposed large-scale 3.3 GW coal-fired power plant project in the Musina-Makhado energy and metallurgical special economic zone has been cancelled and replaced with renewable sources.

The funding of other coal power projects in African countries, such as Zimbabwe, Botswana, Tanzania and Mozambique, is also in the balance. In our forecast, we do not expect any new coal-fired power plants to be commissioned in Africa by 2025.

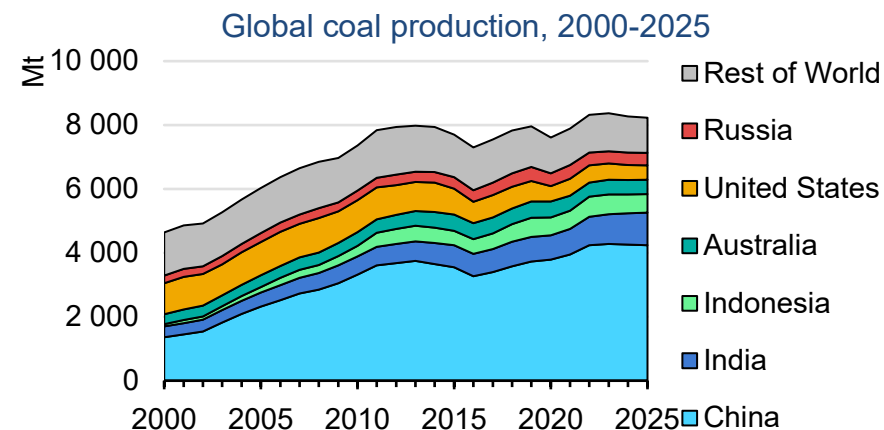
Supply

Global coal supply hits all-time high in 2022 but stalls by 2025

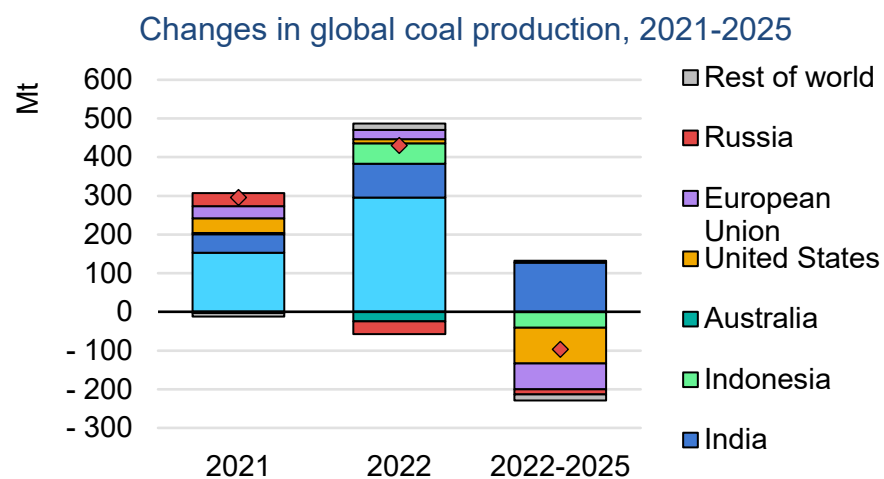
Despite deteriorating economic prospects, global coal supply is forecast to reach a new high in 2022 as demand for coal in power generation increases in response to tight gas markets and high prices. China and India continue to boost their coal production to overcome supply shortages, more than offsetting the decline in Russian production due to Western sanctions imposed in the aftermath of the country's invasion of Ukraine.

Global coal production is forecast to rise by 5.4% to 8 318 Mt in 2022, a new all-time-high and well above the record set in 2019. This follows an increase of 3.9% to 7 888 Mt in 2021 as economies recovered from the pandemic-induced demand drop in 2020. In absolute terms, 2021 growth was mainly driven by production increases of 153 Mt in China (4%) and 48 Mt in India (~6%). Steam coal and lignite accounted for 98% of the 295 Mt increase and around 86% of total production.

The rebound growth trajectory for global coal production is expected to reach a peak in 2023, just slightly above the 2022 level. By 2025, we estimate coal production will fall to 8 221 Mt, back below 2022 levels. The lower levels largely reflect expectations that China's coal production will plateau in the coming years, and the continuing growth in India's coal production (+128 Mt) will be offset by large declines in other regions, such as the United States (-92 Mt), the European Union (-68 Mt), Indonesia (-40 Mt) and Russia (-13 Mt).



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China boosted its coal production in the face of shortages in H2 2021

China's coal production grew 4% in 2021, reaching a new high of 3 942 Mt. Nevertheless, supply failed to keep pace with strong demand from both power generation and non-power industries, resulting in energy shortages in the second half of the year. In response, the government and regional authorities focused on boosting domestic coal production by authorising capacity expansions at existing mines or restarting closed operations. For example, the National Development and Reform Commission (NDRC) eased conditions for mine extensions taking place before April 2022. In Inner Mongolia, authorities approved the restart of 38 disused opencast mines with a capacity of 66.7 Mtpa. Meanwhile, the province of Shanxi suspended the annual production cap and ordered all mines to increase coal output instead. The resulting growth in coal production more than offsets all losses caused by pandemic containment measures, new safety and environmental regulations or natural disasters like floodings in Shanxi in October 2021.

About 83% of China's coal production is thermal coal, with the remaining from met coal.⁴ The bulk of China's thermal coal production is concentrated in just four regions, accounting for more

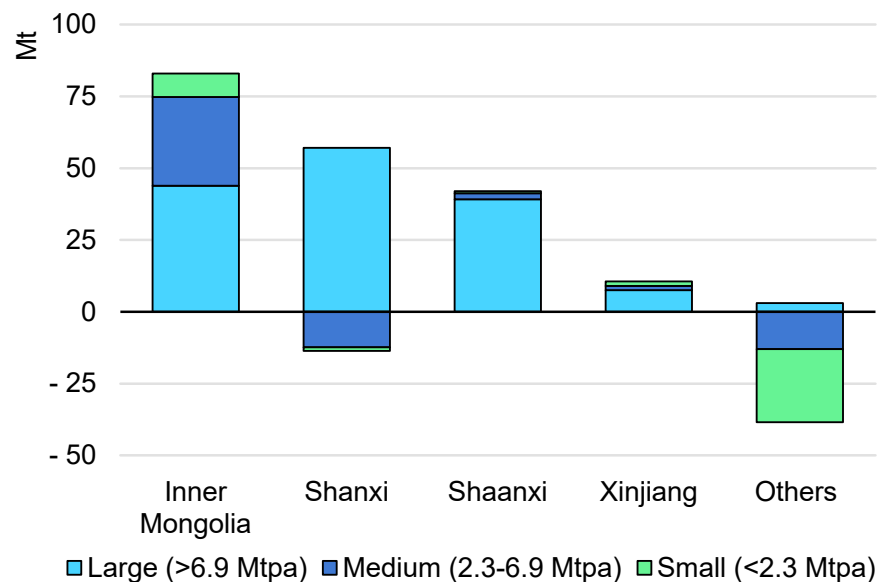
than 80% of the country's thermal coal output: Inner Mongolia (33%), Shaanxi (23%), Shanxi (20%) and Xinjiang (6%). In all four provinces, thermal coal mining increased in 2021. The most significant increase happened in Inner Mongolia (+8%), followed by Shanxi (+7%), Shaanxi (+6%) and Xinjiang (+6%). Thermal coal production in other regions fell 6%, mainly due to declining output from small and medium-sized mines. In total, China's thermal coal production grew 4.6% in 2021.

China's met coal production rose by 1.4% in 2021. The most important met coal mining region is Shanxi, which accounts for half of the country's total production. Other important mining regions are Anhui (8%), Shandong (7%) and Henan (7%) in the east, Guizhou (4%) in the south, and Inner Mongolia (4%) and Heilongjiang (4%) in the north. Shanxi's met coal production increased 1.8% in 2021. As with thermal coal, met coal production is undergoing a shift from small, decentralised mines to large, automated ones.

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

China's major coal-producing provinces substantially ramped up coal output in 2021

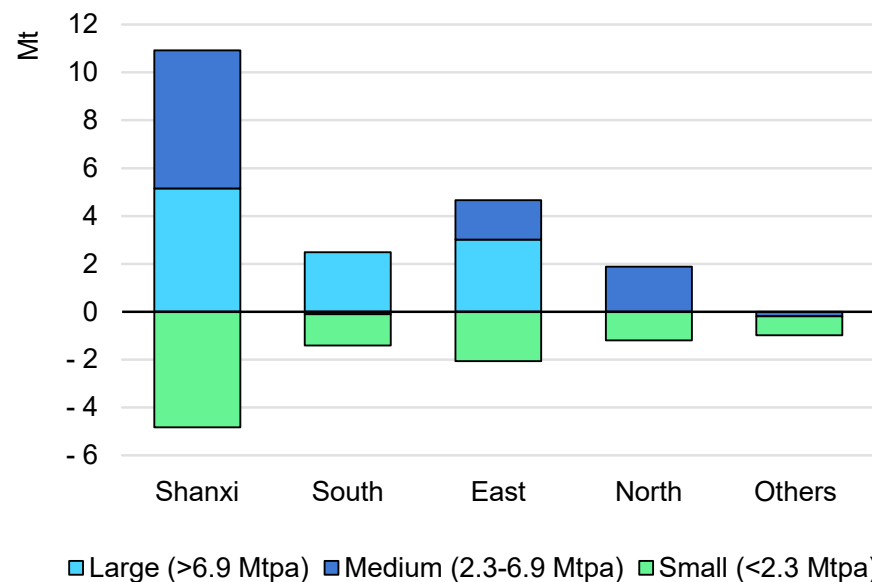
Change in thermal coal production in China's major producing regions by mine size, 2020-2021



IEA. CC BY 4.0.

Source: Adapted from CRU (2022), Thermal Cost Model (database).

Change in metallurgical coal production in China's major producing regions by mine size, 2020-2021



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Source: Adapted from CRU (2022), Metallurgical Cost Model (database).

China's coal production on track to post another record high in 2022

We forecast China's coal production to expand by 8% to 4 237 Mt in 2022, reaching a new high and surpassing the 14th Five-Year Plan's target of 4 100 Mt by 2025. In China's four major coal-producing provinces, output rose sharply in the first nine months of 2022. The higher production levels are part of the government's plans to raise domestic supply, with new capacity approved in 2021 of ~300 Mtpa. The increase in coal production could have been even higher had strict pandemic containment measures not hampered operations and logistics. Increased safety inspections also weighed on coal output.

With domestic coal production rapidly growing, the existing rail capacity has become a bottleneck for transporting coal to domestic ports and to utilities. While the major coal mining regions are mainly located in the north and centre of the country, significant demand is in the industrial centres along the east coast, such as Guangdong or the Shanghai area. As demand for coal increases and the share of imports at the coastal power plants decreases, more coal has to be transported to the east via rail and barge. To cope with the problem, new storage sites are under construction and the China State Railway Group has increased the number of coal trains on existing routes. However, producers and power plants are having difficulties securing sufficient rail cars for coal supplied under long-term contracts. Truck capacity is also scarce, worsened by

pandemic containment measures forcing truck drivers to be regularly tested and then wait for results.

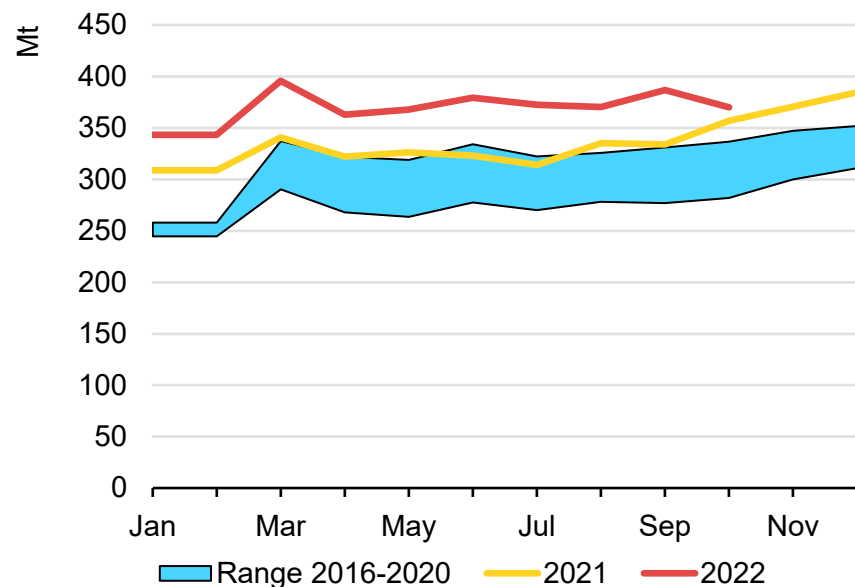
Shanxi, the largest coal mining region in China, increased production by 10% in the first nine months of the year and is aiming for full-year output of 1 300 Mt. This makes Shanxi a bigger coal producer than any country (outside China). Shanxi's coal production might have been even somewhat higher had it not been for several accidents, some of which were fatal. In response, the Shanxi provincial government ordered the suspension of operations and a multi-day inspection at a total of eight coal mines. The largest, Tashan, has a capacity of 25 Mtpa. The other mines have a total capacity of about 7.2 Mtpa.

The second-largest coal region, Inner Mongolia, produced 124 Mt (+19%) more coal between January and September than in the previous year. This was the largest absolute increase among the coal-producing provinces.

In Shaanxi province, coal production rose by 8% or 34 Mt. In late August, operations were hampered when a Covid-19 outbreak forced the local government to suspend more than 90% of mining capacity in Shenmu county, a key thermal coal-producing region in Shaanxi province. At least 60 of the 81 private coal mines with a capacity of ~80 Mtpa were shut down. In 2021, the Shenmu county produced ~310 Mt. To curb coal production, the local government of Yulin, another large coal-producing city in Shaanxi, decided to stop

using coal sales licences. The licences, which limit the supply of coal, were introduced in 2006 with the aim of curbing illegal mining activities, producing beyond the licensed capacity and improving the safety of coal mining and transportation. In relative terms, coal production increased the most in Xinjian province (+32%/68 Mtpa). By mid-September, 13 new mines had been added in the province with a total capacity of 69 Mtpa, which could be further expanded.

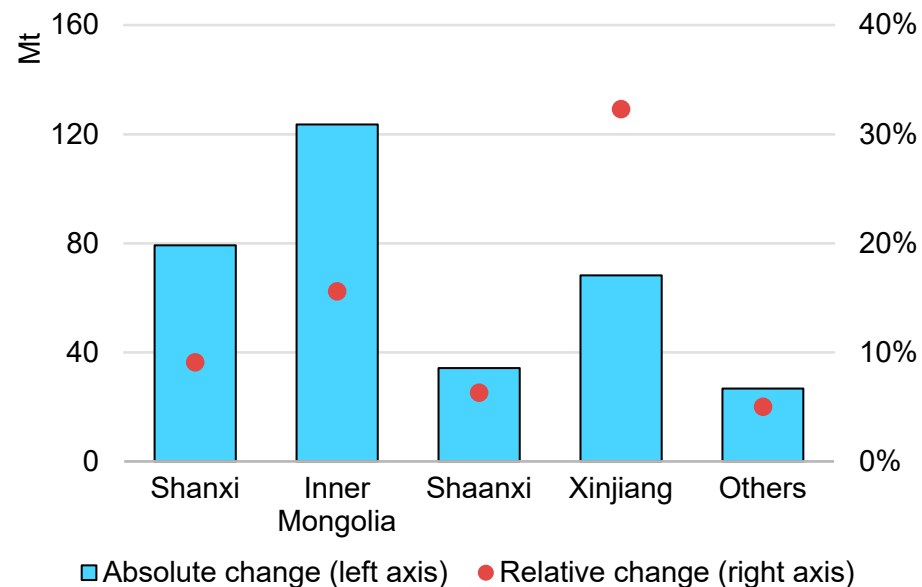
China's coal production by month, 2016-2022



IEA. CC BY 4.0.

Source: National Bureau of Statistics of China (2021), [Statistical Database](#).

Year-on-year change in China's coal production by region, January to September, 2020-2021



IEA. CC BY 4.0.

Source: National Bureau of Statistics of China (2021), [Statistical Database](#).

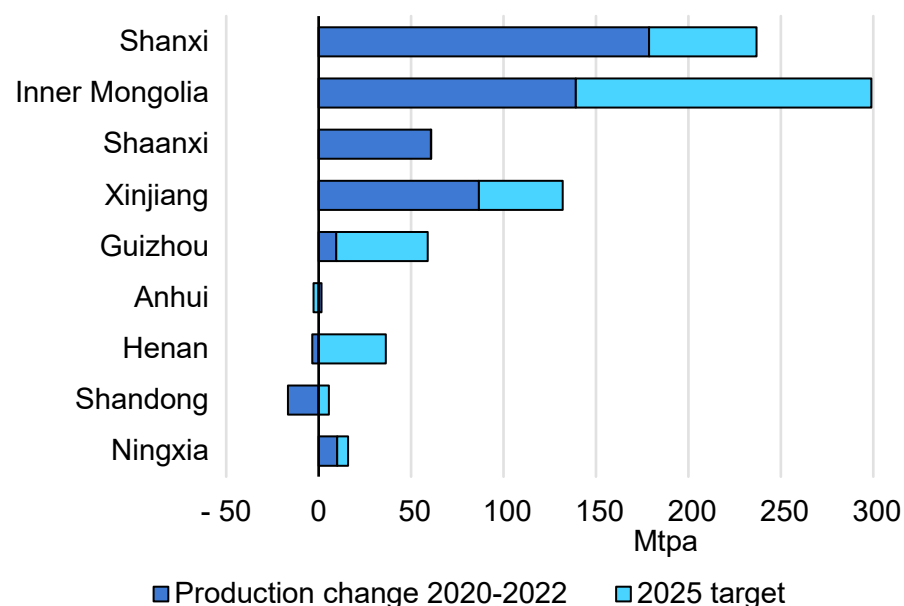
China's coal provinces are on track to exceed their 2025 production targets

The 14th Five-Year Plan sets out China's economic development goals for the 2021 to 2025 period. The plan aims to balance the environment, energy security and affordability in its development strategies. Coal is seen as an irreplaceable source of energy for years to come, although China has committed to peaking its carbon emissions before 2030 and achieving carbon neutrality by 2060.

China has targeted a 1% growth rate in its annual coal consumption projections, to 4 200 Mt in 2025. At the same time, coal production is set to increase to 4 100 Mt, with the remainder to be covered by imports. However, China will most likely surpass this goal in 2022. We expect China's coal production to grow slower and peak next year before starting to decline slightly from 2024 on. As a result, China's 2025 coal production would be very close to the 2022 level of ~4 237 Mt.

Following the national plan, the provinces published their five-year plans, with most also targeting higher coal production. Of the nine largest coal-producing provinces, only Shanxi and Anhui intend to reduce their coal production. However, Shanxi has since revised its initial target of 1 000 Mt and is now aiming for production of 1 300 Mt in 2022. From January to September 2022, Shanxi's coal output increased by 179 Mt compared to the same period in 2020. Three major coal-producing regions, Inner Mongolia (47%), Shaanxi (100%) and Xinjian (66%), have already achieved their targets to a large extent.

Planned and realised changes in China's mining capacity by region, 2020-2025



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Note: The 2022 value represents the difference in coal production during the first nine months of 2020 and 2022.

Sources: National Bureau of Statistics of China (2022), [Statistical Database](#), and Provincial 14th Five-Year-Plans.

India pushes domestic production to reinforce its security of supply

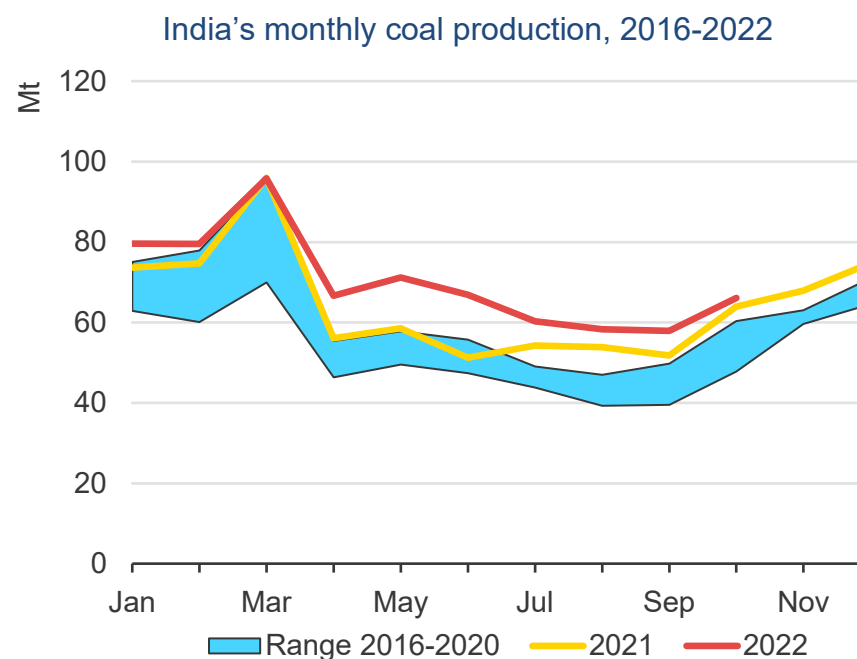
India's ongoing efforts to improve energy security and to reduce import dependency led to substantial increases in domestic production in both 2021 and 2022. India's coal production rose 6.3% to 805 Mt year-on-year (y-o-y) in 2021 and by a stronger 11% to 893 Mt this year.

In recent years India has improved coal availability significantly in a bid to end historical shortages. Nevertheless, despite higher coal production, the country again faced significant coal shortages when several factors coincided in August 2021. Against the backdrop of surging demand due to the post-pandemic economic recovery, supplies were disrupted by heavy monsoons in major mining regions and high prices of imported coal led to liquidity problems resulting in insufficient stock build-up at power plants relying on imports. All combined created an acute supply shortage.

India's coal sector can be divided into three categories: public, captive, and commercial mining. Three state-owned coal mining companies - Coal India Ltd (CIL), Singareni Collieries Company Ltd (SCCL) and NLC - conduct public mining. CIL, the largest coal mining company in the world, accounted for ~77% of the country's production in 2021, and SCCL, the second-largest producer in India, for another 8%.

Captive blocks are industry-owned mines to meet companies' self-consumption, while commercial coal blocks are auctioned by the government to private mining firms for commercial coal sale. The

scale of captive and commercial mining, while still comparatively small, is expected to increase quickly. In the first half of 2022, coal output of these mines jumped by more than 50% compared to 2021.



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Source: IEA based on McCloskey (2022). [McCloskey Coal, Metals and Mining Service](#)

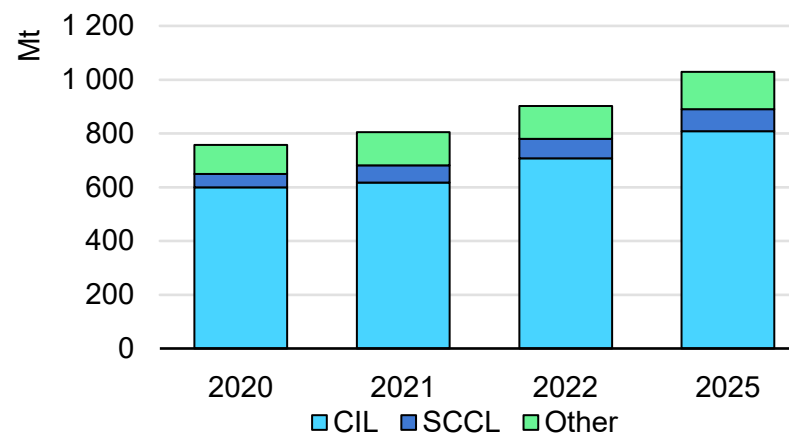
The government's intentions to reduce import dependency will continue to drive coal production growth over our 2022-25 forecast period. Coal-fired generation is India's most important source of electricity, providing about 73% of electricity demand. To achieve production growth, the Indian government has issued a blend of push and pull measures in recent years. On the one side, the government is penalising underperforming power plants and stipulating fixed coal inventory levels at power plants. On the other side, the government pushes the supply up. It permits captive mines to sell up to 50% of their production and to blend up to 30% of imported coal. Moreover, it dedicates railway capacities to coal transport, grants additional production increases to approved expansion projects, and temporarily prioritises thermal coal access for power generation over non-power uses. Addressing increased import prices, the Indian government implemented directives to improve the liquidity of power plant owners.

Additionally, the Indian government is about to issue a coal logistics policy. It targets a multimodal coal infrastructure that keeps up with the increasing coal demand and the domestic production growth while reducing transportation costs. Funded by CIL, railway projects in India's mining belt will be implemented to improve supply chains by enhancing the coal evacuation from mines. The planned projects are expected to increase the coal evacuation capacity of a central railway line to about 125 Mtpa.

India's domestic supply is forecast to continue to grow until and beyond 2025 in line with the steady increase in demand while also striving to reduce import dependency. Total production will surpass

1 000 Mt in 2025, totalling 1 021 Mt. Almost all of the coal production will be thermal coal, mainly for power generation. The state-owned company CIL is expected to contribute substantially to overall domestic production.

India's annual domestic coal production by company, 2020-2025



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Sources: McCloskey (2022), IEA estimates.

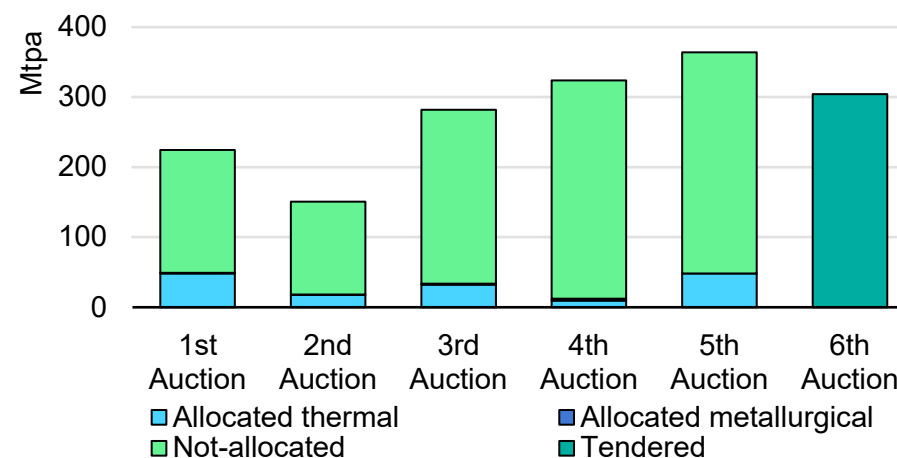
Commercial mines – another important pillar of coal supply for India

Commercial mining is the third pillar of the strategy of the government to boost India's domestic coal production. A special provision to reform the Mining Act in 2015 paved the way for the private sector to produce coal to be sold in the free market out of the monopoly of Coal India. In 2020 the first blocks for commercial mining were auctioned and awarded in November of that year. Since then the Indian government has held several rounds of auctions allocating an estimated cumulated capacity of 156 Mtpa thermal coal and 6 Mtpa coking coal for commercial mining. On 3 November 2022, the Ministry of Coal launched the 6th round of commercial mine auctions, including 141 coal mines, of which 71 are new mines, 62 are ones not awarded in previous auctions, and eight are ones for which single bids were received in the 5th auction.

In the fiscal year 2021-22, captive mines increased their production by ~30% to a total of ~90 Mt. By the end of the fiscal year 2022-23 (March 2023), a total of 48 captive and commercial mines will be in operation, with 11 new mines expected to come on stream. Five of these are located in Jharkhand and will be dedicated to power production by companies such as NTPC, Damodar Valley Corporation, and the Punjab Electricity Board, and to steel production by JSW steel and Araanya. For the ongoing fiscal year, captive and commercial mines are expected to raise their production considerably to about 140 Mt. All in all, numerous

additional commercial mines are about to be developed based on the coal mine tender. At this stage, however, it is difficult to assess how fast and how strong the ramp-up of production from commercial mines will be by 2025 and beyond. Vedanta has reported that it expects to bring into operation Odisha's Radhikapur (West), a block awarded in November 2020 in the first auction, during the fiscal year 2022-23.

Tendered Capacity of India's commercial mine auctions



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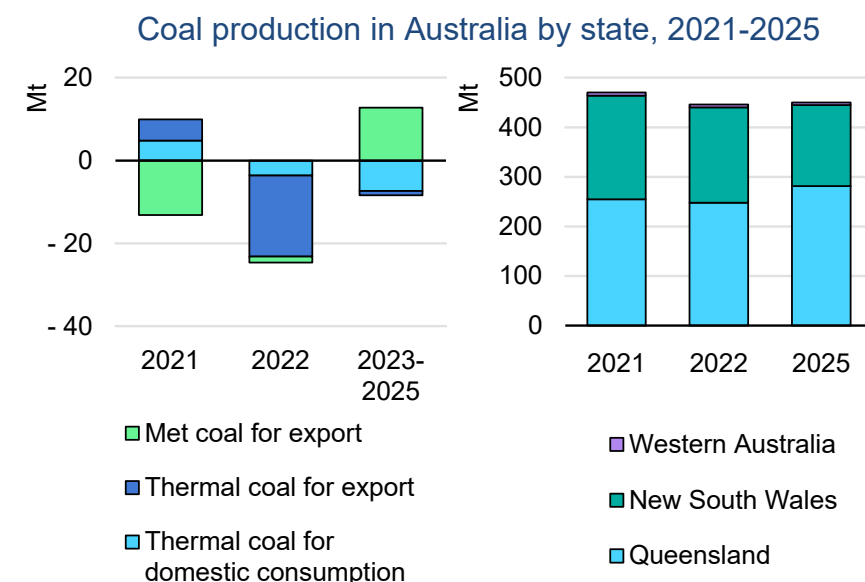
Australia's production constrained by several factors

In 2021, Australia's coal production declined marginally year-on-year, to about 470 Mt, due to adverse weather conditions caused by the La Nina weather phenomenon, the impact of the pandemic on the labour force and skill shortages hindered miners from expanding production and fully benefiting from rising prices. An increase in thermal coal output of about 10 Mt to 300 Mt was offset by a decline in coking coal production (-7%/ -13 Mt). Thermal coal production accounted for ~64% of Australia's coal output.

In 2022, Australia's coal production is expected to decline by 5.2% to 446 Mt, primarily due to weather conditions and the impact of the pandemic on labour supply, which continues to weigh on the country's coal industry. Bringing severe rainfalls, La Nina events affect coal production, railing and shipping in New South Wales and Queensland. After the last event ended in June 2022, the Australia Bureau of Meteorology declared another La Nina event in September, the third in a row. Australian meteorologists forecast that it will last until early 2023, peaking between September and November this year. Resulting flooding frequently causes production downtimes and damage to infrastructure.

The 0.9% decline in coking coal production is partly due to some miners switching to thermal coal by selling PCI and semi-soft coal on the thermal coal market or focusing on thermal coal seams in their mines.

Until 2025, Australia's met coal production is forecast to expand by 8% in total as new mines and expansions of existing ones are commissioned and constraining factors such as skilled labour shortages and weather conditions are overcome. However, thermal coal production will not return to the 2021 level, but will slowly and steadily decline. While pressure from legal disputes and regulators, as well as insurance conditions, have apparently eased during the current energy crisis, we do not expect financing conditions for thermal coal mining to improve.



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Source: Adapted from CRU (2022), Coal Cost Model (database).

Growth of Indonesian coal production underpinned by exports

Indonesia's coal production grew slightly to 569 Mt (+0.6%) in 2021 after a pandemic-induced slump in 2020. The La Nina event brought heavy rainfall to the major coal mining regions of Kalimantan and Sumatra. Furthermore, low heavy-equipment availability hampered the ramping up of coal production.

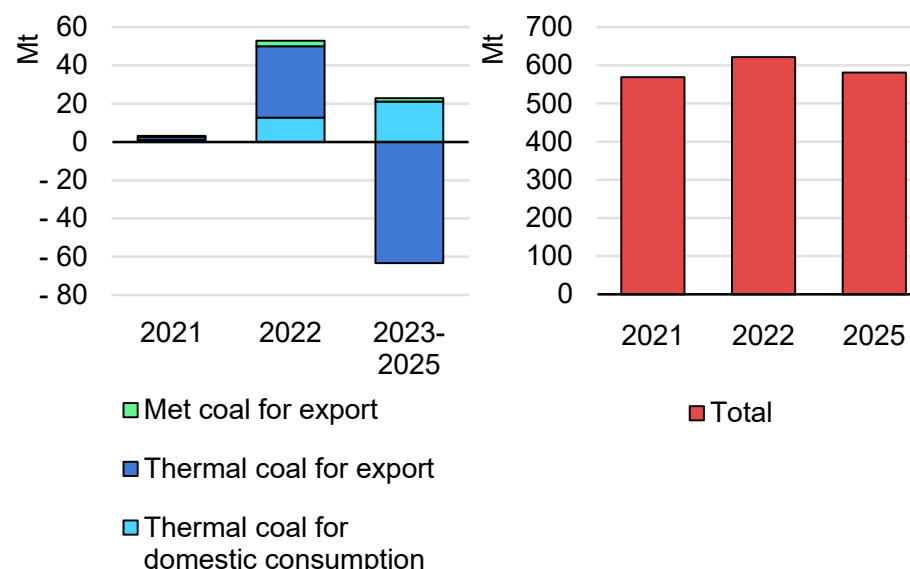
In 2022, the constraining factors on Indonesia's coal production remained largely the same: wet weather conditions, in particular in the Kalimantan region, infrastructural bottlenecks as well as a lack of mining equipment. Furthermore, sharply increased royalties and operational costs, coupled with the government's drive to channel more coal to the domestic market, are reducing incentives, especially for small miners to open or expand their coal production. Despite the limiting factors, for the full year, Indonesian coal production is forecast to expand by 9% to 622 Mt, driven by increased demand for Indonesian coal from abroad.

In the coming years, however, we expect Indonesian coal production to decline by 2.2% annually on average as the import demand of the top export destinations, China and India, declines. Lower production will be partly offset by higher domestic coal consumption in the power sector. In total, we forecast Indonesia's production to decrease to 582 Mt by 2025.

Viet Nam's coal production grew by 8 Mt to 51 Mt in 2021, reducing its dependency on coal imports. In 2022, domestic production is forecast to rise further, mainly driven by the state-controlled coal

producer Vinacomin. We expect Viet Nam's coal production to grow continuously to ~57 Mt by 2025.

Changes in and total coal production in Indonesia, 2021-2025



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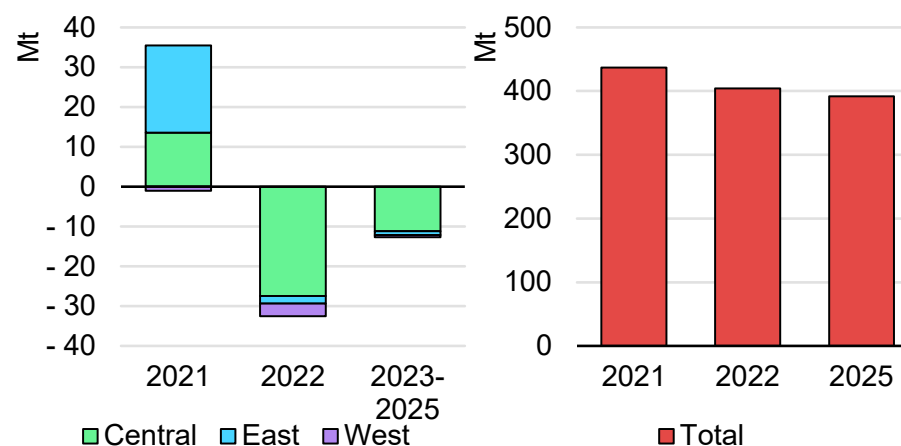
Bans and sanctions weight on Russia's coal production

Eurasia's coal production rose 4.7% to 564 Mt in 2021. The largest producer in the region is Russia, with a total production of 437 Mt (+9%), followed by Kazakhstan at a steady 103 Mt.

The region's coal production in 2022 and the near-term outlook are strongly affected by Russia's invasion of Ukraine and the related geopolitical tensions and economic sanctions. In 2022, Eurasia's coal production is expected to fall 4.6%, primarily driven by a 7.4% decline in Russia's coal production. The EU ban on Russian coal allowed companies to buy coal from Russia until April and to import it by 10 August. Since then, Russian producers who were focused on the European markets have encountered problems redirecting their supplies to other customers, as railway capacity to the east is limited. The Kuzbass region recorded a 9%-slump y-o-y from January to August 2022. Led by reduced demand from Japan and Chinese Taipei, exports to Asia also dropped in the first half of 2022.

According to the country's economy ministry, Russia's coal production is expected to decline in 2023 by another 9% before production resumes growth again in 2024. Even though we believe that inner-Russian infrastructural bottlenecks will be resolved by 2025, we expect the country's coal production to fall by 3% in total until 2025 as import demand from China and India eases.

Russian change in coal production by region and in total, 2021-2025



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Source: Adapted from CRU (2022), Coal Cost Model (database).

Kazakhstan's coal production will rise to 108 Mt (+4.5%) in 2022 due to higher demand from Europe, especially Poland, to replace Russian coal. We expect Kazakh coal supply to expand by 3% to 111 Mt by 2025.

American coal producers struggle to ramp up coal production despite high coal prices

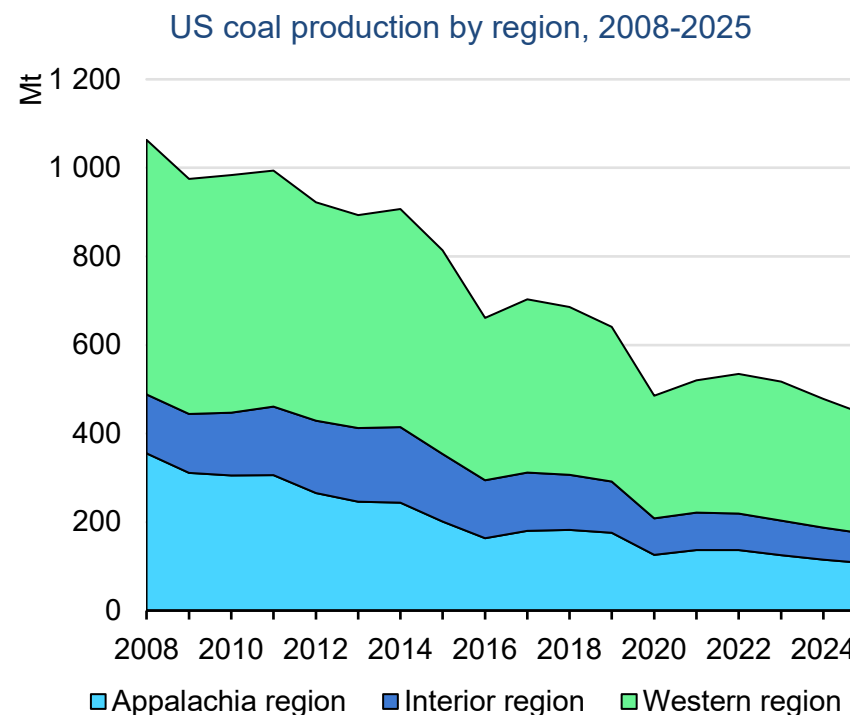
After years of decline and a 24% slump in coal output in 2020, US coal production recovered somewhat, with an 8% increase to 524 Mt in 2021, fuelled by strong domestic demand amid high gas prices and strong growth in GDP (+5.9%) and electricity consumption (+2.6%).

In 2022, coal production is expected to increase by a smaller 2%, despite high export coal prices, steep gas prices and low inventories. Therefore, the United States is not a swing supplier anymore. While coal production in the Western region will increase (+6%), output from the Appalachian region (-0.2%) and the Interior region (-2.8%) will likely decline.

Coal producers in Central Appalachian are struggling to ramp up production due to supply chain issues, investors refraining from the thermal coal mining business, and tight labour markets. Alpha Metallurgical Resources, for example, stepped back from producing thermal coal and refocused on metallurgical coal. Even though US railroads are recovering from the aftermath of Covid-19 by addressing their staffing shortages, thereby increasing rail volumes, transport infrastructure remains bottlenecked for US coal production.

In the coming years, we expect coal production to decline again as domestic demand for thermal coal continues to contract, the lack of investment persists and personnel shortages remain. Our forecast

for US coal supply sees an average annual decline of 6.1% until 2025, when production reaches 443 Mt.



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Source: IEA estimates based on US EIA [Coal data \(2022\)](#)

Mixed outlooks for Colombia and Canada

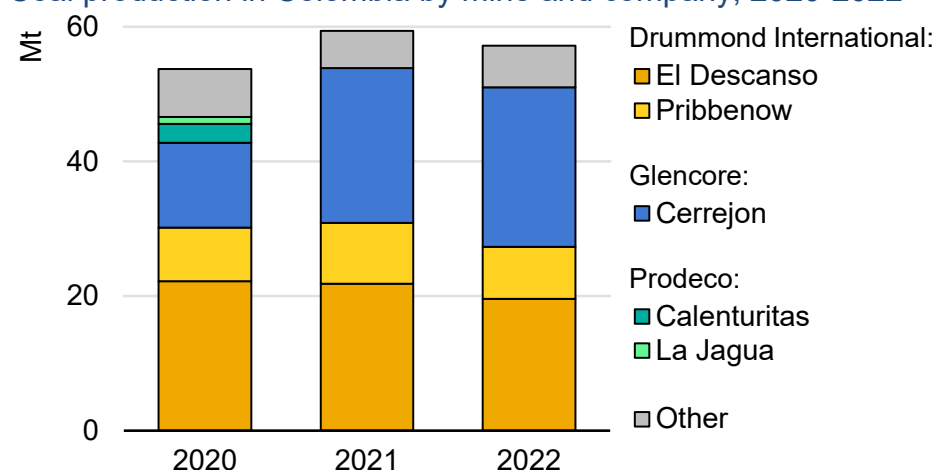
Canada's coal production rose 4.8% to 47 Mt in 2021, with most of the increase in met coal, which accounts for ~57% of the country's output. Canadian supply chains were affected by an 18-day strike of national rail workers in mid-2022 and another 3-week strike at the Westshore export terminals until mid-October. Despite these obstacles, coal production is expected to rise by 3.6 Mt in 2022. However, we forecast Canada's coal production to decline to 45 Mt by 2025 due to reduced thermal coal production in response to slower domestic demand.

Colombian coal production increased by 5.7 Mt to 59 Mt in 2021, powered by a rise in thermal coal output of 7 Mt, which offset a small decline in metallurgical coal of about 1 Mt. In 2022, the country's coal production is forecast to decrease by 3.7%, to around 57 Mt. Production from Colombia's largest producer Drummond is running short of this year's targets, which will more than offset a surge in output from smaller companies located in the inner provinces in 2022. Due to heavy rainy seasons, Drummond had to reduce its export projections for 2022. In addition, long-term contracts hinder Drummond from profiting from high coal prices. After increasing output by 11% in the first half of 2022, Cerrejon is facing infrastructure issues at Puerto Bolivar and significant production curtailments due to blockades and protests by Indigenous people in the second half of the year. Companies from inner Colombia are expected to increase their exports from 1.5 Mt

in 2021 to 6-7 Mt, profiting from a high willingness to pay on the demand side. The shipments are increasingly directed through Caribbean terminals such as Puerto Nuevo, Carbosan, Barranquilla, and Puerto Brisa.

By 2025, we expect Colombian coal production to decline by about 1 Mt due to reduced demand from key importers.

Coal production in Colombia by mine and company, 2020-2022



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Source: Adapted from CRU (2022), Coal Cost Model (database).

Increase in EU coal production is short-lived before returning to the downward trend

Coal production in the European Union rose by a robust ~10% in 2021, driven by the post-pandemic recovery and fuel switching from higher-priced natural gas. The two major coal-producing countries are Germany (38%) and Poland (32%). Smaller coal producers include the Czech Republic (9%), Bulgaria (9%), Romania (5%) and Greece (4%). About 83% of the EU's coal production is lignite.

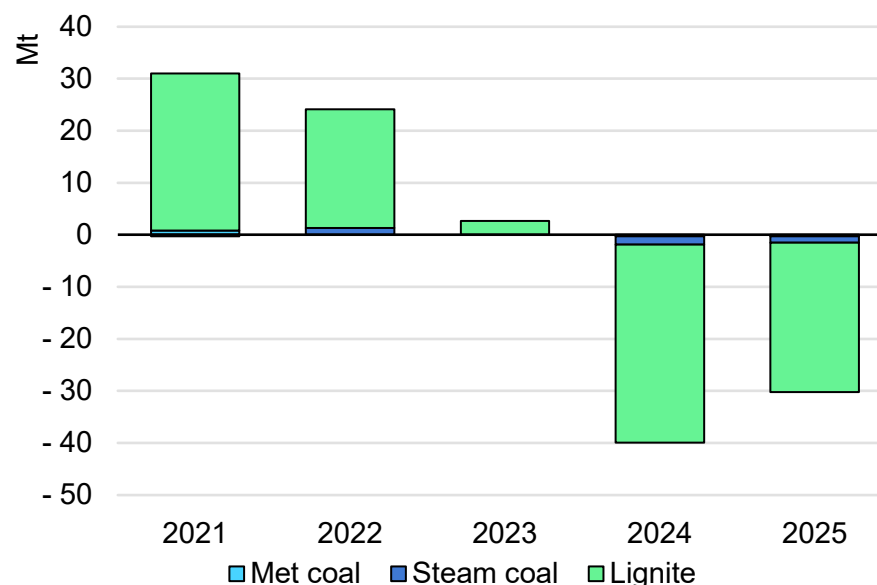
As a result of Russia's invasion of Ukraine and the subsequent energy crisis which has engulfed EU countries, we expect coal supply and demand to remain at higher levels in the coming years. Coal supply is forecast to increase by 7% to 357 Mt in 2022 and by a further 2.7 Mt in 2023.

Germany, the largest lignite producer, increased coal production by 18% in 2021 in response to stronger demand. In the current energy crisis, Germany is trying to expand its coal-fired power production to replace gas use. Instead of shutting down 1.6 GW of lignite-fired power plants by the end of 2022 as planned, the government has issued a waiver to allow production to continue until March 2024. By contrast, production in Poland is expected to remain constrained. Mines in Silesia need large investments and the mining company Bogdanka has ongoing problems maintaining current steam coal production.

We expect the European Union to resume phasing out coal from 2024, leading to a substantial production decline, particularly in lignite mining. Production of hard coal in Poland and smaller

volumes in the Czech Republic will ease only slightly. By 2025, EU coal production is forecast to fall 19% to about 289 Mt compared to 2022 levels.

Changes in coal production in the European Union, 2021-2025



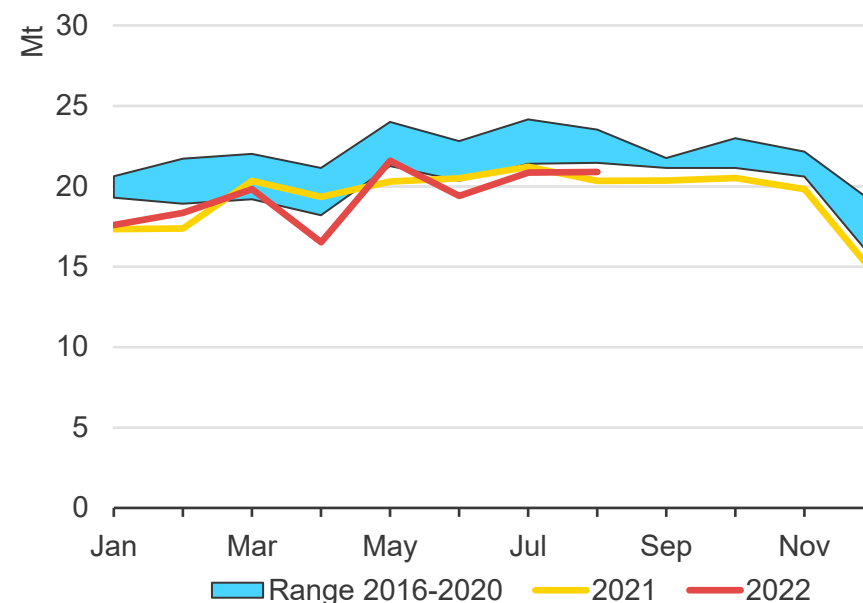
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South Africa's coal production drops with falling consumption and rail issues

South Africa is the continent's largest coal producer by far, with a share of ~93%. In 2021, South African coal production dropped by almost 8% to 229 Mt. The decline is expected to continue in 2022, falling another 3.3% due to weak domestic consumption and poor railway performance by operator Transnet Freight Rail. Key issues were large-scale cable theft (in total 1 500 km of cable have been stolen in the last five years), unavailability of locomotive and spare parts, vandalism and infrastructure bottlenecks.

Furthermore, derailments of wagons frequently block rail lines for multiple days. For example, in June rail lines were down for four days due to a derailment. From January to September, Transnet's rail deliveries to Richards Bay Coal Terminal were more than 30% below the historical average. In October, a ten-day workers' strike put additional strain on Transnet's transport capacities. On top of bottlenecks in export infrastructure, domestic demand has been weak. The state-owned power utility Eskom continued to experience frequent unplanned outages of coal-fired power plants, leaving some mining companies with no choice but to close their operations for care and maintenance, despite record-high prices in overseas markets. Furthermore, heavy rain negatively impacted the country's coal production in the first quarter. For the coming years, we expect some stabilisation of South Africa's coal production but no recovery. In 2025, we forecast total coal production of 217 Mt.

South Africa monthly coal production, 2016-2022



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High international coal prices have incentivised other Southern African countries, such as Mozambique, Botswana, Tanzania and Zimbabwe, to increase their coal production. Mozambique, the continent's second-largest coal producer, reported output of 11 Mt in 2021. Despite strike action in May 2022 at an Indian-owned coal mine, we expect the country's output to increase by 3.3 Mt in 2022 before beginning to decline to 11 Mt again by 2025.

Botswana is expected to increase coal production in the coming years as the government actively supports coal exploitation to diversify the country's economy from diamond mining. With high coal prices making exports economically viable, Botswana's private coal producer Minergy is operating at full capacity of 1.5 Mtpa in 2022. Shipments are made from Wavis Bay in Namibia and Maputo in Mozambique, crossing Zimbabwe. Multiple new projects are under development (see Chapter 5), some of which are expected to start production by 2025. Coal production is forecast to rise from 3 Mt in 2022 to 4 Mt in 2025.

Trade

Global trade rebounded on strong demand in 2021, but will decline through 2025

International coal trade started slowly recovering from the economic fallout from Covid-19 in 2021, with volumes rising to 1 333 Mt for the year⁵, accounting for ~17% of global coal demand. However, while the trade of thermal coal (which includes lignite and some anthracite) increased by 1.6%, metallurgical (met) coal trading volumes declined by 2.3%, reversing previous year's developments. The great majority of coal traded in 2021 (93%) is seaborne.

Traditionally, coal trade has been concentrated in the Pacific and Atlantic Basins, with South Africa and – to a lesser extent – Russia linking the two. However, international coal trade patterns shifted in recent years as Europe's import demand declined and South African exports moved to the Pacific and the Indian Ocean. In 2021, however, surging natural gas prices reversed this development as coal import demand in Europe rose. Imports by Germany (38 Mt) surpassed Türkiye (36 Mt) again to make it the largest importer outside of Asia Pacific, which accounted for 79% of global coal imports.

Indonesia increased its exports by ~7% to 436 Mt, holding on to its pole position as the world's largest coal exporter by weight in 2021.

Despite a 5 Mt decline in exports, Australia remained the second-largest exporter by weight at a total 370 Mt. China increased its imports by around 7% to 338 Mt and remained the largest importer. China drastically reduced imports from Australia due to a dispute between the two countries' governments, and instead raised supplies from Indonesia and Russia. India's coal imports fell about 6% to 207 Mt while Japan remained at about 173 Mt. The three countries make up for 52% of all imports.

In 2022, Russia's invasion of Ukraine led to a complex reshuffle of global coal trade. As a consequence of its aggression, wide-ranging international sanctions imposed on Russia, including the payment, shipping and insurance of energy exports, disrupted trade flows. In April, new purchases of Russian coal were banned in the EU while exports from existing contracts were halted on 10 August onward. As a result, Russian coal prices plummeted and international coal flows began to reroute. While Asian countries, such as India and China, increased their imports from Russia, countries complying with the ban have sought alternative supplies. High coal prices have incentivised small coal producers

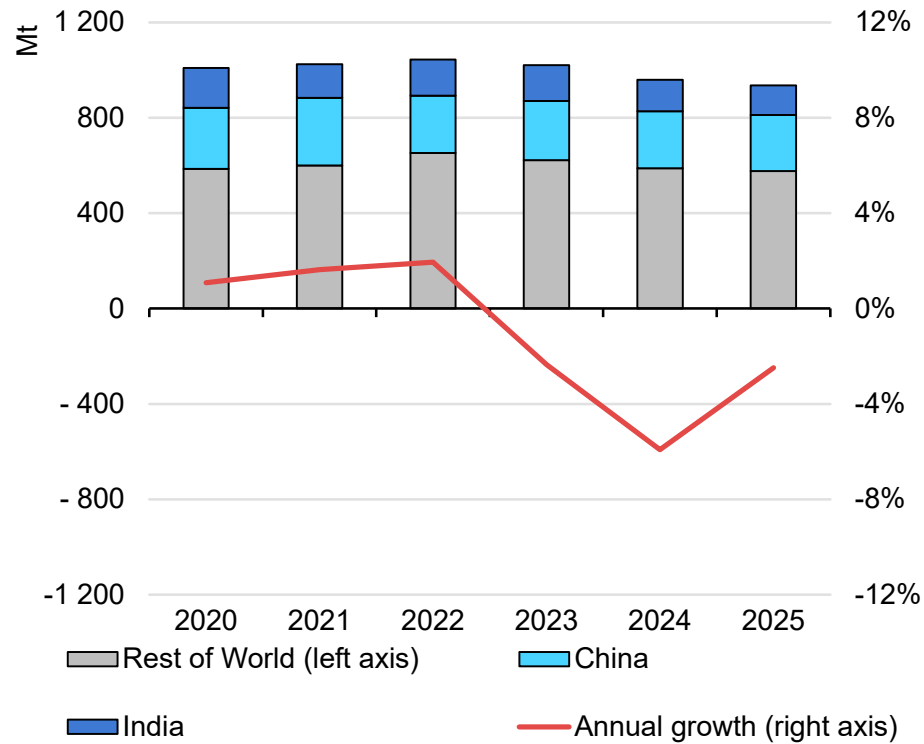
⁵ For various reasons, annual imports and exports do not match: for example, some exports reported in December may be reported as imports in January. Trade volumes in this section refer to exports.

such as Tanzania and Botswana to enter global coal markets. In total, we expect coal trade in 2022 to reach 1 351 Mt.

Through 2025, two fundamental developments will shape global trade. First, countries, particularly in Europe, will adapt to and overcome the current energy crisis and return to their coal phase-out paths. Second, continued efforts to secure energy supplies by China and India lead to higher domestic output and lower imports. Overall, we expect the thermal coal trade to sharply decline, by about 10% until 2025. By contrast, the metallurgical coal trade will continue to grow by ~6%.

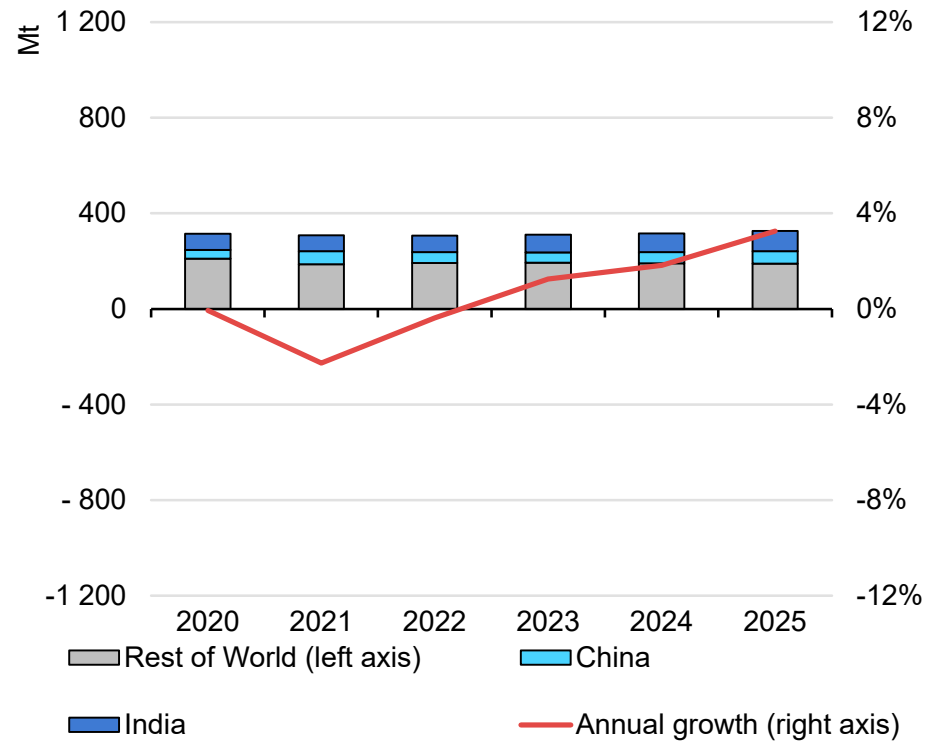
Thermal coal trade declines but met coal trade increases through 2025

Thermal coal trade developments (exports by destination), 2020-2025



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Metallurgical coal trade developments (exports by destination), 2020-2025



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Thermal Coal

Thermal coal trade recovered in 2021 from a steep decline in 2020

After a Covid-19-induced decline, thermal coal trade rebounded to 1 025 Mt in 2021, led higher as the economic recovery gathered pace and by rising gas prices. Approximately 94% of the trade was seaborne.

The share of the international coal trade in global coal demand decreased from about 16% to 15% as increasing imports were outpaced by growing demand, which was mainly met by higher domestic supply, particularly in China and India.

The Asia Pacific is the most important thermal coal trading region: it was the origin of ~63% of all exports and the destination for about ~82% of all imports in 2021. Indonesian thermal coal exports accounted for ~42% of the global trade, raising its market share from ~40% in 2020. Australia ranked second, with a market share of ~19%, followed by Russia at 17%, South Africa at 6%, Colombia at 5% and the United States at 4%.

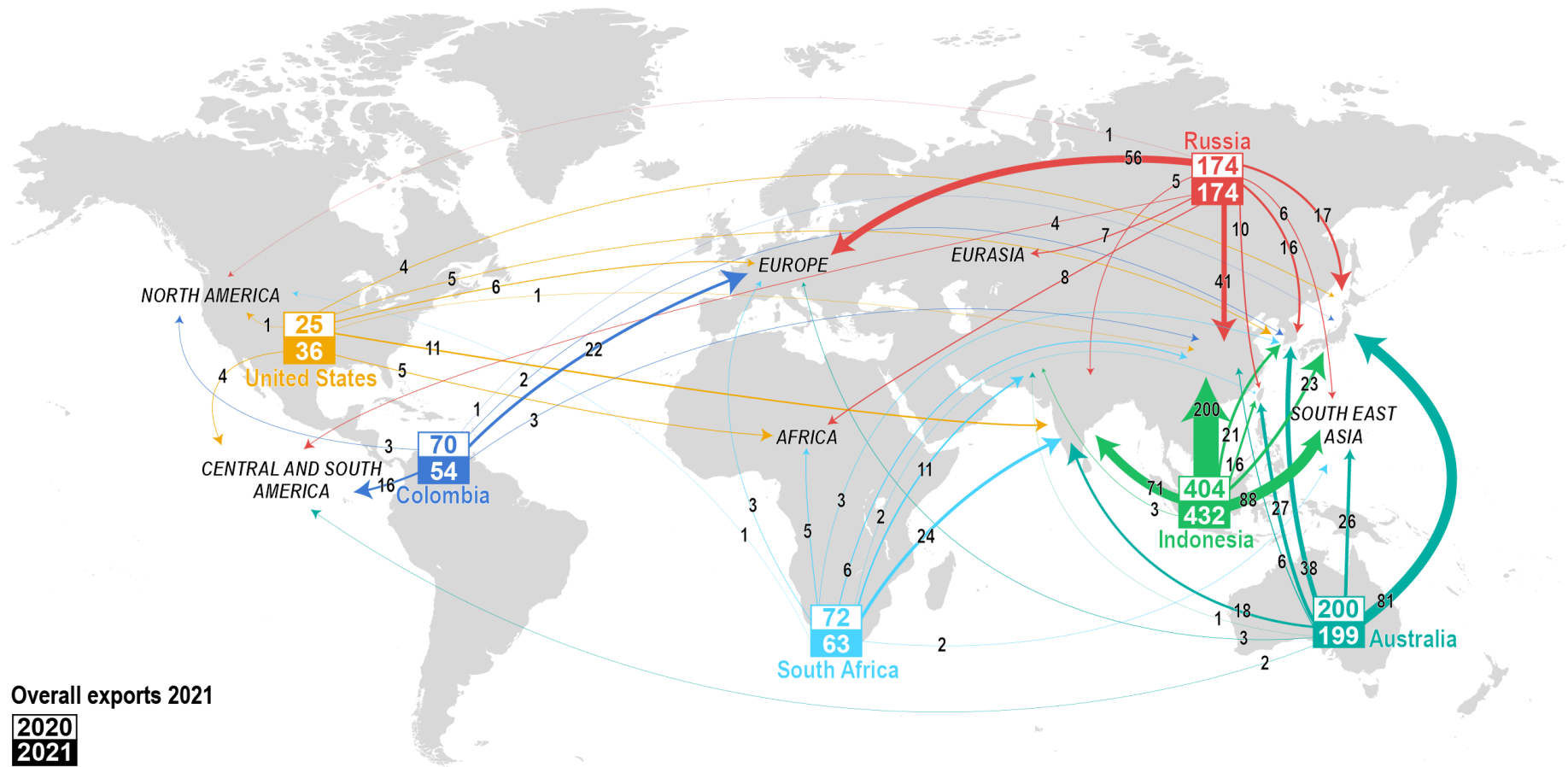
China remained the world's largest importer of thermal coal, increasing volumes by 16% to 284 Mt, followed by India and Japan. In 2021, India's thermal coal imports contracted 10% to about 141 Mt. This was partly due to higher domestic production and buyers' reluctance to pay higher prices, leading to severe coal shortages in the second half of 2021. Japan's imports decreased to about 129 Mt. Thermal coal imports in Southeast Asia fell by 11 Mt to 126 Mt, mainly driven by a sharp decline in Viet Nam. Imports by

the European Union rose strongly to 61 Mt (+25%) due to high gas prices.

Despite high coal prices, not all exporting countries were able to expand their exports. While Indonesia (+27 Mt) and the United States (+12 Mt) significantly raised volumes, Colombian (- 16 Mt) and South African (-10 Mt) exports declined sharply. Exports from Russia remained at the 2020 level. Indonesia increased its volumes to 432 Mt (+7%), returning to a growth trajectory, which was temporarily interrupted due to lower demand from India in 2020. By contrast, the rise in US exports may prove to be short-lived as higher exports came at the expense of falling stocks. The decline in Australia's exports is mainly attributed to the pandemic reducing labour availability and adverse weather conditions from a strong La Nina phenomenon, which brought heavy rainfalls and severe storms. Australia's thermal coal exports to China almost vanished due to an unofficial ban and were redirected to other Asian countries, such as Japan, Korea, and India. In Colombia, adverse weather conditions hampered some mining operations. South African coal exports were reduced by disruptions to the country's rail infrastructure caused by extensive cable theft, strikes and prolonged underinvestment.

Despite EU rebound, thermal coal trade remains concentrated in the Asia Pacific Basin

Main trade flows in the thermal coal market, 2021 (Mt)



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Note: Map values are based on available export data and do not necessarily match import numbers

Thermal coal imports are expected to contract through 2025

Imports of thermal coal are expected to decrease slightly to 1 035 Mt in 2022. Thermal coal imports account for 77% of global coal imports and for 15% of overall thermal coal demand.

The stagnation in 2022 is largely due to lower imports by China, which saw a significant ramp-up of domestic supply and a deceleration of demand growth. Strong increases in thermal coal imports from India and Europe offset the decrease.

China's thermal coal imports are forecast to decline by 44 Mt to 240 Mt in 2022. The country remains the world's largest importer of thermal coal by far, but its share will edge lower from 28% to 23%. In February, imports tumbled to 9 Mt, the lowest level since November 2020, but recovered thereafter and reached previous year's level in August. China significantly increased imports of Russian coal in the second half of the year as steep price discounts emerged following widespread Western bans and sanctions on the country's energy supplies. In August, China imported 6.6 Mt of Russian coal, a sharp year-on-year increase of 2.2 Mt.

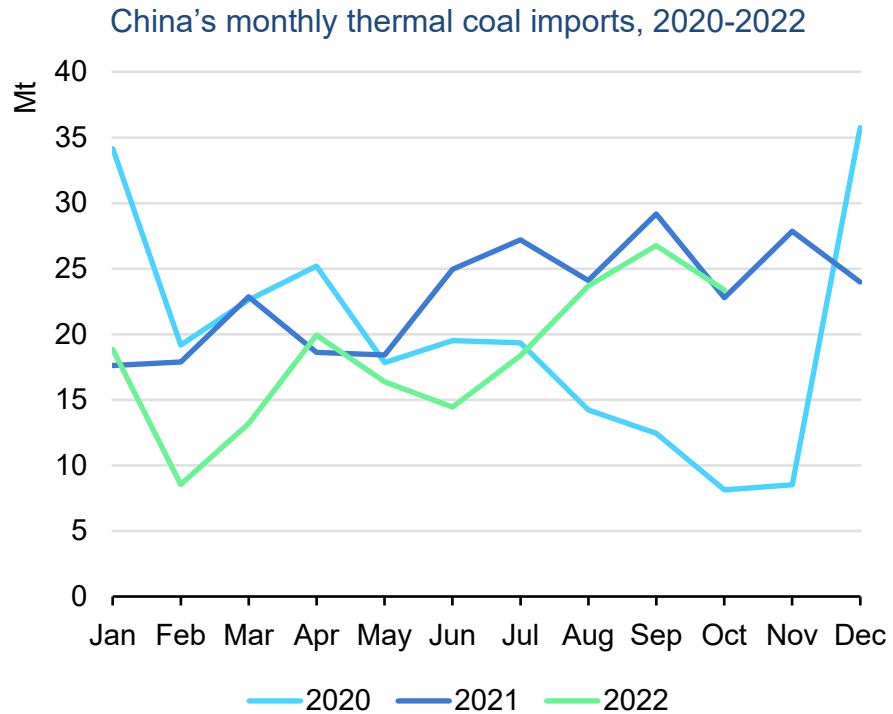
India is on course to increase thermal coal imports to 152 Mt, up by 11 Mt from 2021 levels, maintaining its position as the second-largest thermal coal importer. Higher imports were supported by the Indian government's new mandates obligating operators of coal-based power plants to increase inventories by importing at least 10% of their coal demand and easing the restrictions on coal blending. India's imports also rose to a multiple-year monthly high of

around 20 Mt in June as buyers ramped up imports of sharply discounted coal from Russia. Imports from Australia, therefore, halved during the first three quarters compared to 2021. Japan is forecast to import 140 Mt in 2022, an increase of 11 Mt.

Imports by Southeast Asia continue declining to 124 Mt (- 3 Mt/- 2.2%) owing to Viet Nam's weaker demand. EU imports, instead, are expected to rise to about 82 Mt, up by 20 Mt or almost 33%, as the demand for coal-fired electricity generation surged in view of high gas prices. The European Union will, thus, end up slightly below the level of Korea, which is forecast to increase thermal coal imports to 92 Mt (+2 Mt/~2.2%).

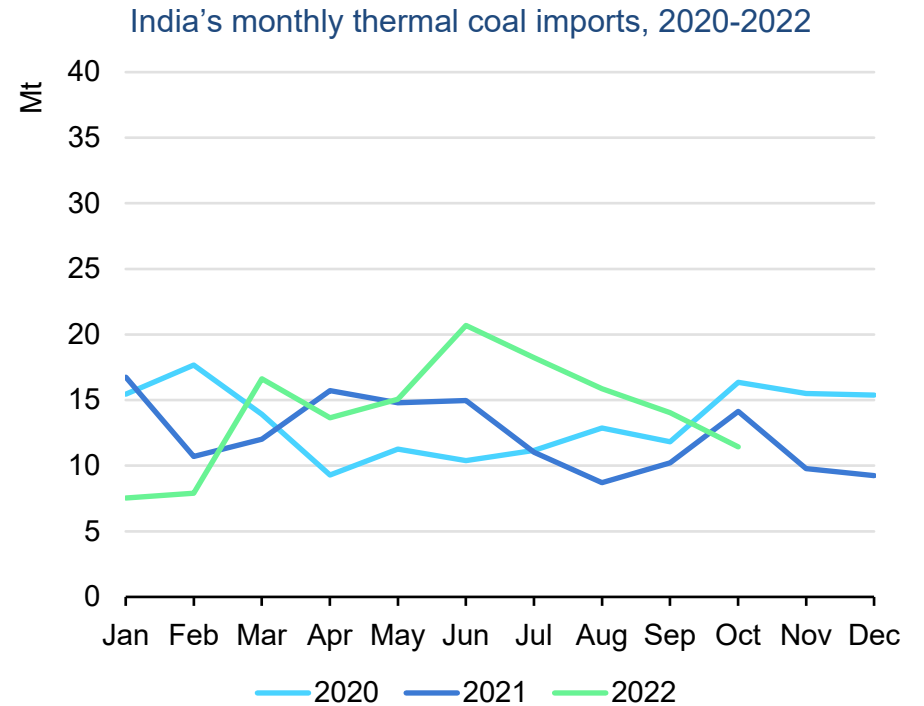
From 2022, thermal coal imports are expected to steadily contract to about 936 Mt in 2025, as China and India reduce their dependency on imports and the European Union turns away from coal-fired power generation. The European Union posts the sharpest decline in imports (-45 Mt/-56%), followed by India (- 27 Mt/-18%) and Japan (-24 Mt/-17%). By contrast, imports in parts of Asia are expected to rise. Excluding China, India, Japan and Korea, Asia's thermal coal imports are forecast to grow by 29 Mt to 231 Mt by 2025. The increase is mainly led by Southeast Asian countries such as Viet Nam, the Philippines, and Malaysia. Until 2025, the share of thermal coal in overall coal imports is expected to decline to about 74%. The majority of imports will remain seaborne (94%). Our forecast, however, face considerable

uncertainties in view of the ongoing energy crisis, the involved price development and the unclear prospects of the ramp-up of India's domestic supply.



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Source: IHS Markit (2022), [Coal Price Data and Indexes](#).

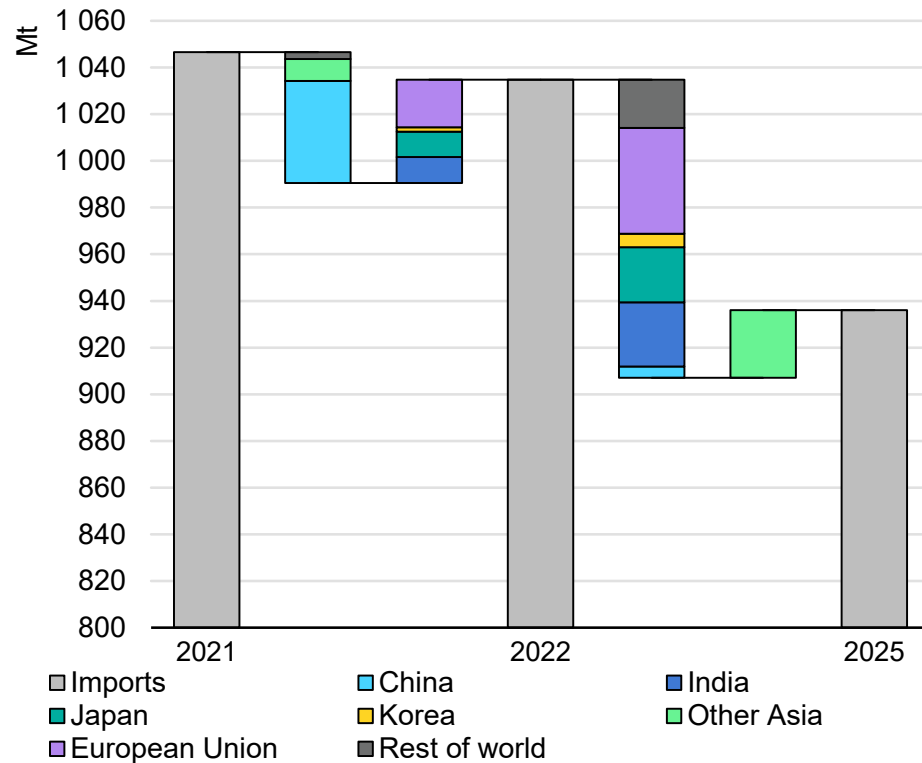


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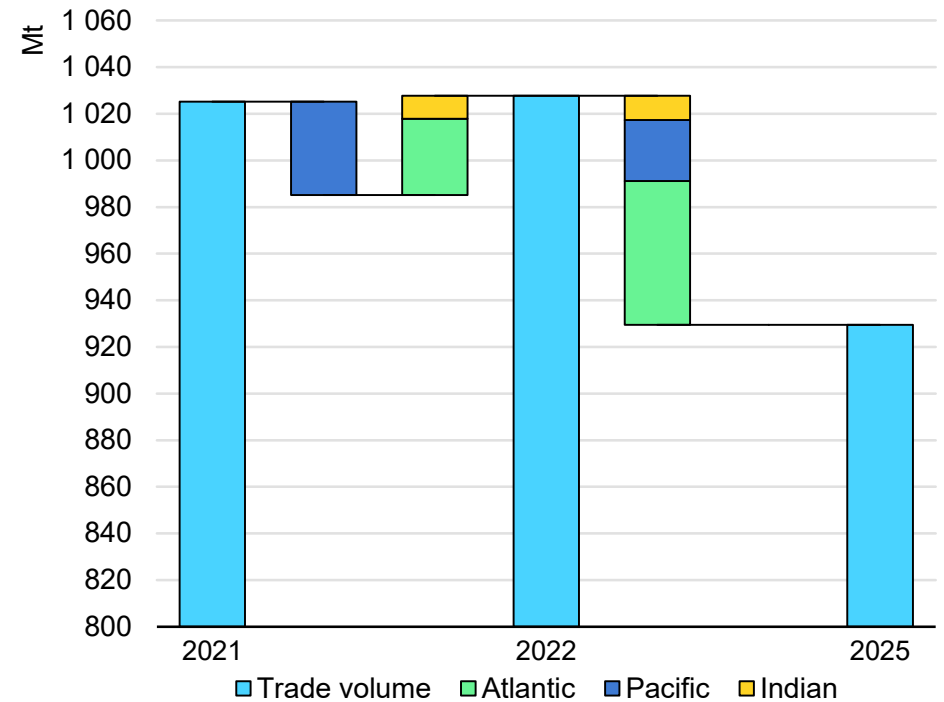
Source: IHS Markit (2022), [Coal Price Data and Indexes](#).

Thermal coal imports decline and uncertainties rise

Global thermal coal import changes, 2021-2025



Seaborne thermal coal trade changes by basin, 2021-2025



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Note: The "Indian" category covers India, Pakistan, Bangladesh and Sri Lanka.

Sanctions accelerate the shift of Russia's exports eastward

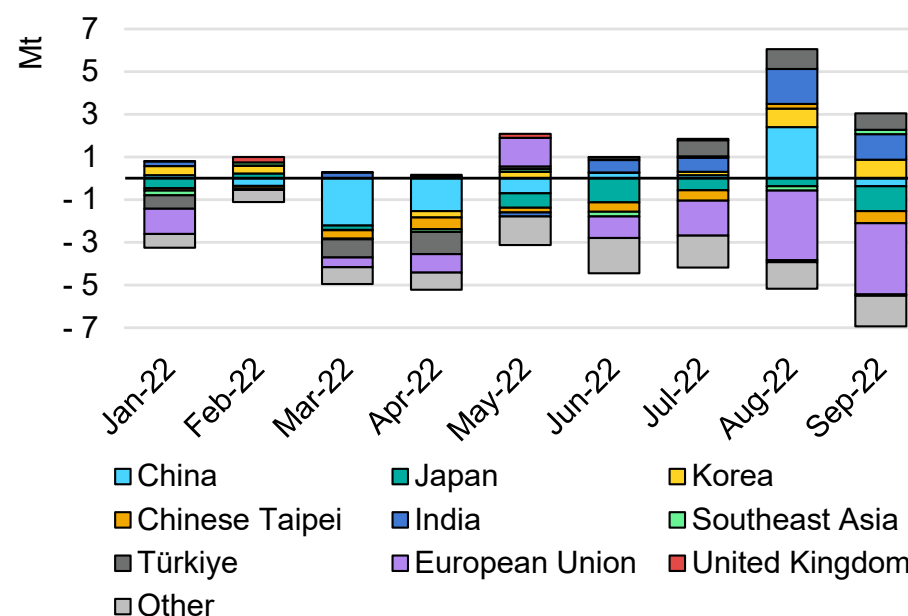
Sanctions on Russia's coal exports have upended traditional trade flows, especially to Europe, with shipments steadily moving eastward to countries not party to international agreements. The European Union's ban on Russia's coal exports was partially implemented in April, although arrivals were allowed until 10 August. Russia's coal exports to European countries started to decline in March before plummeting when the ban took full effect in early August.

During the first half of 2022, Russia's exports of thermal coal were already well below the level in 2021. When the EU ban came fully into force in August, European countries halted imports and exports increased to India, China, Türkiye and Korea, though the volumes only partially offset the plunge in exports to the West. Exports to Asia were constrained by limited rail capacity within Russia. In addition, sharply higher freight rates for Russian exports and securing financing and insurance became increasingly difficult. In total, we expect Russia's thermal coal exports to decline by 10% to 157 Mt in 2022. The lower volumes, however, largely reflect the end of land-based exports to Poland and Ukraine, which cannot be rerouted eastward in the short term due to railway bottlenecks.

Russia's thermal coal exports are expected to decline further in 2023, constrained by sanctions. At the same time, by the end of our forecast period, we forecast Europe's demand for coal imports to decline as the shift to cleaner fuels gathers pace. Although Russia

will probably improve existing export infrastructure eastwards, Asian import demand is forecast to decline mainly as a result of expanding domestic production in India and China. As a consequence, we expect Russia's thermal coal exports to decline to ~150 Mt in 2025, about 4.3% below the 2022 export volume.

Monthly y-o-y change of thermal coal imports from Russia by destination, 2022



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Source: IHS Markit (2022), [Coal Price Data and Indexes](#).

Indonesia proves to be the most flexible exporter of thermal coal

Indonesia's thermal coal exports are expected to reach 469 Mt in 2022, 9% above previous year. The country's coal exports account for about 7% of global thermal coal demand. Faced with a shortage in the domestic market, the Indonesian government imposed a ban on coal exports in January 2022. The ban was imposed in response to non-compliance by some coal producers with an obligation that requires producers to provide at least 25% of their output to the domestic market. Thermal coal exports in January plummeted to about 13 Mt, down 66% from year-ago levels. As Western countries refrained from buying Russian coal and China reduced its imports, Indonesian exports shifted towards Europe. In 2022, Indonesia is expected to post record-high exports to Europe. Compared to 2021, thermal coal exports increased from 0.2 Mt to 2.3 Mt during the first seven months of the year. Most of these shipments went to Italy, the Netherlands, Poland and Switzerland. With an expected growth of 37 Mt in 2022, Indonesia is underscoring that it has the most flexible capacity and is the only major exporter with capacity for a quick ramp-up, albeit mostly of low calorific value (CV) coal.

In 2022, Australia's thermal coal exports were heavily affected by inclement weather conditions and skilled labour shortages. Between January and August, exports were 8% lower than a year earlier. In view of the bad weather conditions experienced for much of the remainder of the year, we expect Australia's thermal coal exports to decrease by 15 Mt to 184 Mt.

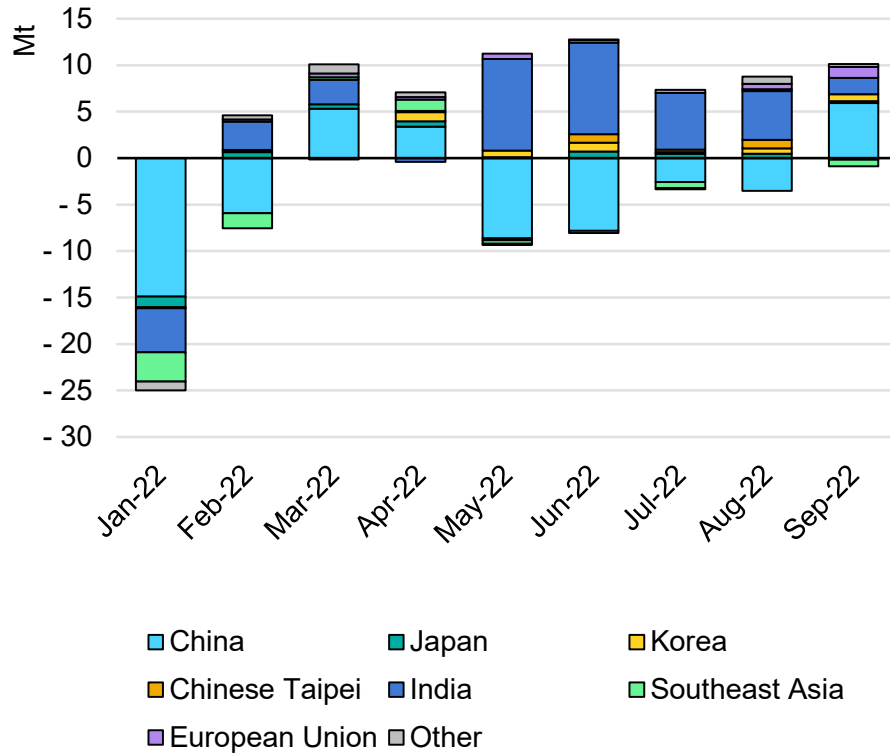
South African producers continue to struggle with severe logistical shortages. However, exports are forecast to recover from last year's decline to 69 Mt (+10%) in 2022. Benefiting from high market prices, other African countries, such as Tanzania and Botswana, entered the export market. Thermal coal exports from African countries other than South Africa are forecast to almost double to 11 Mt this year.

In the Americas, exports from the United States are expected to edge marginally lower, to 35 Mt (-2.8%). Colombia's exports are projected to fall for a second year in a row to 52 Mt (-3.7%), as smaller domestic suppliers' elevated exports do not offset the weather-related outages faced by Colombia's largest exporter Drummond.

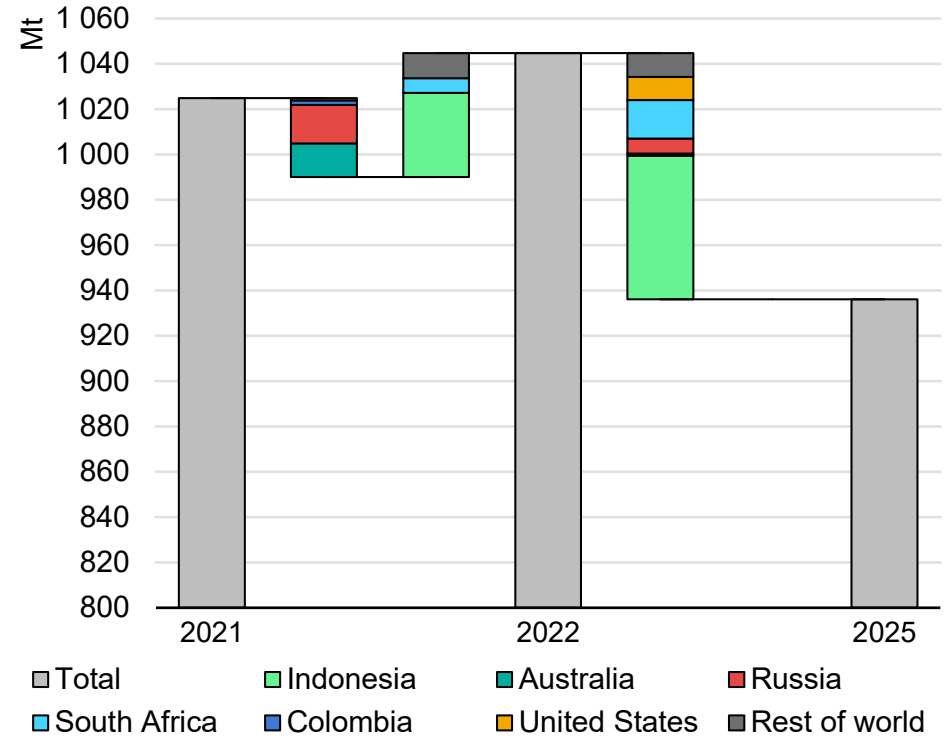
After rising in 2021 and 2022, global thermal coal exports will decrease continuously until 2025, to 936 Mt, which is 72 Mt lower than in Covid-19 year 2020. The decline is driven by strong increases in domestic supply in China and India, and lower coal-fired power generation in the European Union. The share of thermal coal trade in global demand, therefore, declines to about 13%. In total, all suppliers' exports decrease. While exports from Indonesia decline by about 14%, Australia's exports contract only marginally (- 0.5%). Russia's exports fall by 4.3% compared to 2022 while North American volumes decrease 28% by 2025.

All major supplier's thermal coal exports decline through 2025

Indonesia's monthly y-o-y thermal coal export changes by destination, 2022



Global thermal coal export changes, 2021-2025



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Source: IHS Markit (2022), [Coal Price Data and Indexes](#).

Metallurgical Coal

Met coal trade continues to be concentrated in Asia, with Australia leading exports

Although met coal just accounts for 23% of the global coal trade, international markets are much more important for met coal than for thermal coal. In 2021, imports of met coal provided ~29% (324 Mt) of global demand, of which about ~91% was seaborne.

Metallurgical coal exports declined for the second year in a row, falling to 308 Mt in 2021.

The met coal market is highly concentrated on the export side. Australia is by far the largest exporter with a market share of ~56% in 2021. It was followed by the United States (13%), Russia (13%) and Canada (9%). The four suppliers account for ~91% of all metallurgical coal exports.

About 72% of the met coal was imported by the Asia Pacific region in 2021. For years, China has been the largest importer of met coal, but volumes fell sharply (-25%) in 2021 due to a combination of weak steel production, a ban on Australian coal imports and Covid-19 restrictions to Mongolian exports. In turn, India moved to the top position, accounting for about 20% (66 Mt) of global met coal imports, followed by China (17%), and Japan (14%). The European Union accounted for about 15%.

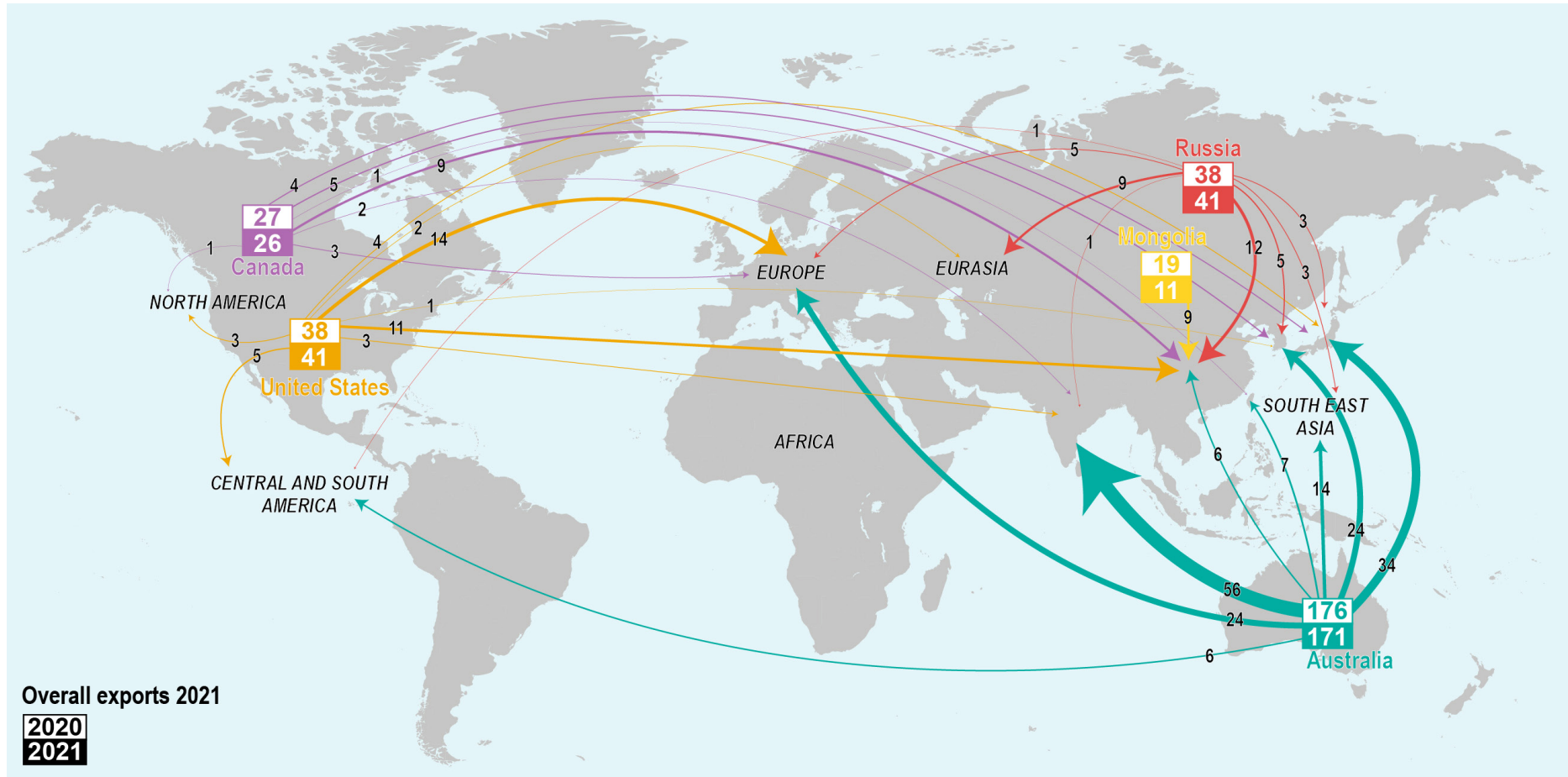
The largest relative increase in imports was in Southeast Asia (+42% /+7 Mt) due to strong industrial growth and a post-pandemic economic recovery. The European Union also imported 7 Mt more than in 2020, which is just a partial recovery since imports dropped by 9 Mt in 2020.

Due to an unofficial Chinese ban on Australian coal in response to diplomatic tensions in 2021, Australia's met coal exports to the country dropped dramatically, to 6 Mt from about 40 Mt in 2020. Australia's exports shifted to other Asian countries such as India (56 Mt/+21%), Japan (34 Mt/+13%), and Korea (24 Mt/+33%). Exports to the European Union also increased, by about 32% to 17 Mt.

China's met coal imports from Mongolia also fell sharply, from 19 Mt in 2020 to 11 Mt in 2021, as pandemic containment measures at the border curbed the truck-based exports. China filled the gap by increasing imports from Russia, the United States and Canada.

Australia dominates met coal trade

Main trade flows in the metallurgical coal market, 2021 (Mt)



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

China and India lead the growth in met coal imports through 2025

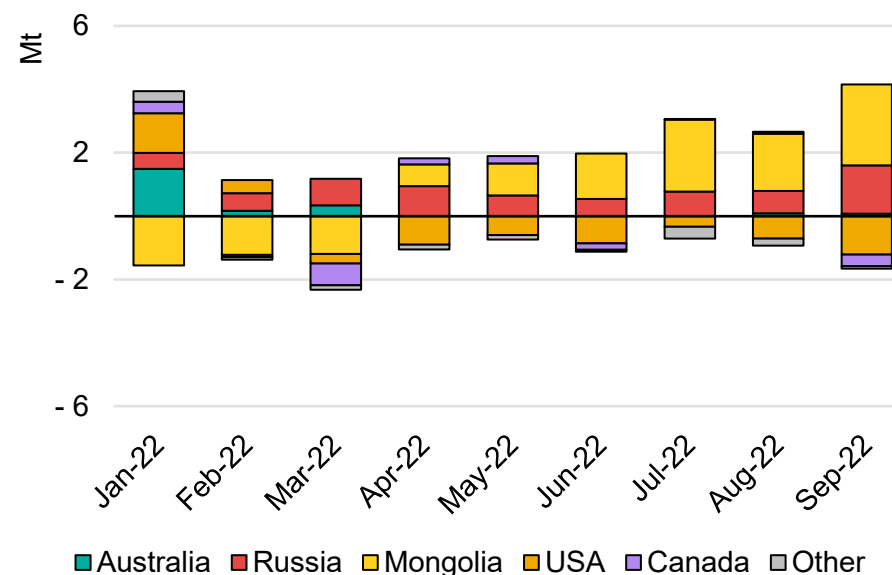
Global met coal imports are expected to decline 5.4% to 307 Mt in 2022, in large part because of the weaker economy, especially in China. The struggling construction sector weighed heavily on China's steel and therefore met coal demand. We forecast China's met coal imports to decline by 17% this year to just 45 Mt. While imports from Australia are still down due to the unofficial ban on Australian coal, China increased its imports from Russia and Mongolia. Mongolia completed a rail link to China this year, which allows the country to boost its exports. Until then, coal was transported by truck to China and pandemic containment measured at the border curbed the trade capacity.

Met coal imports of many other countries, such as Türkiye (-2 Mt), Korea (-1 Mt) and Germany (-1 Mt), also declined as high energy prices weighed on steel demand and production. Meanwhile, India's met coal imports are forecast to increase by ~4 Mt in 2022 as the economy performs comparatively well.

With the global economy expected to be back on a stronger growth trajectory by 2025, we forecast a 6.4% rise (+20 Mt) in met coal imports by then. The majority of the increase can be attributed to India (+15 Mt), followed by China (+7 Mt), where we expect

economic growth to accelerate and steel production to increase again. However, the gains are partially offset by lower imports from Japan (-4 Mt), Korea (-2 Mt) and the European Union (-3 Mt).

China's monthly y-o-y met coal import changes by origin country, 2022



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Source: IHS Markit (2022), [Coal Price Data and Indexes](#).

Despite the adverse weather conditions, Australia remains the leading met coal exporter

Met coal exports are forecast to edge marginally lower in 2022, to 307 Mt (-0.4%). Exports from Australia, by far the world's largest met coal exporter, are expected to decline by ~3% (-5 Mt), as heavy rainfalls disrupted coal mining and transportation, and, to a lesser extent, as some semi-soft coking coal and PCI was sold into thermal markets. Exports to India are set to fall the most, while exports to Europe increased slightly. On a global scale, the lower Australian exports are almost fully offset by increased volumes from Mongolia (+6 Mt), which partially recovered from a steep 8 Mt drop last year.

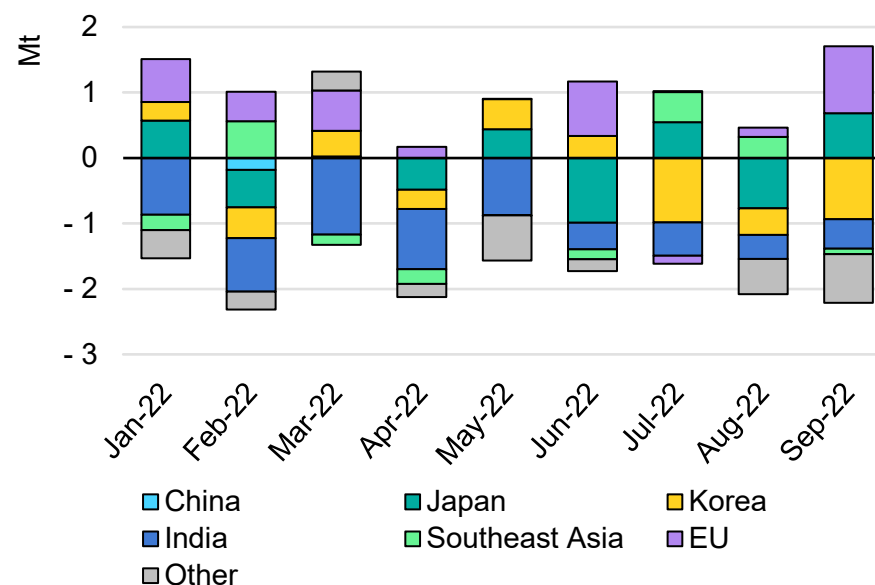
Among other exporting countries, we expect Canada (+2 Mt) and Mozambique (+1.5 Mt) to expand their met coal exports in 2022, while Russia's exports decline (-5.9 Mt).

By 2025, the international met coal market is forecast to grow by 20 Mt to 326 Mt (+6.4%). Most of the increase is expected to come from Australia (+13 Mt) as weather conditions normalise, improving mine and infrastructure performance. Conditions were poor for three consecutive years due to the La Nina weather phenomenon. In addition, met coal projects under development are expected to advance as they continue to find financing, insurance and government support - much more so than thermal coal projects.

Russia's met coal exports are forecast to recover by 3.6 Mt as eastbound infrastructure bottlenecks are removed. Met coal exports from countries like Mongolia (+1.3 Mt), Canada (+1.5 Mt) and

Mozambique (+0.3 Mt) are expected to continue the growth of recent years, while exports from the United States are forecast to decline by 1.2 Mt by 2025.

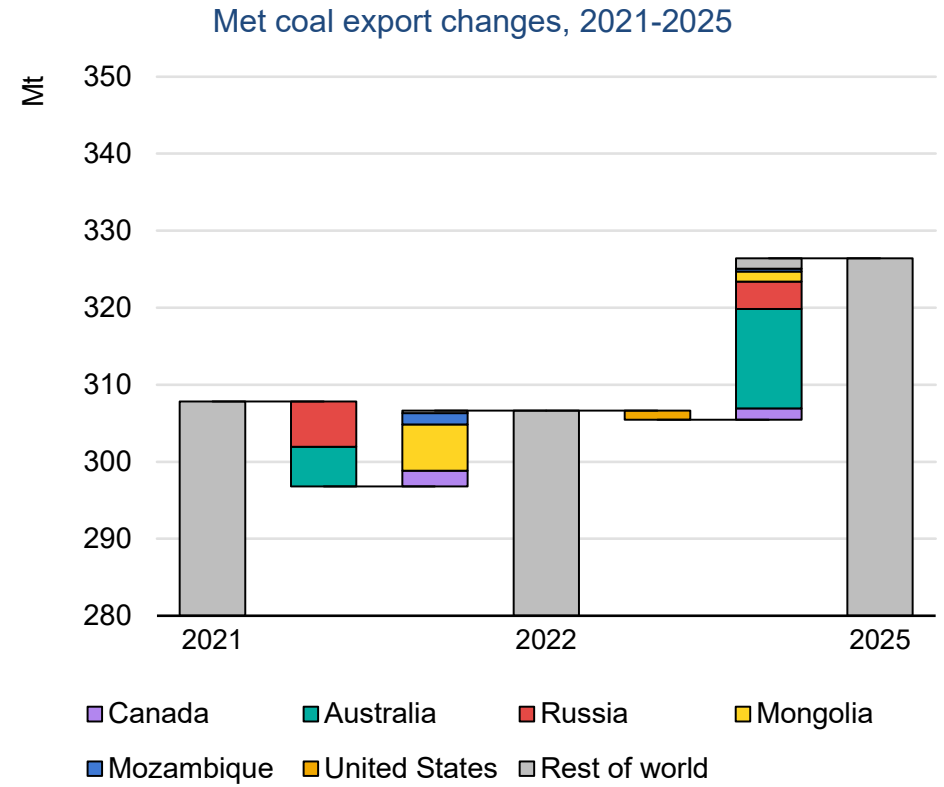
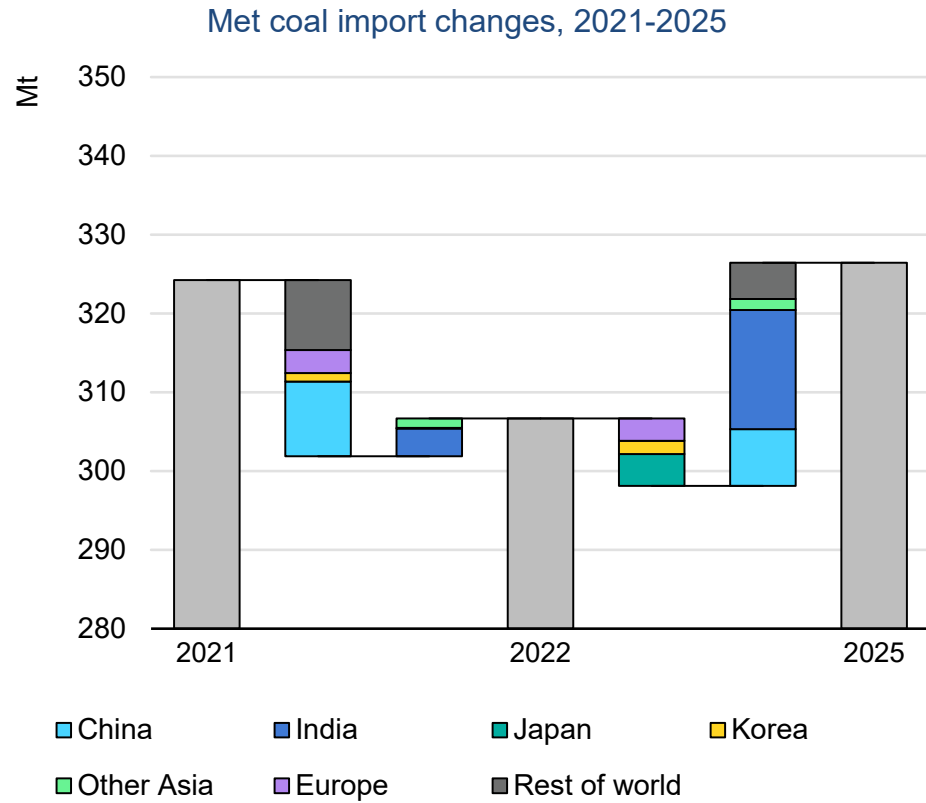
Australia's monthly met coal export changes by destination, 2022



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Source: IHS Markit (2022), [Coal Price Data and Indexes](#).

Growing met coal import demand met by Australia



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Prices and costs

Prices

International coal prices reach record highs - thermal coal even traded above coking coal

After falling to 14-year lows in 2020, thermal coal prices rebounded strongly in 2021. Most international thermal price indices reached all-time highs in October, reflecting a supply-demand imbalance following the post-Covid-19 recovery, with coal and electricity shortages in China and India, to name the most relevant cases. Newcastle free on board (FOB) prices for high-grade thermal coal with a calorific value of 6,000 kcal/kg and the API2 prices (index for coal deliveries to Europe) reached an unprecedented USD 253/t and USD 254/t, respectively. Prices eased again by the end of the year as China's efforts to increase production bore fruit, and coal inventories returned to normal.

In January 2022, spot thermal coal prices were initially pushed up when the Indonesian government decided to suspend exports immediately in response to domestic supply shortages. At the end of January, Australian high-grade coal was trading at USD 261/t, which was a new record at the time, while prices in Europe (API2) traded lower at USD 206/t.

Russia's invasion of Ukraine triggered prices worldwide to skyrocket to another record high of USD 380/t in March 2022. European thermal coal prices caught up again with Australian prices. By contrast, South China's import prices were less affected due to lower demand, enhanced domestic production and the opportunity to buy discounted Russian coal. With the end of the heating season in the Northern Hemisphere, global seaborne thermal coal prices

softened briefly in April. In May, European and Australian prices picked up again. Australian high-grade thermal coal prices climbed straight to the next record high of about USD 425/t in May as flooding in the country hampered coal production and transportation while utilities in Europe and Northeast Asia sought to obtain supplies of non-Russian coal.

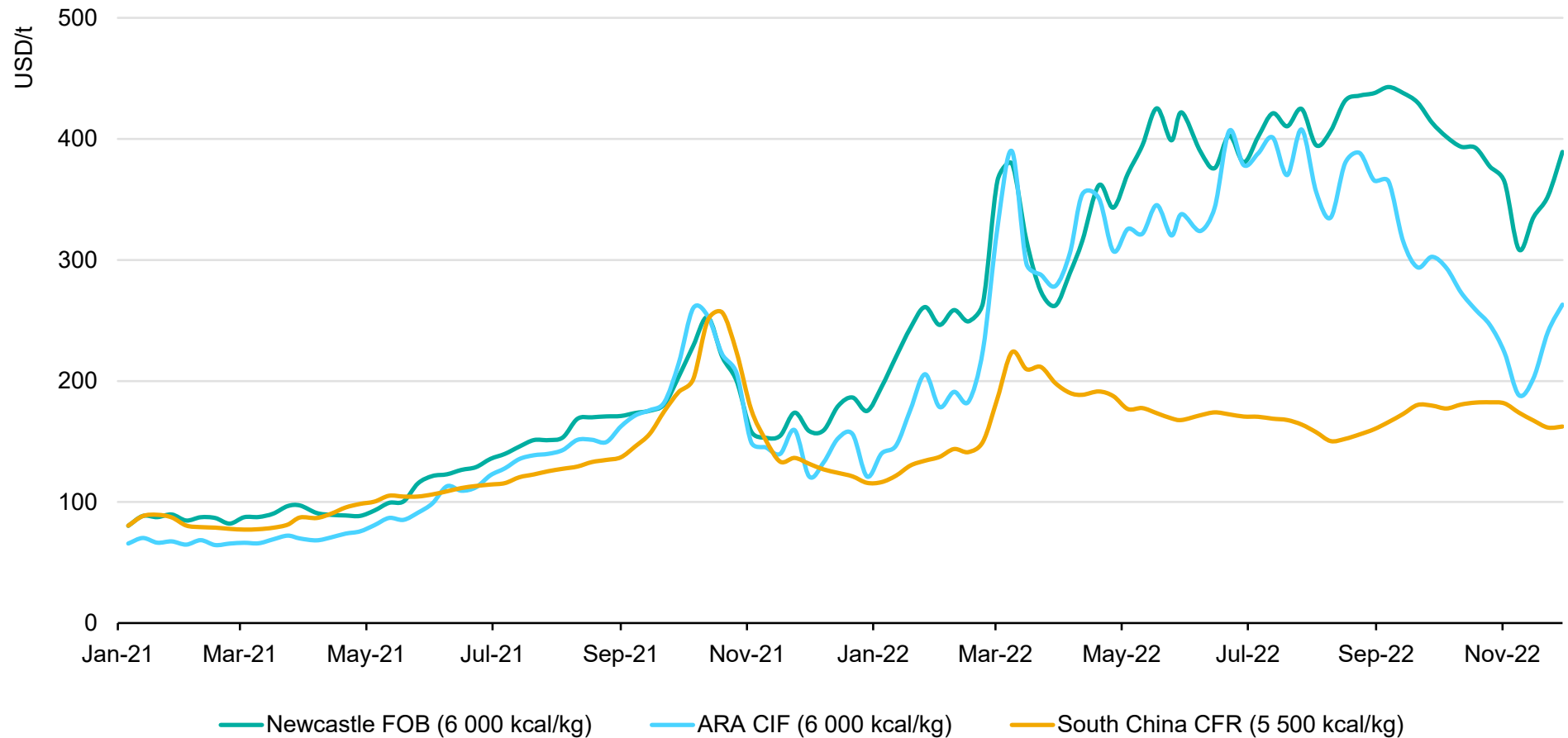
European import prices for thermal coal were lower than Australia's in early summer but jumped in July when Russia reduced gas flows to Europe. Rising fears Russia could cut off supplies altogether sent natural gas prices in Europe soaring, prompting the region's utilities to buy more coal and driving prices above USD 400/t. The price of Australian high-CV thermal coal continued its upward trend, reflecting strong demand from Japanese utilities reliant on this coal type and the inability of Australian exporters to significantly increase export volumes, partly due to adverse weather conditions. In September, high-CV thermal coal prices reached USD 443/t, the fourth record within 12 months. In Europe, gas and coal prices declined in September, as the continent appeared better prepared for winter than expected - in spite of a steep reduction in Russian gas pipeline deliveries to Europe. In November, European and Australian prices reversed their downward trends with the start of the heating season.

South China's thermal coal import prices trended downwards from March to August, as higher domestic production and moderate

demand led to lower import volumes. In addition, Chinese companies, like those in various other importing countries, are buying Russian coal at substantial discounts. In August and September, import prices in South China increased slightly due to stronger import demand. A severe heatwave and drought hit the country, reducing hydropower generation and pushing up coal demand for cooling.

International thermal coal prices climb from record to record, while prices in China diverge

Marker prices for different types of coal, 2020-2022



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Note: FOB = free on board. CIF = cost, insurance and freight. CFR = cost and freight.

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In a reversal of fortune, thermal coal has traded above coking coal since mid-2022

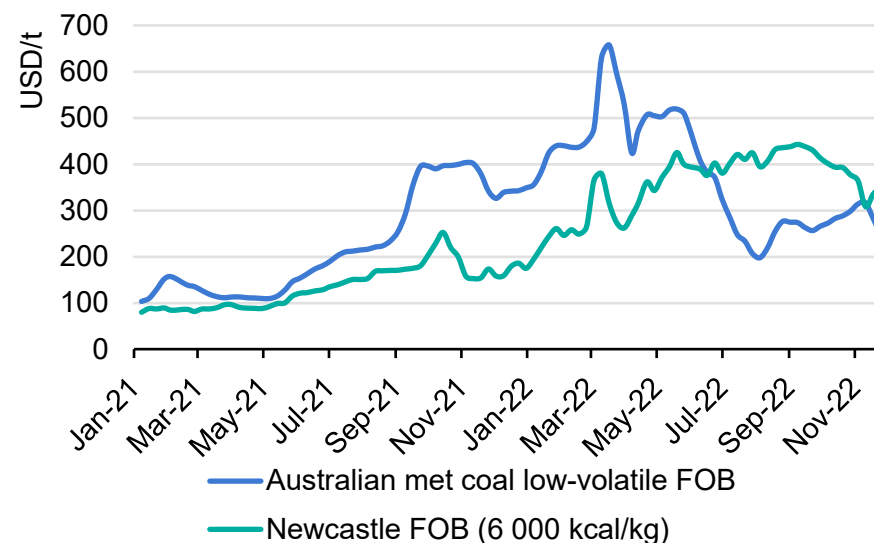
Coking coal prices surged in 2021, driven by global economic growth and, particularly, by strong demand from China, where the economy grew 8.1%. In the fourth quarter, coking coal prices reached record highs. For example, prices for Australian coking coal with low volatiles peaked at about USD 400/t before declining slightly as China's economic growth slowed.

In January and February 2022, coking coal prices rose further before the Russian invasion and associated uncertainty pushed prices to unprecedented levels. In mid-March, a tonne of Australian low-volatile coking coal reached a peak price of USD 658/t. Prices then eased but remained at a very high level of more than USD 500/t until the end of May.

Since June, prices have declined again due to fears of a global recession and the weak performance of China's steel industry. This led to an unprecedented situation: coking coal prices fell below high-CV thermal coal prices. Since coking coal has a higher energy content than thermal coal, coking coal could – theoretically – be blended with lower-grade thermal coal to replace more expensive high-grade thermal coal. To a small extent, met coal producers have started to switch to thermal coal by selling met coal products such as semi-soft coking coal and PCI on the thermal coal market and increasingly mining thermal coal seams in their mines. However, the potential for switching is limited as suppliers have to fulfil their existing contracts. In addition, technical limitations make it

difficult to use met coal in power plants. The price spread between the two types of coal has even widened further, highlighting the extraordinary situation in global coal markets. In early August, low-volatile coking coal prices reached an interim low point below USD 200/t before rising again to around USD 270/t, partly a consequence of the met-to-thermal coal switch. Until November, prices were on a converging trajectory before the start of the heating season reversed this trend.

Marker prices for different types of Australian coal, 2021-2022



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Note: FOB = free on board
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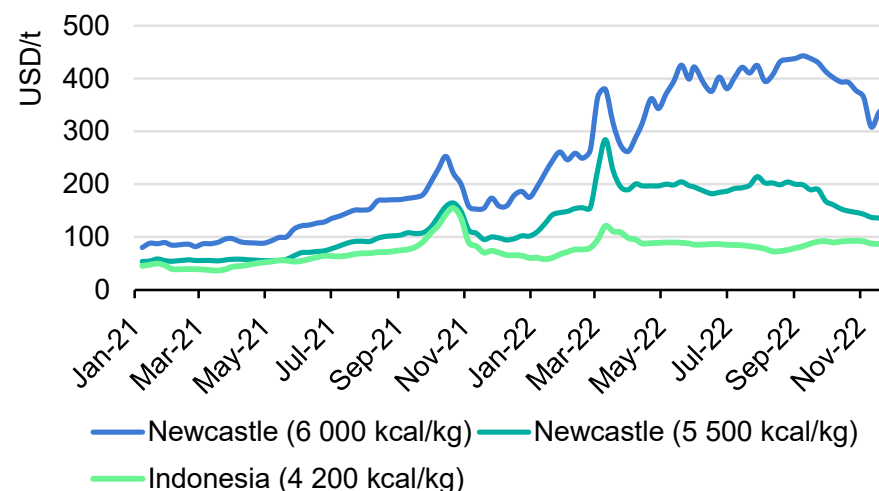
Higher-quality coal posted sharper price increases

Thermal coal traded in the Pacific Basin differs in quality. Coal can be characterised primarily by its energy content, the calorific value (CV). Although different types of coal can substitute for each other to some degree, they each represent separate market segments.

Prices in those market segments used to be strongly connected to each other. In the second half of 2021, when demand was high and supply was tight in China and India, prices in all market segments rose in parallel to record levels and then eased as China's imports fell by the end of the year.

In 2022, however, the price development has decoupled. The current supply strains in Europe and Northeast Asia are mainly affecting prices for high-grade coal. Australian thermal coal with a CV of 6 000 kcal/kg is trading for more than twice the price of coal with a CV of 5 500 kcal/kg. Japanese buyers, in particular, who are turning away from Russian coal supplies, have limited alternatives to buying Australian high-grade coal, as power plants and logistics are optimised for this type of coal. Simultaneously, the “La Nina” weather event brought adverse weather conditions such as heavy rainfalls and flooding to Australia, hampering coal exports. In comparison, prices for low-grade Indonesian coal have hardly changed since April 2022, mainly because Indonesian supply expanded and China's import demand was lower. Furthermore, competition from Russian coal exports, which trade at large discounts, increased.

Marker prices for different types of Australian coal, 2021-2022



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Note: FOB = free on board

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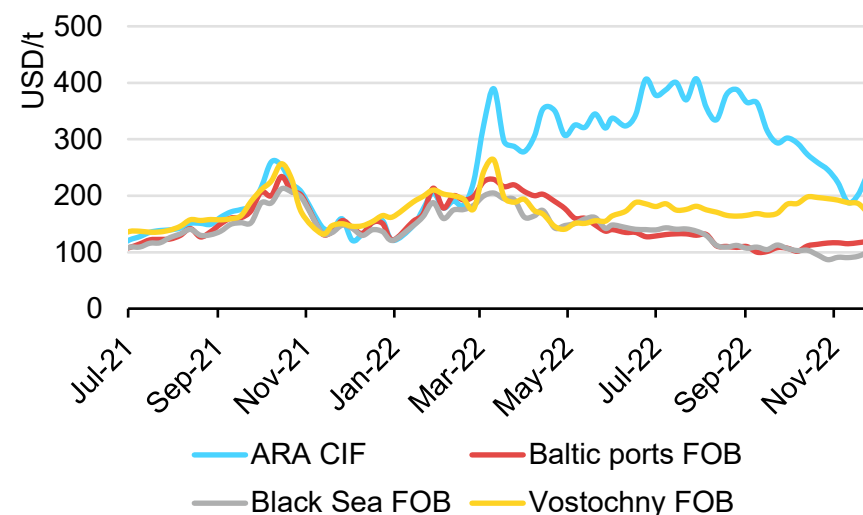
Big discounts for Russian coal find new buyers in Asia

Many countries and companies are hesitant to buy coal from Russia in response to the Russian invasion of Ukraine. Western sanctions, that include the exclusion from the SWIFT system, put a major hurdle in place for making payments. The United States announced a general ban on Russian coal in March, followed by the European Union, the second-largest importer after China, in April. Also, some Japanese and Korean utilities announced they have stopped buying Russian coal. Altogether, the European Union, Japan and Korea accounted for about 40% of Russian coal exports in 2021. Although the EU coal ban came only fully into force in early August, it immediately impacted spot prices. Russian coal prices have declined since March, while ARA (Amsterdam Rotterdam Antwerp) prices rose further. The discount for Russian coal at Baltic ports rose from 41% in March to 73% in September.

From March to June, the import ban put more pressure on export prices at Russia's Baltic ports and Vostochny, while prices at Black Sea ports, which mainly supply Türkiye, the Middle East, North Africa and India, were about USD 40/t higher. In the second half of the year, Western Russian prices fell by about USD 20/t in August when the EU coal import ban came into force. Prices at the Far Eastern port of Vostochny, instead, were pushed up to about USD 80/t above Western Russian prices driven by increasing imports from Chinese and Southeast Asian buyers. Prices even reached ARA levels, before the start of the heating season pushed

European prices and its premium on Russian prices. In the category of mid-CV coal (5 500 kcal/kg), firm demand from Asia meeting railway constraints drove coal prices at Far Eastern Russian ports above Australian prices in October, for the first time since February. In November, prices on a fob basis at the port of Vostochny settled at around USD 172/t, a premium of around USD 30/t to Australian prices.

European and Russian thermal coal (6 000 kcal/kg) price markers, 2021-2022



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Note: API = Argus/McCloskey's Coal Price Index. FOB = free on board. CIF = cost, insurance and freight.

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China's import price spread narrows on high domestic production and tight seaborne markets

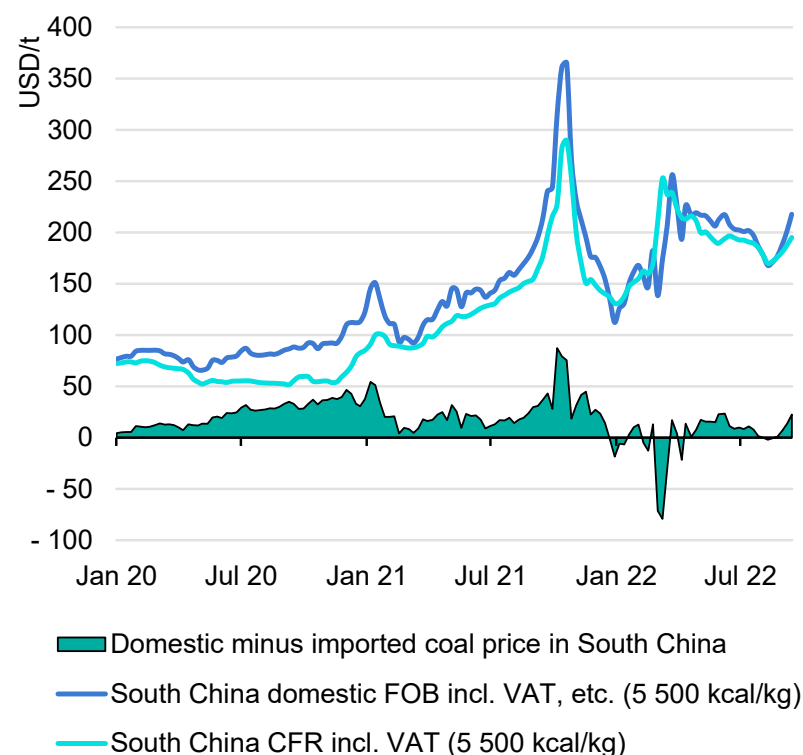
In recent years, China's policies to curb imports have led to a spread between domestic coal prices and prices in the Pacific Basin. The main driver has been China's import quotas, exact terms and conditions of which are unknown. Moreover, China introduced an unofficial ban on Australian coal in 2020, raising the premium Chinese buyers have to pay for domestic coal.

The price spread increased until 2020, reaching a peak of USD 47/t in December. On average, Chinese buyers had to pay a 40% premium to domestic coal on import prices in 2020. At the beginning of 2021, the price spread decreased as soon as China's heating season ended. In the second half of the year, China's coal supply could not keep up with demand, and import volumes and prices rose sharply. As a result, the price spread spiked to USD 87/t in October. Since then, China's supply has increased sharply and import demand has fallen - and with it the price spread. Rising demand in Europe kept seaborne coal prices high and caused the price spread to tip into the negative for the first time in December 2021.

In 2022, seaborne coal markets are tight due to insufficient supply, exacerbated by the Russian aggression in Ukraine and subsequent geopolitical tensions. At the same time, China has become less dependent on coal imports as domestic supply increases. As a result, the price spread between China's domestic coal market and

the Pacific seaborne coal market fell below zero several times, averaging only USD 1.60/t in the first nine months of 2022.

Price arbitrage domestic versus imported coal in China, 2020-2022



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Note: FOB = free on board; CIF = cost, insurance and freight; VAT = value-added tax.
Source: CRU (2022).

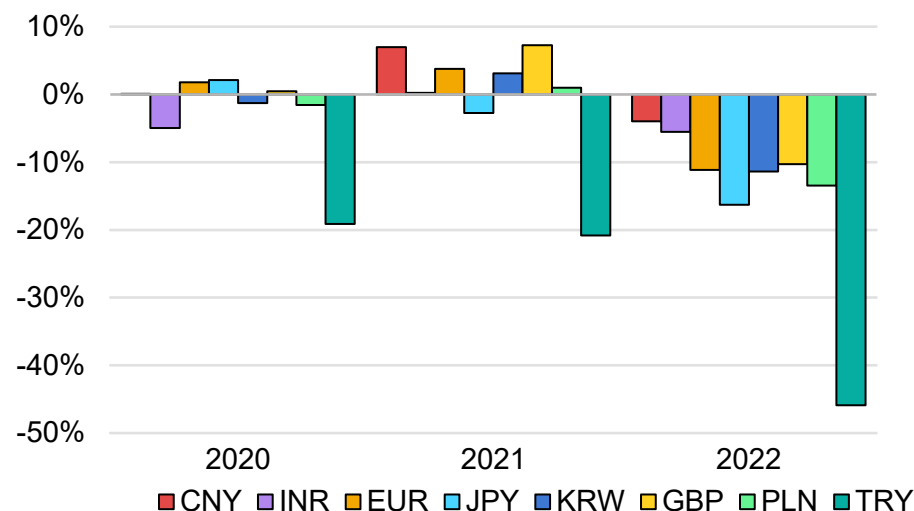
A strong appreciation of the US dollar makes coal imports even more expensive in many places

International coal trade contracts are negotiated mainly in US dollars. Therefore, the value of a country's currency against the dollar affects how affordable coal imports are. In recent years, the exchange rates of major coal-importing countries have fluctuated only slightly. Currencies such as the Chinese yuan, the euro, and the British pound appreciated in 2020 and 2021, primarily due to the Federal Reserve's loose monetary policy. One exception is the Turkish lira, which has depreciated sharply in recent years.

Faced with rising inflation rates from 2021, the US Federal Reserve began to raise interest rates. As a result, the dollar's relative value rose against other currencies. This development makes the current energy crisis even more expensive for countries that rely on high energy imports. The Japanese yen, for example, depreciated by 16% in the first eleven months of 2022. The euro, Korean won, British pound, and Polish zloty also lost 10-11% in value this year. The depreciation of the Turkish lira accelerated as well leading to a loss in value of more than 46% compared to the US dollar. Due to the loss in value, importers from China and India reportedly turned to lower grades of coal, boosting the Indonesian low-CV coal market.

The sanctions against Russia have forced Russian producers to look for alternative buyers, and payments in yuan, rupees, rubles or Emirati dirham have been reported.

Year-on-year development of selected importing countries' currencies against the US dollar, 2020-2022



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Notes: CNY = Chinese yuan renminbi. INR = Indian Rupee. EUR = Euro. JPY = Japanese Yen. KRW = Korean Republic Won. GBP = Great Britain Pound. PLN = Polish Zloty. TRY = Turkish Lira. 2022 values represent average exchange rates to November 2022.

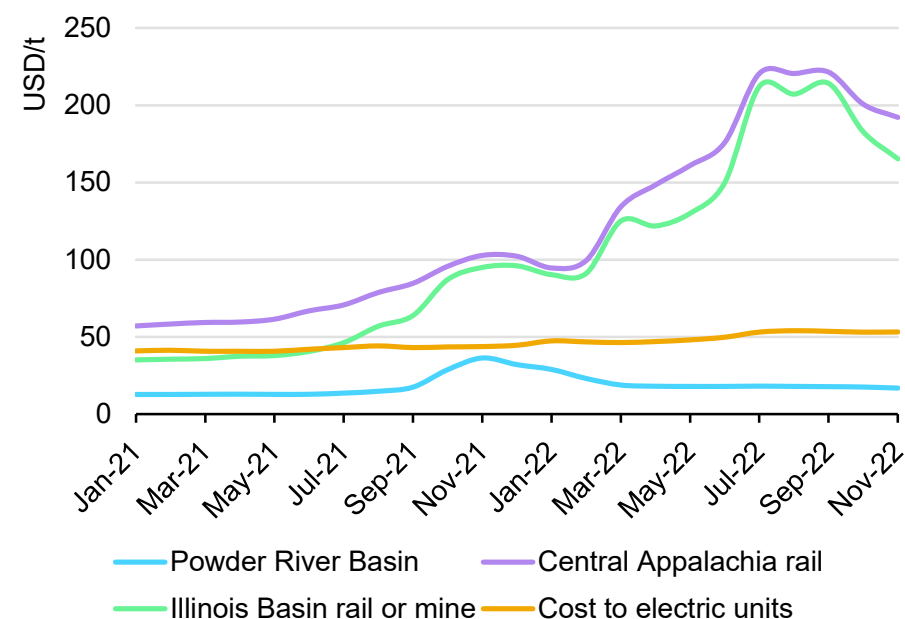
Source: OECD (2022), [Monthly Monetary and Financial Statistics \(MEI\) exchange rates \(USD monthly averages\)](#).

Most coal miners in the United States are unable to take advantage of high prices

About 85% of the coal produced in the United States is consumed domestically. Most domestic coal trade takes place under long-term contracts with fixed prices. As a result, many US coal mines can barely benefit from the current high world market prices. US power plants' average costs for delivered coal have increased by only ~31% from January 2021 to September 2022. As operating costs have simultaneously risen sharply, they have undercut the rising sales revenues of some mine operators. In response, surface mines have begun to link sales agreements and prices to diesel indexes to gain price flexibility and cover the elevated production costs.

Spot prices for thermal coal, mostly affected by export coal prices, have increased enormously over the same period, almost threefold in the Central Appalachian region and more than fivefold in the Illinois Basin. Spot prices in the Powder River Basin were not responsive to current global coal prices because only limited volumes are transported to ports on Canada's east coast for export. Prices rose only in late 2021 as coal inventories fell across the United States. Despite high spot prices in Central Appalachia and the Illinois Basin, coal producers do not seem to have an appetite to increase production and their share of exported coal. The lack of long-term perspectives makes finance or even hiring workforce very hard. Total US coal exports are expected to increase only marginally this year.

Spot coal prices in different regions of the United States and cost for coal to electric units, 2021-2022



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Source: Argus Media Ltd. All rights reserved. EIA (2022), [STEO](#).

Thermal coal prices surpassed oil on an energy basis

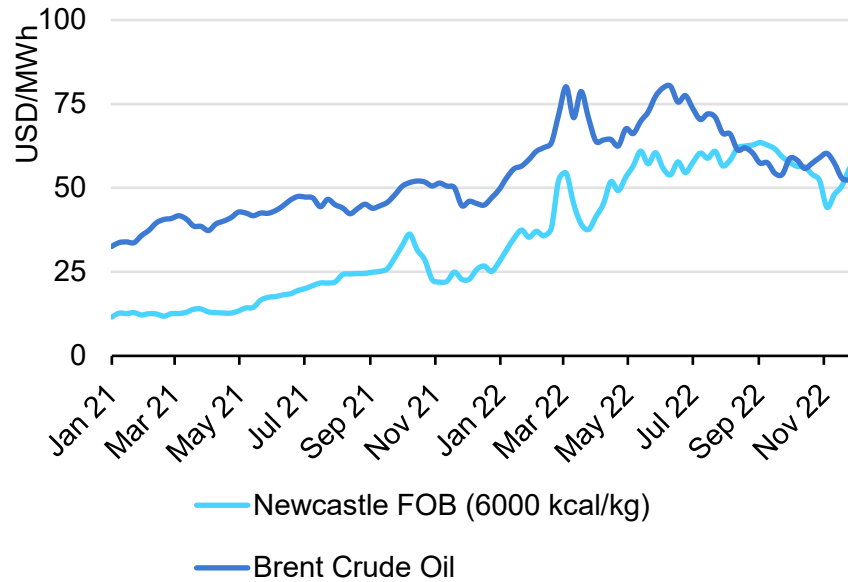
Since the second half of 2021, prices for energy commodities, such as oil, coal and gas, have surged, albeit by varying degrees. The main drivers in 2021 have been the economic recovery, particularly in Asia and North America and the constraint on supply expansion and Russia's reduced gas supplies to Europe. In 2022, the Russian invasion of Ukraine and the subsequent geopolitical tensions added turmoil and uncertainty, leading to what can be considered the first global energy crisis.

During the energy crisis, the importance of coal as a substitute for scarce gas increased worldwide, while oil demand declined as the global economy slowed. For the first time ever, coal prices (Newcastle high-CV coal) – in terms of energy content – rose above the price of Brent crude oil twice in 2022, in August and November. Crude oil, which has a higher fundamental value in terms of calorific value, usually trades at a multiple of coal prices, because versatility makes it a superior fuel, suitable for many different applications. This phenomenon was short-lived, however, as Newcastle coal prices fell shortly afterwards and crude oil prices recovered soon.

Gas and coal prices tend to be highly correlated, as both are linked through the potential for switching between gas- and coal-fired

power generation in most countries. In 2021, coal prices closely followed the upward trend of gas prices until August, reflected in a high correlation between both prices. However, in the second half of 2021, coal and gas prices on the European market decoupled several times and showed a negative or near-zero correlation. While gas prices reached peak levels, peaking in October and December, coal prices declined from a record high in October as China's import demand weakened. In 2022, price volatility was high for both commodities and so was the moving correlation coefficient. Both prices spiked when Russia started its invasion of Ukraine, then fell and trended sideways until June. Since then, gas prices have risen rapidly as Russia curbed flows and Europe focused on filling storage. However, plant availability and low water levels on the Rhine, which impeded coal shipments to power plants in Southern Germany, constrained coal-fired power generation. European coal prices continued trending sideways at only slightly elevated levels. Since September, prices for both commodities have declined hand in hand.

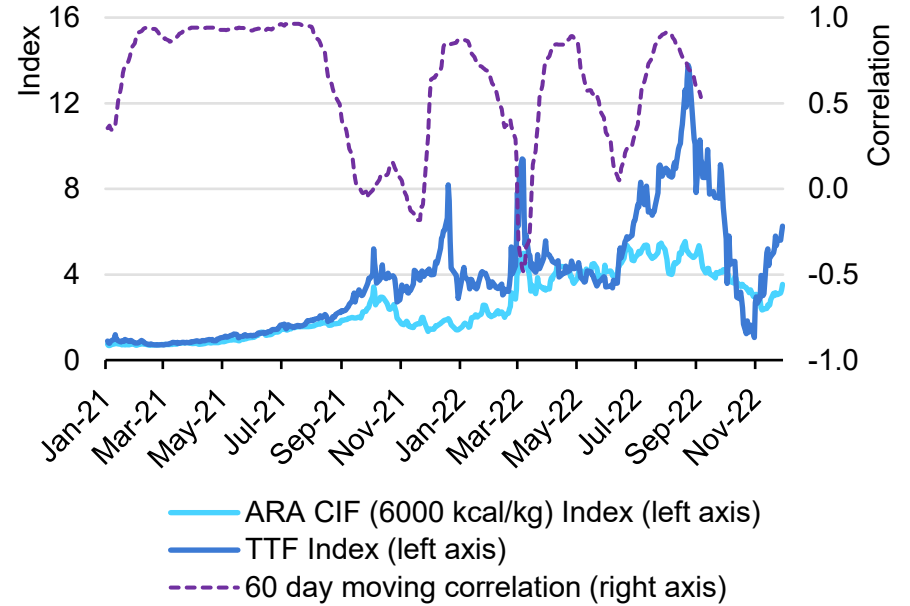
Marker prices for ARA CIF coal and Brent Crude Oil, 2021-2022



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Note: FOB = free on board
Source: Argus Media group. All rights reserved.

Correlation of ARA CIF coal and TTF gas prices, 2020-2022



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Note: CIF = cost, insurance and freight. TTF = Title Transfer Facility
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Forward curves suggest very tight market conditions until 2025

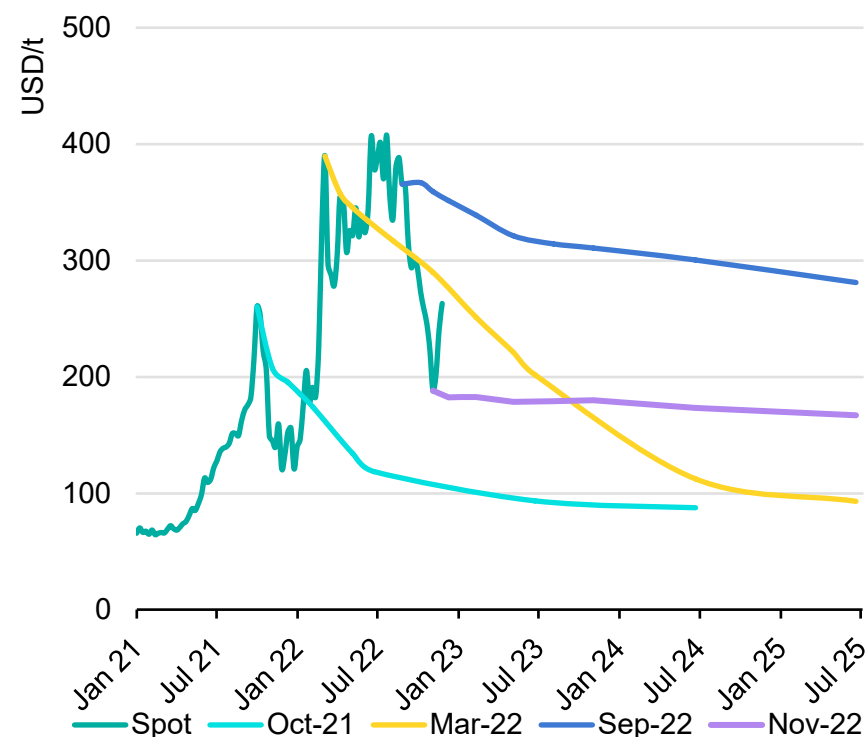
The forward price curve of API2 (a price index for coal deliveries to Europe) shows backwardation. In other words, spot prices are higher than future prices, indicating short-term shortage and market expectations that prices will decline.

However, the forward curve's backwardation has turned softer in recent months as forward prices have significantly shifted upward. When prices peaked for the first time in October 2021, market participants believed market imbalances would be short-lived and prices would normalise to levels below USD 100/t within one year. In mid-March when spot prices were close to USD 400/t, even long-term API2 swaps for the calendar year 2025 were traded just below USD 100/t. Five months later, in mid-September spot prices had declined slightly to USD 366/t but swap prices for coal for 2025 almost tripled to USD 281/t. Two months later, mid-November, after spot prices had slumped to USD 188/t, API2 swap prices for 2025 fell again to USD 167/t. After spot prices returned to an upward trajectory with the beginning of the heating season, swap prices for 2025 increased to USD 237/t at the beginning of December.

Thus, coal markets are expected to remain tight for the foreseeable future. However, the future price direction, will strongly depend on the developments on the European natural gas markets. Following Russia's invasion in Ukraine, Russia has sharply reduced gas supplies to Europe, and the continent now relies on supplies from tight global LNG markets. From March to October, future prices of

gas (TTF, July 2025 contract) rose from USD 12.20/MBtu to USD 22.10/MBtu, a smaller relative increase compared to coal prices.

API2 spot prices and forward curves, 2021-2025



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Costs

Coal supply costs increased in 2021 but prices rose more and profitability improved

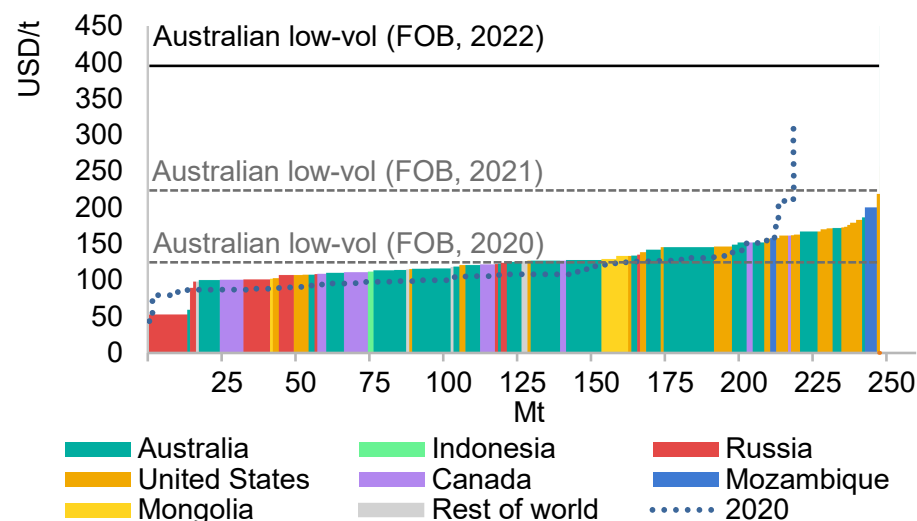
The supply costs for metallurgical coal are generally higher than those for thermal coal. This is because met coal is more often mined underground and, on average, comes from smaller coal mines than thermal coal. In addition, the preparation costs for met coal are higher than for thermal coal.

In 2021, the cost of coking coal supply was relatively stable compared to 2020, but the amount of exported coking coal increased. In particular, Russia's Elga low-cost coal mine, which ramped up exports in 2021, has placed itself at the beginning of the export supply curve for coking coal. As prices increased, so did the profitability of coking coal production. The average FOB price for Australian low-volatile met coal rose by 79% compared to the previous year.

The supply cost curve for high and low CV thermal coal shifted upward as the cost of input factors such as fuel, steel products and labour increased. In particular, mining costs at Indonesian and Australian mines rose. The key factor here was royalties, which roughly doubled in Australia and almost tripled in Indonesia. In addition, the depreciation of local currencies led to an increase in operating costs, such as the cost of fuel and mining equipment. However, the profitability of coal mines, particularly high-CV mines, increased sharply as prices reached record highs. The average FOB price for Australian thermal coal with a CV of 6 000 kcal/kg increased by 134% from 2020 to 2021.

In 2022, coal mine profitability remains exceptionally high as prices have continued to rise. In the first nine months, Australian high-CV thermal coal traded at ~356 USD/t on average, a y-o-y-increase of 161%.

Indicative hard coking coal FOB supply curve 2021 and average FOB marker prices



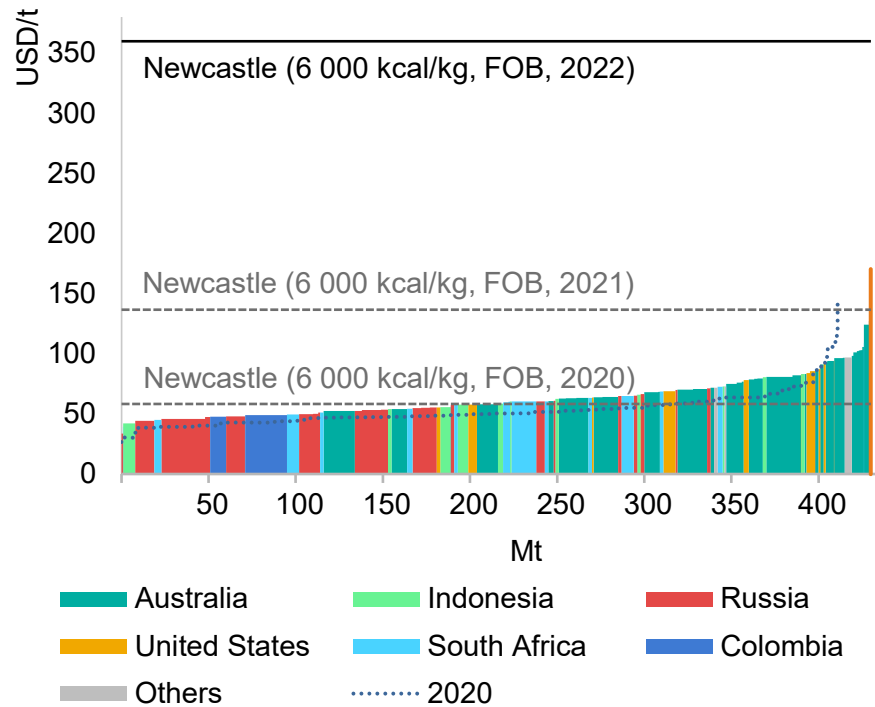
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Notes: FOB = free on board. HCC = hard coking coal. Cost curves account for variable production costs, overburden removal, royalties, inland transportation and port usage fees. The annual average FOB marker price is based on the monthly average index for Australian prime hard coking coal. The 2022 price is based on the average for January-September.

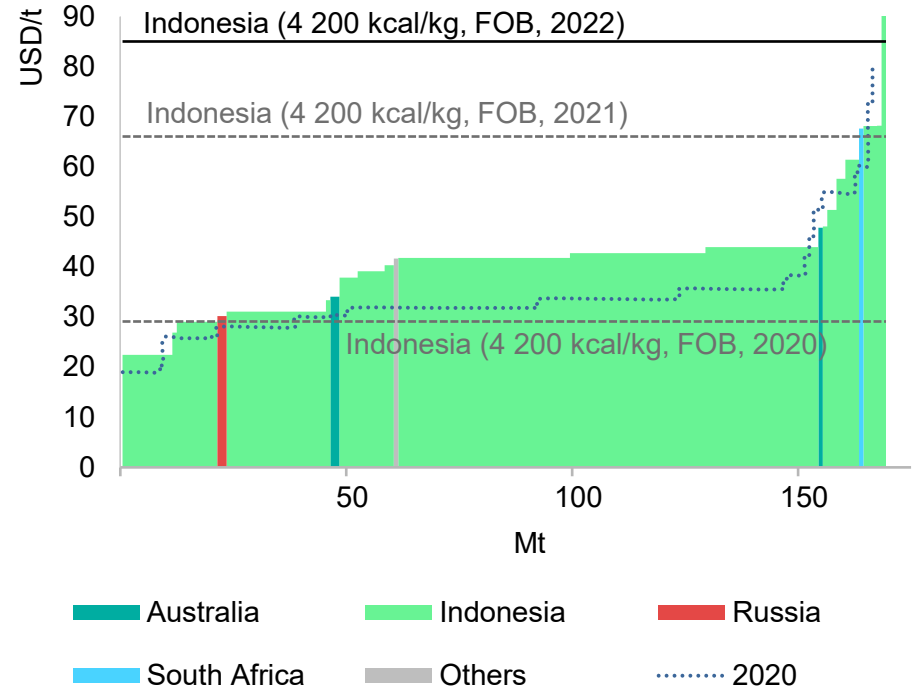
Source: Argus Media group. All rights reserved. Adapted from CRU (2022), Metallurgical Cost Model (database)

Record margins for coal producers

Indicative high calorific (> 5 700 kcal/kg) thermal coal FOB supply curve 2021 and average FOB marker prices



Indicative low calorific (< 4 500 kcal/kg) thermal coal FOB supply curve 2021 and average FOB marker prices



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Note: The cost curves account for variable production costs, overburden removal, royalties, inland transportation, and port usage fees. The cost curve is not adjusted for different qualities of coal. The transportation costs given are to the closest port, so the FOB costs of Russian producers in Asia are somewhat higher than the figure shows. The annual average FOB marker price is based on the monthly average index from Newcastle/Indonesian steam coal. The 2022 prices are based on the monthly average from January-September.

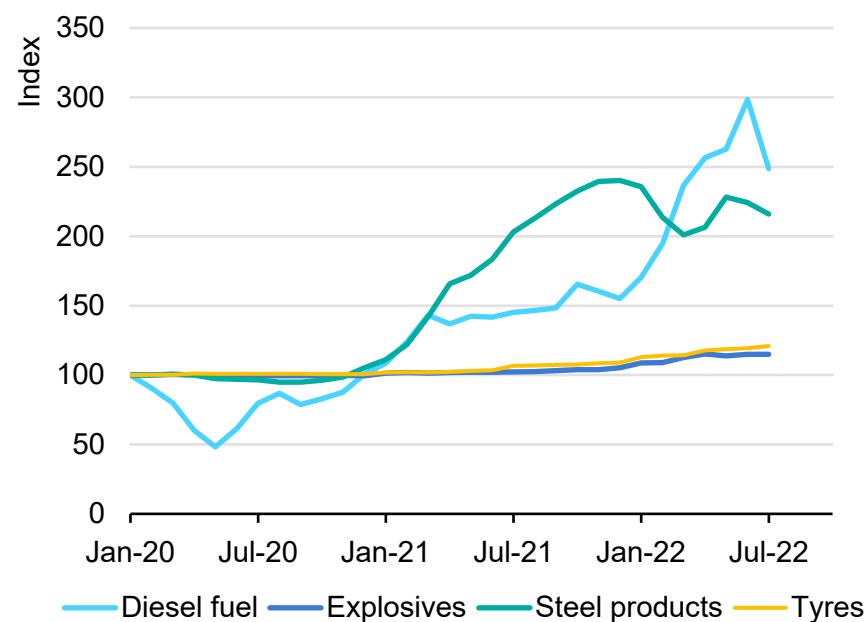
Source: Argus Media group. All rights reserved. Adapted from CRU (2022), Thermal Cost Model (database).

Input costs of coal mines rose sharply

The cost structure of coal mines is determined mainly by operating expenses such as labour and fuel costs, taxes and royalties as well as transportation expenditures (e.g., for inland transportation, 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 relatively stable in recent years. In an overall inflationary environment, they have increased by about 20% and 15%, respectively, since the beginning of 2021. In contrast, fuel and steel prices have been subject to wide fluctuations. In the wake of the Covid-19 pandemic, fuel prices fell to their lowest level since 2003 in June 2020. Prices recovered in 2021 and jumped to record levels in the first half of 2022 amid global energy shortages. Prices for steel products more than doubled in 2021 as the economy recovered before slipping slightly in 2022 as the economic outlook deteriorated.

Nominal prices of selected commodities and input factors used in coal mining, 2020-2022



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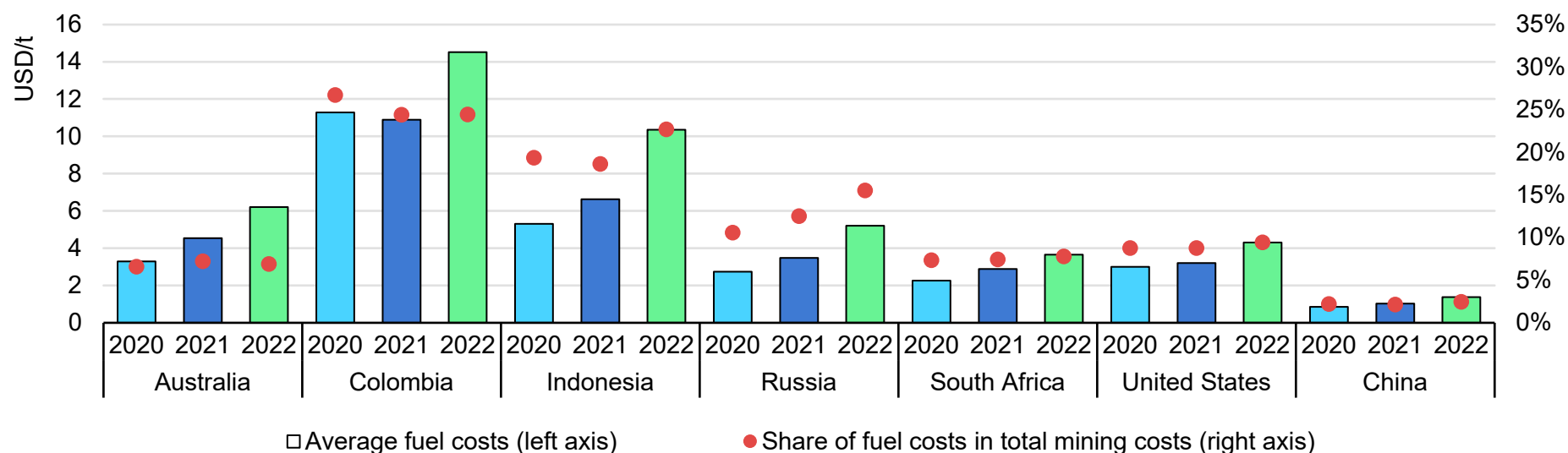
Source: US Bureau of Labour Statistics (2022), [Producer Price Indexes](#).

Fuel costs rose in many countries, in particular lifting opencast mining costs

Diesel fuel costs are an important factor in a mine's operating cost. In particular, opencast mines rely on diesel-fuelled trucks and other equipment. As opencast mining is the predominant mining method in Colombia and Indonesia, fuel prices are a more important factor for the mines' profitability than, for example, in China, where opencast mining has a rather small share.

In 2021, oil prices recovered from the very low levels of 2020, when the Covid-19 pandemic weighed heavily on prices. Diesel prices rose further in many countries in 2022. However, the share of fuel costs in total operating costs remained constant in most countries, as other cost factors such as labour and sustaining capital costs increased even more. Indonesia and Russia recorded an increase.

Average fuel costs and share in total coal mining costs in selected countries, 2020-2022



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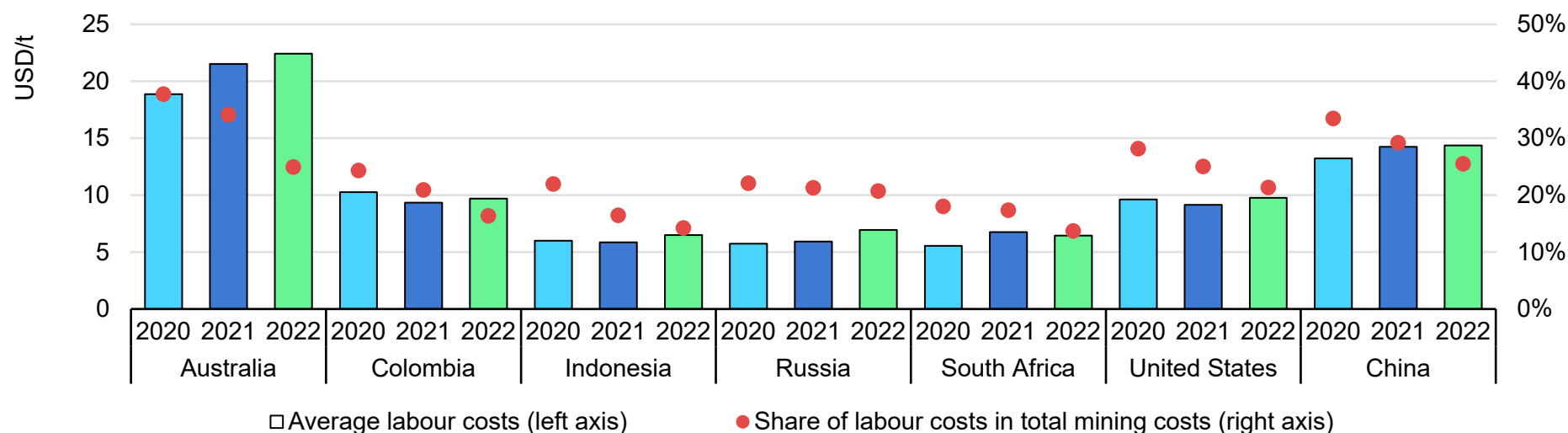
Source: Adapted from CRU (2022), Thermal Cost Model (database).

Labour costs continue to rise in most countries

Labour costs vary significantly among coal-producing countries and affect the competitiveness of exporters.⁶ In Australia, Russia, South Africa and China, labour costs increased in 2021, partly due to the appreciation of the local currencies against the US dollar. In 2022, labour costs rose in all major coal-exporting countries as companies

seek to increase coal production and are willing to pay higher wages to hire enough workers. However, due to a surging increase of other cost factors such as resource costs, the share of labour costs in total operational costs sunk for all considered countries.

Average labour costs and share in total coal mining costs in selected countries, 2020-2022



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Source: Adapted from CRU (2022), Thermal Cost Model (database)

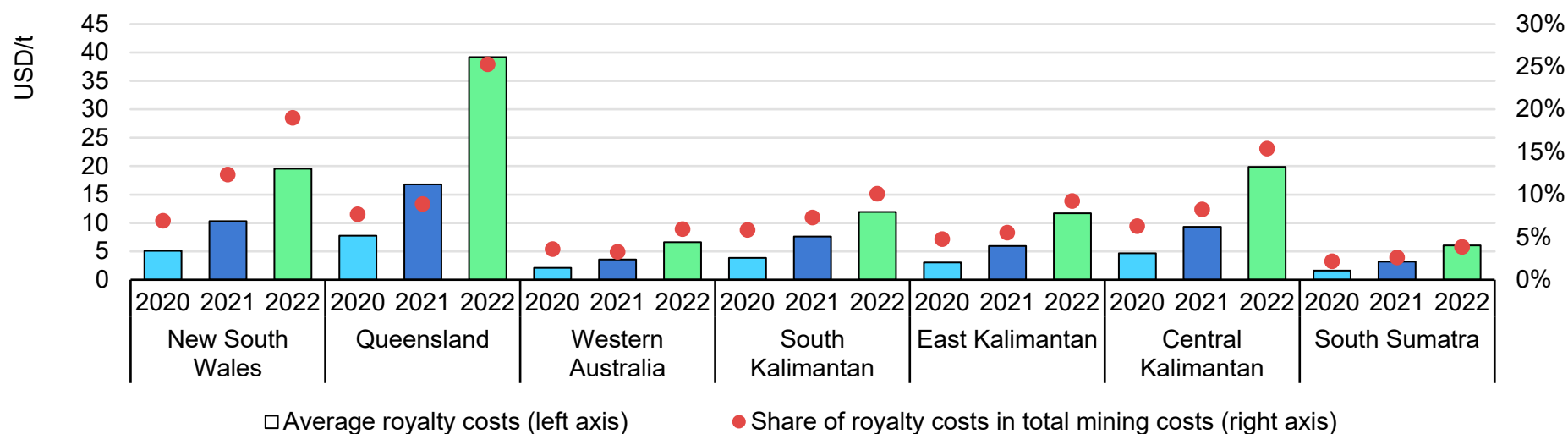
⁶ China is included because its domestic coastal coal trade of more than 800 Mt is comparable with global trade.

Governments raise royalties to participate in high market prices

The national and regional governments secure the right to receive royalties for each tonne of coal produced in return for granting mining licences. The height of royalties varies from country to country and from region to region. In 2021 and 2022, governments across the globe increased royalties to benefit from rising coal prices.

In many countries, royalties roughly doubled both in 2021 and again in 2022. Australia's mining region Queensland increased royalties the most, both in absolute and relative terms. In 2022, royalties account for about a quarter of mining costs in Queensland, or USD 39 on average. Indonesia switched from a CV-based to a spot price-linked system, which led to an increase in royalties from 3% to up to 10% for some mining companies.

Average royalties and share in total coal mining costs in selected countries, 2020-2022



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Source: Adapted from CRU (2022), Thermal Cost Model (database).

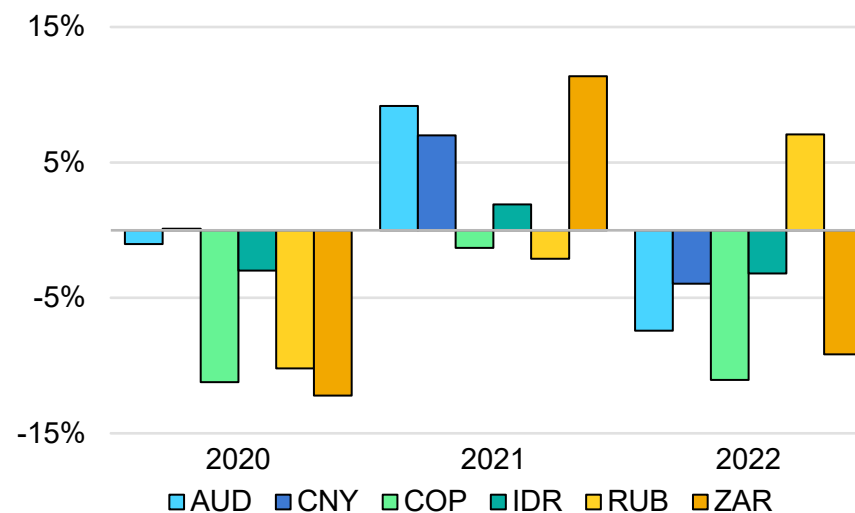
A strong US dollar increases the competitiveness of other exporters

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

In 2020 most coal-exporting countries' currencies depreciated against the US dollar, driven by the economic crisis related to the Covid-19 pandemic. With a loose US monetary policy, the global economic recovery and surging energy prices, the currencies of the export-oriented economies like China and top-energy exporters like Australia, Indonesia and South Africa appreciated against the US dollar in 2021.

Since the second half of 2021, the US Federal Reserve raised the interest rates, and investments in US dollar became more attractive, causing investors to withdraw money from other countries. In particular, developing countries' currencies like the Colombian peso and the South African rand depreciated against the US dollar in 2022. An exception is the Russian ruble, which appreciated slightly against the US dollar despite western sanctions due to extraordinarily high revenue streams from energy exports.

Year-on-year development of selected currencies against the US dollar, 2019-2022



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Notes: AUD = Australian dollar; CNY = Chinese yuan renminbi; ZAR = South African rand; RUB = Russian ruble; IDR = Indonesian rupiah; COP = Colombian peso. The chart displays the y-o-y average exchange rate development of the selected currencies expressed in change from the previous year. 2022 represents average exchange rates to August 2022 for all currencies except the AUD, which is to September 2022.

Source: OECD (2022), [Monthly Monetary and Financial Statistics \(MEI\): Exchange rates \(USD monthly averages\)](#).

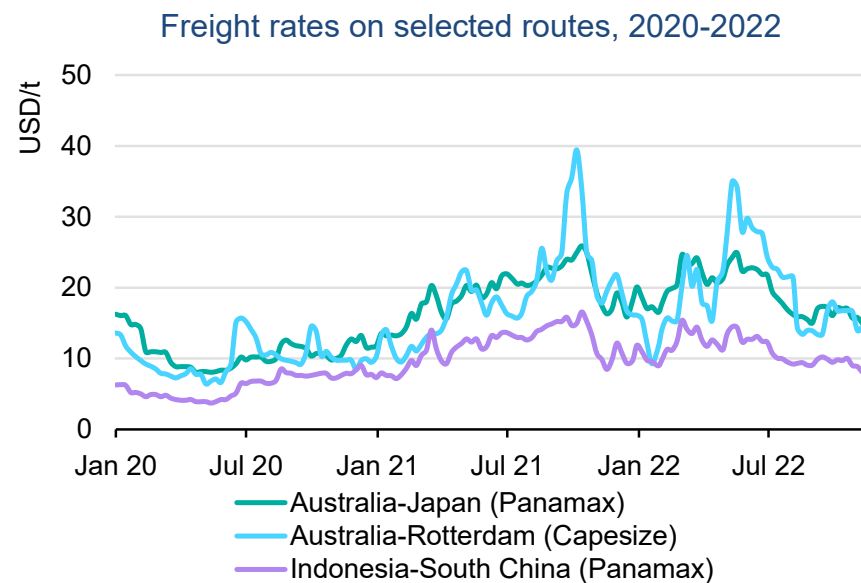
Freight rates ease as global economy slows

About 93% of the global coal trade is seaborne and shipped by dry bulk vessels. Seaborne coal trade makes up [23% of total seaborne dry bulk trade by mass](#), ahead of grain (10%) and slightly behind iron ore (29%). The vessels can be categorised by the deadweight tonnage (dwt). The four main vessel types are Handysize, Handymax/ Supramax, Panamax, and Capesize, with the most used being Panamax (60 000 – 80 000 dwt) and Capesize (over 80 000 dwt).

Shipping costs are mainly determined by fuel prices, while final freight rates depend on supply and demand. The pandemic-related demand reduction for coal and iron ore led to a decline in freight rates in 2020. Freight rates for shipments from Australia to Japan and Europe, served mainly by Capesize vessels, were more affected than those with Panamax vessels, e.g. on the route from Indonesia to China.

In 2021, freight rates picked up strongly as global demand for goods and energy increased. Energy shortages in China and India further increased import demand in the second half of the year. Freight rates to Europe peaked in October amid tight gas supplies and rising demand for thermal coal. In addition, some ports were partially or fully closed as part of the measures to contain the Covid-19 pandemic, which led to queues on ships and reduced the overall supply of cargo capacity.

Freight rates declined at the end of 2021 as energy prices fell and pressure on global supply chains eased slightly. In March 2022, freight costs rose again due to the Russian invasion of Ukraine, which caused energy and grain prices to increase dramatically. In addition, unfavourable weather conditions, e.g. on the Australian east coast, hampered coal shipments. In the second half of the year, freight rates declined as grain prices fell and the global economy, and thus demand for goods, slowed. Currently, the global coal trade bottleneck is coal production, not transport.



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Coal mining projects

High prices hardly stimulate coal mining projects

Two reasons could justify an uptick in coal investment. First, the unprecedented high prices prevailing since October 2021 have made thermal coal one of the best-performing commodities since then. Second, the energy crisis triggered by Russia's invasion of Ukraine and its consequences, i.e. energy shortages, has renewed focus on energy security. Whereas the two above-mentioned factors undeniably impact market players' moods, the analysis of the evolution of the individual projects and new ones does not show signs of significant acceleration in coal investment outside China and India.

The pressure from environmental, social and governance (ESG) policies is not easing. Countries are not relaxing climate or coal phase-out goals (although some countries have temporarily delayed the deadline), and getting the approval, finance and insurance of a new project has become more challenging. Renewed interest in CCUS has not impacted investment decisions yet. Investor data show some increase in sustaining CAPEX to enjoy the current prices for longer and in some expansionary CAPEX, particularly in flexible producers like Indonesia. Still, investment in greenfield

projects is not accelerating. Last but not least, a part of the current market tightness comes from the reverse of European coal imports, which, driven by the extreme gas shortage, are growing. However, there is a common vision among investors that the EU's appetite for coal, particularly non-Russian coal after the ban on the country's imports, will be a short-term opportunity, which producers will try to cash in, but that will not drive new investment.

This report classifies projects as "more advanced" or "less advanced".⁷ The more-advanced projects worldwide amount to an expected production capacity of ~92 Mtpa. More than 65% of these are metallurgical (met) coal projects, although met coal accounts for less than 15% of global coal demand and about one-third of international trade. The more-advanced projects are concentrated in Australia (36%), Russia (23%) and South Africa (15%). The total pipeline of more-advanced projects has declined very slightly by a capacity of 3 Mtpa as some projects have been realised and very few less-advanced projects have progressed.

All less-advanced projects together amount to a production capacity of 663 Mtpa, of which ~75% are thermal coal projects. The volume

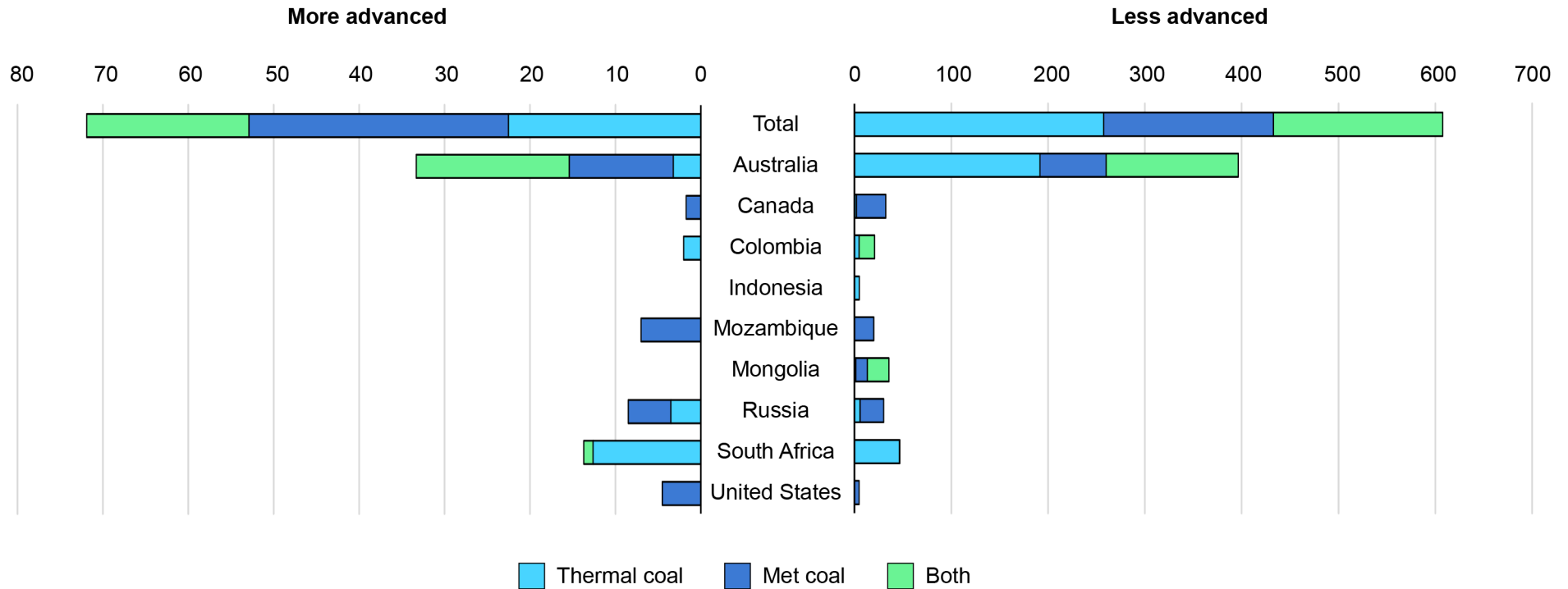
⁷ More-advanced projects have been approved and obtained a final investment decision or are under construction, while less-advanced projects are at the feasibility or environmental assessment stage, or they are awaiting approval.

of less-advanced projects has decreased by about 90 Mtpa compared to last year's report, as some major projects have been cancelled or are considered cancelled due to a lack of progress in recent years. According to official data, about 63% of the less-advanced projects are in Australia. However, this number should be taken with caution, as Australia is more transparent about planned coal projects than other countries. Uncertainty about new mining investments is particularly high in Indonesia, the country with the highest new production among the major exporting countries. A non-exhaustive list of coal mining projects in the major exporting countries can be found in the Appendix.

Investments in mining projects often go hand in hand with infrastructure investments. The largest project completed this year is a 415 km rail link from Mongolia's largest coal mine, Talvan Tolgoi, to the Chinese border. Other examples of large infrastructure projects can be found in Russia to increase the country's export capacity to the east or in southern Africa to export coal from landlocked Botswana.

More-advanced coal mining projects are primarily in Australia and Russia

Capacity of hard coal export mining projects by country and coal grade (Mtpa)



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Metallurgical coal projects continue to be the focus for investors on coal

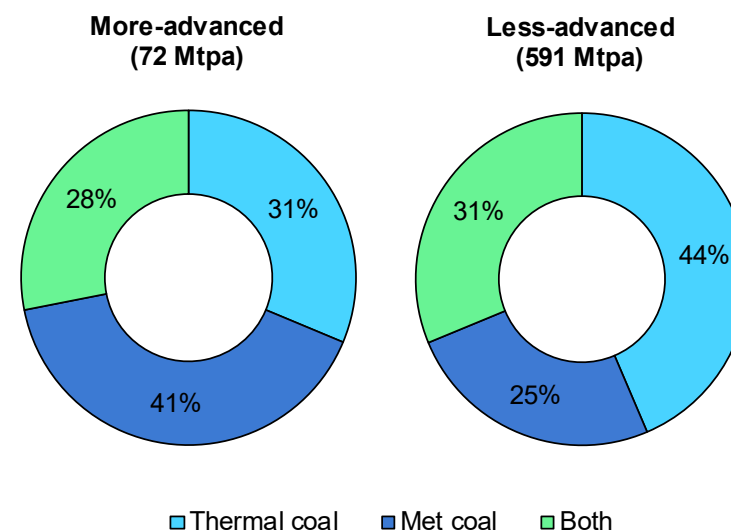
Steel production will remain coal-based in the medium term. Other promising technological approaches, such as hydrogen-based steelmaking, are not yet available on the scale and at the cost required and are not expected in the coming years. This is reflected in a share of about one-third of all more-advanced coal export mining projects.

Investors seem to prefer metallurgical coal projects to thermal coal projects. Pure thermal coal projects account for only about 35% (32 Mt) of the more-advanced projects, although thermal coal's market share is three times that of coking coal. However, thermal coal's share is about 43% in the less-advanced projects.

The lower appetite for thermal coal projects reflects an expected reduction in demand and the higher risks and uncertainty associated with climate targets and public opposition. Due to the availability of substitutes for coal-fired power generation, such as renewables, investors are pushing companies to reduce their carbon footprint.

The major mining companies continue to turn away from thermal coal by splitting up or selling their coal-related assets. Companies such as Rio Tinto and Anglo American have already divested most of their coal mines. BHP announced the intention to sell its Mt Arthur thermal coal mine. The company announced that it did not find a buyer and instead it applied for a permit to operate beyond 2026, until 2030.

Coal grades in hard coal export mining projects



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Australia is home to most of the announced export-oriented coal projects

In Australia, mining companies continue their efforts to increase coal production by expanding existing sites and (re)opening mines. Most of the mines produce metallurgical coal, the only new thermal coal mine is Carmichael mine. The mine, owned by Bravus, began production in the last quarter of 2021 and commenced regular coal export shipments through the Abbot Point port in January 2022. All other new mines produce coking coal. In Queensland, Qcoal restarted the Cook mine in April, which had been on care and maintenance since December 2019. The mine is expected to reach a full capacity of 1.2 Mtpa in November. In April, Bowen Coking Coal (BCC) reopened and shipped the first coal from the 1-1.2 Mtpa Bluff ultra-low volatile PCI mine. A few months later, in July, the company also began mining met coal at the Broadmeadow East pit. The company also intends to commission the nearby Burton pit late in the fourth quarter and to start up the new 5 Mtpa Burton coal handling and processing plant next year to form the Burton met coal complex. In New South Wales (NSW), SIMEC Mining plans to increase the capacity of the Tahmoor South metallurgical coal mine from 3 Mtpa to 4 Mtpa.

More than 46% of the world's more-advanced coal mining projects are in Australia, amounting to 33 Mtpa of new capacity. Most of these projects are located in Queensland (25 Mtpa). Approximately 19 Mtpa of coal mining capacity could commence operations by 2023. Pembroke Resources is advancing its USD 1 billion Olive

Downs coal project, which is scheduled for commissioning next year. In NSW, Malabar Coal's Maxwell mine, with a capacity of 3 Mtpa to 3.6 Mtpa, is set to start operations in mid-2023. The mine will produce about 75% coking coal, and the remainder thermal coal. Furthermore, Australian Pacific Coal will resume production at the Dartbrook underground mine, which has been idle for 16 years, in the second half of 2023. The thermal coal mine has an initial production rate of 1.5 Mtpa, but has been approved to produce up to 6 Mtpa in 2024. The company is targeting a further increase in the mine's capacity to 10 Mtpa.

Australian planning authorities, which have been stricter toward new coal projects in recent years, appear to be taking a softer stance. Several projects have already been approved this year. MACH Energy received approval to double the production capacity of its Mount Pleasant mine in NSW from 10.5 Mtpa to 21 Mtpa and to extend the life of the mine from 2026 to 2048. The mine produces thermal and semi-soft coking coal. Furthermore, the projects to extend the life of the 7.5 Mtpa New Acland thermal coal mine, owned by New Hope, and the 5 Mtpa Carborough Downs coal mine, owned by Fitzroy Resources, was approved.

The overall capacity of the less-advanced project pipeline amounts to about 565 Mtpa, of which 348 Mtpa are thermal coal projects. The total capacity of planned projects has decreased compared to the previous year, as some projects have advanced and others

have been cancelled. South 32, for example, has decided not to proceed with the Dendrobium Next Domain extension project, after the NSW Independent Planning Commission rejected the plan. Without the expansion, the mine's capacity will drop to 5.5 Mtpa instead of the targeted 7.5-8 Mtpa and will likely close in 2028. The company also vows not to develop or invest in greenfield met coal projects.

Russia's ailing coal sector looks more at the East

In response to the European ban on imports of Russian coal, the country's coal exporters are accelerating the long-planned expansion of infrastructure to the east in order to increase exports, especially to China and India. So far, however, Russian exporters are suffering from the sanctions and lack of capacity in the railway network to reroute coal that used to be exported in northwest ports to the east.

In the second half of 2022, a first Sino-Russian railway crossing over the Amur is to be put into operation, which will significantly expand cross-border transport capacities. It will connect Russia's Nizhneleninskoye with China's Tongjiang, initially with a capacity of 5 Mtpa, which can be expanded to 21 Mtpa in the future.

Further infrastructure projects are progressing. For example, A-Property's new terminal Port Elga at Cap Manorsky with a railway connection to its Elga complex, with a planned capacity of 30 Mtpa and a commencement date in 2024, got environmental approval in September.

To strengthen its ties with India, SUEK is opening an office in India as it intends to increase thermal and coking coal imports from Russia by up to 40 Mtpa until 2035. To this end, further investments in shipping infrastructure are likely yet not announced.

The commissioning of two expansion projects close to the Chinese border favours the reorientation eastwards. Kolmar's Inaglinsky

extension project is ramping up production targeting an additional 4 Mtpa coking coal capacity. A-Property completed the extension of its Elga mine. However, the ramp-up of the 6 Mtpa coking and thermal coal mine depends on the pace of the associated railway development. The mine is operated by ELSI, which is the result of a merger of A-Property's portfolio firms Elga and Sibanthracite and now the largest metallurgical coal exporter in Russia. Additionally, A-Property started to ramp up production at its 5 Mtpa Verkhneteshsky open-cut coking coal mine in the Kuzbass region, also operated by ELSI. The mine will predominantly serve the Asian market and is expected to reach an output of 1 Mtpa by the end of 2023. On top of that, UglePromInvest's Sibirskaya commenced production of its 6 Mtpa thermal coal mine.

More-advanced projects comprise thermal and coking coal operations in the south and the north. SUEK's Chernogorsky expansion project, close to Novosibirsk, has a production capacity of 3.5 Mtpa thermal coal. AEON's West-Taymyr Industrial Cluster, close to port Dikson in the Kara Sea, has a coking coal production capacity of 5 Mtpa.

Further expansion projects close to the West appear to be on hold due to transportation constraints eastwards as the European Union shuns Russian coal.

While South Africa's coal sector stagnates, neighbouring countries step in

South Africa

The South African coal mining sector is slowly contracting after years of underinvestment, with coal mining capacity declining and the rail network underperforming in recent years. In fact, no new mining capacity was added this year. The only notable capacity extension is the completed construction of Exxaro's Grootegeluk 6 processing plant, which will allow the company to increase the production of high-grade export coal to 1.7 Mtpa.

South Africa's pipeline of more-advanced projects comprises a potential production capacity of approximately 13 Mtpa. One of the most advanced projects is the Makhado thermal and coking coal operation, owned by MC Mining. Construction is scheduled to begin in early 2023. Once commissioned, the mine could produce up to 1.1 Mtpa of coking and thermal coal for sale domestically and internationally. The original plan was to use the coal processing plant at Vele Colliery, about 130 km away. Now MC Mining is considering building an additional coal processing plant at the site to reduce operating costs.

In addition, less-advanced projects with a total production capacity of 47 Mtpa are known. The most recent announcement is the potential life extension of Thungela's 4.6 Mtpa Khwzela thermal coal mine.

Botswana

While South Africa's coal production is declining, Botswana is preparing to fill the breach, at least in part. Projects with a potential capacity of at least 10 Mtpa are already more advanced. Some aim to supply South Africa, whose domestic coal production is insufficient to supply the power sector. To this end, and to provide the landlocked country with access to South African export terminals, South Africa's Transnet and Botswana's railroad company have agreed to repair and upgrade a 126-km rail line between the two countries. The rail line will allow heavy trains to travel from Botswana to the export ports of Richards Bay and Durban.

At the country's oldest operating coal mine, Morupule Coal Mine (MCM), construction has begun on the Motheo project, which includes an open pit mine, a coal preparation and processing plant, and associated infrastructure. The project will expand MCM's capacity from 2.8 Mtpa to 4.2 Mtpa. In June, Botswana mining company Minergy Energy reported that Botswana's second operating mine, the Masama thermal coal mine, commissioned in 2020, has reached its production capacity of about 1.5 Mtpa. The company intends to double the capacity if it can secure additional investment. Minergy also started exporting through the Matola terminal at the Port of Maputo in Mozambique and the Walvis Bay

ports in Namibia, given the limited logistical capacity to export through South African ports.

A large part of Botswana's coal resources are located in the Mmamabula coalfields, and the country is seeking to exploit them. In 2021, Maatla Resources started its Mmamabula coal project. The mine is expected to start production in mid-2023 with a production rate of 1.2 Mtpa and later ramp up to about 4.5 Mtpa. The coal will be sold domestically and on the South African market. India-based Jindal also announced plans to start constructing a 4.5 Mtpa coal mine in the southeastern Mmamabula coalfields in 2022. The mine is expected to be developed in two to three years and supply a planned local power plant and the South African market. In the long term, the company's vision is to significantly increase coal production at the Mmamabula site to 24 Mtpa and export coal overseas.

Mozambique

All proposed coal mining projects in Mozambique are classified as less advanced and none of the projects has reported progress by 2022.

However, the importance of the Port of Maputo is increasing as it provides an alternative to constrained South African export capacity for coal exports from landlocked Botswana. Grindrod, the port's

owner, has announced a number of investments to increase its dry bulk export capacity from 1.5 Mtpa to 4.5 Mtpa.

Zimbabwe

The Zimbabwean government is planning new mines with corresponding coal-fired power plants in the northwestern district of Hwange, which would require investment in coal mines to fuel those plants. However, it is unclear whether the development will go ahead since potential investor China has decided to ban investment in coal-fired power plants abroad. One coal project already under development is the Lubu Coking Coal Project, which could produce up to 5 Mtpa of met coal. In 2022, owner Contango announced that quality tests had been better than expected. The first coal is expected to be delivered by the end of the year.

Tanzania

In view of the current high price level, Tanzanian coal mines, which actually concentrate on domestic coal-fired power generation, are trying to export coal. This is being facilitated in tandem by an expansion of export capacity at the port of Mtwara. The port has multiplied the number of ships it can handle per month and is aiming for an export capacity of 0.65 Mtpa.

In the United States, Canada and even in Europe, coking coal projects take centre stage

United States

In the United States, multiple coking coal mines and a thermal coal mine started operation in 2022. Ramaco Resources increased its metallurgical coal production capacity by a total of ~2.6 Mtpa, powered partly by the expansion projects at the Berwind and the Elk Creek complex and partly by the commission of two new mines: the 0.7 Mtpa Knox Creek mine and the 0.2 Mtpa Big Creek 2 mine. Moreover, Ramaco Resources acquired Ramaco Carbon LCC at the beginning of the year and commenced production in its 0.25 Mtpa thermal coal Brook Mine.

Peabody reopened its Shoal Creek mine, which closed in 2020 due to low demand, and started ramping up coking coal production. The mine is set to reach its maximum production capacity of 2.1 Mtpa soon. Furthermore, additional coking coal projects with an aggregated capacity of 4.5 Mtpa are categorised as more advanced, with North Central Resources' Longview coal mine standing out with a total of 3 Mtpa. Its start of production has been rescheduled from end-2022 to mid-2023.

Canada

Due to political restrictions, multiple coking coal projects have been cancelled lately. As a result, the project pipeline's capacity decreased by ~10 Mtpa to ~34 Mtpa.

The only more-advanced project is CST's Grande Cache mine with a maximum capacity of 1.7 Mtpa, which appears to be on the brink of reopening. Together with the less-advanced coking coal projects Grassy Mountain (4.5 Mtpa) by Bega Mining and Mountain Tent (1.1 Mtpa) by Montem, it was excepted from a restriction on exploration and development projects passed by the Alberta government. The largest project under development is the 10 Mtpa coking coal project Fording River Extension by Teck Coal. Its start has been scheduled for 2027.

Europe

After committing to phasing out coal-fired power generation, European mining projects only focus on new coking coal mines in the United Kingdom and Poland. Poland's first new coking coal mine in 25 years, JSW's Bzie-Debina 1-Zachod, commenced production with a capacity of 2.2 Mtpa. In the United Kingdom, West Cumbria Mining's 2.5 Mtpa coking coal project Woodhouse Colliery has been approved in December 2022, making it the United Kingdom's first new coal mine project in 30 years. The mine could be operational within two years with an estimated production of 0.5 Mtpa in the first phase.

Indonesia and Mongolia are expanding export capacities, while Colombia halts development

Indonesia

The lack of transparency regarding mining projects makes it difficult to compare Indonesia with other countries. However, traceable projects are predominantly thermal coal projects in different stages. Kangaroo Resources started ramping up its thermal coal project Parkar North slowly. The project has a maximum production capacity of 16 Mtpa. In addition, ITM's Graha Panca Karsa mine commenced production at the beginning of this year with a maximum capacity of 2 Mtpa. Moreover, IATA ramped up production of its Indonesia Batu Prima Energi mine with an overall capacity of 1 Mt. The most recent mine commissioning is the Bumi Barito Mineral mine. The mine is 60%-owned by Cokal and will produce both coking and PCI coal in the Central Kalimantan province. Cokal started operations in October and aims to reach maximum capacity of 2 Mtpa in 2023.

Mongolia

Investments in Mongolia are strongly directed to improve access to China's coking coal market infrastructural-wise. Mongolia has completed the Tavan Tolgoi rail line, a 233 km railway link to China (to Gashuua Sukhait) with a capacity of 30-50 Mtpa. It will enable boosting coking coal exports from the Tavan Tolgoi mine by replacing truck transport. Mongolia has also completed a second major rail link to China – from Zuunbayan to the border point

between Khangai and Mandal. Moreover, China intends to expand a third border checkpoint between Zamyn-Uud and Erlian in 2022. Additionally, though more expensive, to increase throughput as the countries' rail gauges are different, Mongolia is shifting from bulk cargo to containers.

Besides infrastructural accomplishments, Mongolian coking coal mining projects such as Aspire Mining's Ovoot project with a capacity of 4 Mtpa or Saker Resources' Shinjinst with a total capacity of 3 Mtpa are progressing. Both projects appear to be close to starting production.

Colombia

The new government of Colombia has expressed its intention to reduce Colombia's dependency on oil and coal gradually. For this legislative period, it plans not to grant any new exploration project of fossil resources. Before this year's elections, investors started to retreat from the consolidating Colombian market. BHP and Anglo American sold their stakes in the Cerrejon coal mine to Glencore at the beginning of 2022. At the same time, Glencore's portfolio company Prodeco Group relinquished its mining titles on Prodeco. New contracting is in progress under that uncertain environment. However, Ronin Resources announced an expansion of its Vetas project near the eastern border with Venezuela. The project could produce PCI and semi-soft metallurgical coal once operational.

General annex

Tables

Total coal consumption (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Asia Pacific	5 830	6 153	6 251	6 492	5.5%	1.6%	1.3%
China	4 045	4 232	4 250	4 337	4.6%	0.4%	0.7%
India	905	1 033	1 103	1 220	14.1%	6.8%	3.4%
Japan	174	174	177	158	-0.1%	1.8%	-3.8%
Southeast Asia	356	361	375	422	1.5%	3.8%	4.0%
North America	462	529	502	410	14.4%	-5.1%	-6.5%
United States	430	496	465	383	15.4%	-6.3%	-6.3%
Central and South America	48	50	45	37	3.8%	-8.9%	-6.8%
Europe	585	649	685	552	10.9%	5.7%	-7.0%
European Union	392	449	478	371	14.4%	6.5%	-8.0%
Middle East	13	12	10	7	-7.0%	-14.5%	-11.7%
Eurasia	344	348	350	351	1.0%	0.6%	0.1%
Russia	217	225	236	227	3.9%	4.8%	-1.4%
Africa	195	189	180	190	-3.1%	-4.5%	1.7%
World	7 477	7 929	8 025	8 038	6.0%	1.2%	0.1%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Thermal coal and lignite consumption (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Asia Pacific	4 916	5 242	5 351	5 592	6.6%	2.1%	1.5%
China	3 306	3 511	3 542	3 643	6.2%	0.9%	0.9%
India	839	959	1 027	1 128	14.2%	7.1%	3.2%
Japan	132	130	133	118	-1.3%	2.3%	-4.0%
Southeast Asia	339	338	350	394	-0.4%	3.7%	4.0%
North America	444	504	479	388	13.6%	-4.9%	-6.8%
United States	417	479	450	369	15.0%	-6.0%	-6.4%
Central and South America	35	35	32	22	0.0%	-9.2%	-11.7%
Europe	522	580	620	489	11.1%	6.8%	-7.6%
European Union	341	390	421	319	14.6%	8.0%	-8.9%
Middle East	9	8	6	3	-13.2%	-23.2%	-24.1%
Eurasia	265	265	280	281	0.2%	5.7%	0.0%
Russia	153	159	173	167	3.7%	9.3%	-1.2%
Africa	193	186	177	187	-3.5%	-4.6%	1.7%
World	6 382	6 820	6 945	6 960	6.9%	1.8%	0.1%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Metallurgical coal consumption (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Asia Pacific	915	911	900	900	-0.4%	-1.2%	0.0%
China	739	720	708	694	-2.5%	-1.7%	-0.7%
India	66	75	76	92	12.9%	2.0%	6.6%
Japan	42	44	44	40	3.6%	0.2%	-3.2%
Southeast Asia	17	24	25	28	41.6%	5.8%	4.0%
North America	19	26	23	22	34.6%	-8.9%	-1.5%
United States	13	17	14	14	27.7%	-14.1%	-1.9%
Central and South America	13	15	14	15	13.5%	-8.3%	2.7%
Europe	62	69	66	62	10.0%	-3.9%	-1.8%
European Union	52	58	56	53	13.2%	-3.9%	-2.0%
Middle East	4	4	4	4	6.4%	0.8%	0.8%
Eurasia	79	82	69	70	3.6%	-15.7%	0.4%
Russia	64	67	63	59	4.5%	-6.0%	-1.9%
Africa	2	3	3	3	27.3%	2.7%	2.2%
World	1 095	1 110	1 080	1 078	1.3%	-2.7%	-0.1%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Total coal production (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Asia Pacific	5 747	5 947	6 358	6 456	3.5%	6.9%	0.5%
China	3 789	3 942	4 237	4 237	4.0%	7.5%	0.0%
India	758	805	893	1 021	6.3%	10.9%	4.6%
Australia	474	470	446	450	-0.7%	-5.2%	0.3%
Indonesia	566	569	622	582	0.6%	9.3%	-2.2%
North America	538	579	594	494	7.5%	2.5%	-5.9%
United States	486	524	535	443	8.0%	2.0%	-6.1%
Central and South America	61	66	65	62	9.7%	-2.9%	-1.3%
Europe	447	485	519	433	8.6%	6.9%	-5.8%
European Union	302	332	357	289	10.2%	7.3%	-6.8%
Middle East	2	2	2	2	0.0%	3.6%	0.0%
Eurasia	539	564	538	537	4.7%	-4.6%	-0.1%
Russia	402	437	404	392	8.6%	-7.4%	-1.1%
Africa	260	245	243	238	-5.9%	-0.7%	-0.7%
World	7 592	7 888	8 318	8 221	3.9%	5.4%	-0.4%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Thermal coal and lignite production (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Asia Pacific	4 851	5 061	5 480	5 596	4.3%	8.3%	0.7%
China	3 114	3 257	3 561	3 595	4.6%	9.3%	0.3%
India	752	799	886	1 013	6.3%	10.9%	4.6%
Australia	290	300	277	268	3.4%	-7.7%	-1.0%
Indonesia	562	565	615	572	0.5%	8.9%	-2.3%
North America	460	491	505	408	6.9%	2.7%	-6.9%
United States	436	468	480	391	7.3%	2.5%	-6.6%
Central and South America	56	63	61	58	12.0%	-3.1%	-1.4%
Europe	432	470	504	419	8.7%	7.2%	-6.0%
European Union	288	318	342	275	10.4%	7.6%	-7.0%
Middle East	0	0	0	0	31.2%	1.1%	0.0%
Eurasia	436	456	438	434	4.7%	-4.0%	-0.2%
Russia	303	332	308	295	9.7%	-7.4%	-1.4%
Africa	253	236	234	228	-6.7%	-1.0%	-0.8%
World	6 488	6 777	7 221	7 143	4.5%	6.5%	-0.4%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Metallurgical coal production (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Asia Pacific	896	886	878	860	-1.0%	-1.0%	-0.7%
China	675	684	676	642	1.4%	-1.2%	-1.7%
India	6	6	7	8	0.6%	13.0%	4.7%
Australia	184	171	169	182	-7.2%	-0.9%	2.5%
Indonesia	4	5	7	9	15.2%	62.3%	7.4%
North America	79	88	89	86	11.4%	1.3%	-1.0%
United States	50	56	55	52	13.4%	-1.7%	-2.1%
Central and South America	4	4	4	4	-20.0%	1.1%	0.6%
Europe	14	15	15	15	5.0%	0.3%	-1.4%
European Union	13	14	14	14	5.9%	0.1%	-1.4%
Middle East	1	1	1	1	-3.2%	4.0%	0.0%
Eurasia	103	108	101	102	4.8%	-6.8%	0.5%
Russia	99	104	96	96	5.0%	-7.6%	0.0%
Africa	7	8	9	10	24.4%	8.7%	2.1%
World	1 104	1 111	1 096	1 078	0.6%	-1.3%	-0.6%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Total coal imports (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Europe	137	154	176	118	12.2%	14.3%	-12.5%
Japan	174	173	184	156	-0.5%	6.3%	-5.3%
Korea	123	126	127	119	1.7%	0.7%	-2.0%
Chinese Taipei	63	70	65	66	10.3%	-6.8%	0.4%
China	317	338	285	288	6.8%	-15.7%	0.3%
India	220	207	221	209	-5.9%	7.1%	-1.9%
Southeast Asia	154	150	148	160	-2.4%	-1.5%	2.7%
Rest of world	150	153	136	147	2.3%	-11.4%	2.6%
World	1 338	1 371	1 341	1 262	2.5%	-2.1%	-2.0%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Thermal coal and lignite imports (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Europe	86	96	121	66	11.2%	26.0%	-18.4%
Japan	132	129	140	116	-1.9%	8.4%	-6.0%
Korea	86	90	92	86	4.0%	2.2%	-2.1%
Chinese Taipei	55	61	56	56	11.0%	-8.8%	0.0%
China	244	284	240	235	16.2%	-15.4%	-0.7%
India	157	141	152	125	-10.3%	7.8%	-6.4%
Southeast Asia	137	126	124	135	-7.7%	-2.2%	3.1%
Rest of world	119	119	111	117	0.1%	-7.3%	1.8%
World	1 017	1 047	1 035	936	2.9%	-1.1%	-3.3%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Metallurgical coal imports (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Europe	51	58	55	52	13.9%	-5.0%	-1.7%
Japan	42	44	44	40	3.6%	0.2%	-3.2%
Korea	37	36	35	33	-3.5%	-3.0%	-1.6%
China	73	55	45	52	-24.6%	-17.3%	5.0%
India	63	66	69	84	5.1%	5.4%	6.8%
Rest of world	55	66	58	64	19.6%	-11.6%	3.3%
World	321	324	307	326	1.1%	-5.4%	2.1%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Total coal exports (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Australia	376	370	350	362	-1.5%	-5.4%	1.1%
Canada	32	32	36	36	0.1%	14.3%	-0.5%
Colombia	72	55	53	53	-23.8%	-3.2%	0.0%
Indonesia	408	436	473	411	6.8%	8.5%	-4.6%
Russia	212	215	192	189	1.0%	-10.7%	-0.5%
South Africa	73	63	70	53	-13.4%	10.3%	-8.9%
United States	63	77	76	65	23.4%	-1.3%	-5.2%
Rest of world	88	85	101	94	-3.3%	19.0%	-2.4%
World	1 323	1 333	1 351	1 262	0.7%	1.4%	-2.2%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Thermal coal and lignite exports (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Australia	200	199	184	183	-0.4%	-7.4%	-0.2%
Colombia	70	54	52	52	-22.9%	-3.7%	0.0%
Indonesia	404	432	469	406	6.8%	8.6%	-4.7%
Russia	174	174	157	150	-0.4%	-9.8%	-1.4%
South Africa	72	63	69	52	-13.5%	10.4%	-9.0%
United States	25	36	35	25	47.4%	-2.8%	-10.7%
Rest of world	63	68	79	68	7.2%	16.4%	-4.7%
World	1 008	1 025	1 045	936	1.6%	1.9%	-3.6%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Metallurgical coal exports (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Australia	176	171	166	179	-2.7%	-3.0%	2.5%
Canada	27	26	28	30	-2.9%	7.8%	1.7%
Mongolia	19	11	17	18	-40.9%	54.4%	2.5%
Mozambique	4	4	6	6	13.1%	34.2%	1.9%
Russia	38	41	35	39	7.2%	-14.4%	3.3%
United States	38	41	41	40	7.9%	0.0%	-1.0%
Rest of world	13	13	13	15	-1.4%	2.5%	3.3%
World	315	308	307	326	-2.3%	-0.4%	2.1%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Total seaborne coal imports (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Europe	128	147	176	118	15.1%	19.8%	-12.5%
Japan	174	173	184	156	-0.5%	6.3%	-5.3%
Korea	123	126	127	119	1.7%	0.7%	-2.0%
Chinese Taipei	63	70	65	66	10.3%	-6.8%	0.4%
China	295	326	267	268	10.4%	-18.1%	0.1%
India	220	207	221	209	-5.9%	7.1%	-1.9%
Southeast Asia	154	150	148	160	-2.4%	-1.5%	2.7%
Rest of world	125	127	126	137	1.8%	-0.9%	2.8%
World	1 282	1 325	1 313	1 233	3.4%	-0.9%	-2.1%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Seaborne thermal coal and lignite imports (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Europe	77	89	121	66	15.4%	35.6%	-18.4%
Japan	132	129	140	116	-1.9%	8.4%	-6.0%
Korea	86	90	92	86	4.0%	2.2%	-2.1%
Chinese Taipei	55	61	56	56	11.0%	-8.8%	0.0%
China	241	282	239	234	16.9%	-15.5%	-0.7%
India	157	141	152	125	-10.3%	7.8%	-6.4%
Southeast Asia	137	126	124	135	-7.7%	-2.2%	3.1%
Rest of world	106	106	105	112	0.1%	-1.1%	2.0%
World	992	1 025	1 028	929	3.3%	0.2%	-3.3%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Seaborne metallurgical coal imports (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Europe	50	58	55	52	14.5%	-4.5%	-1.7%
Japan	42	44	44	40	3.6%	0.2%	-3.2%
Korea	37	36	35	33	-3.5%	-3.0%	-1.6%
China	54	44	28	34	-19.0%	-35.4%	6.5%
India	63	66	69	84	5.1%	5.4%	6.8%
Rest of world	43	53	54	60	22.0%	2.3%	3.5%
World	290	300	285	304	3.5%	-4.8%	2.1%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Total seaborne coal exports (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Australia	376	370	350	362	-1.5%	-5.4%	1.1%
Canada	31	31	36	35	-1.3%	15.5%	-0.5%
Colombia	72	55	53	53	-23.8%	-3.2%	0.0%
Indonesia	408	436	473	411	6.8%	8.5%	-4.6%
Russia	212	215	192	189	1.0%	-10.7%	-0.5%
South Africa	73	63	70	53	-13.4%	10.3%	-8.9%
United States	63	77	76	65	23.4%	-1.3%	-5.2%
Rest of world	37	43	48	46	15.2%	12.3%	-1.2%
World	1 272	1 290	1 298	1 214	1.4%	0.6%	-2.2%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Seaborne thermal coal and lignite exports (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Australia	200	199	184	183	-0.4%	-7.4%	-0.2%
Colombia	70	54	52	52	-22.9%	-3.7%	0.0%
Indonesia	404	432	469	406	6.8%	8.6%	-4.7%
Russia	174	174	157	150	-0.4%	-9.8%	-1.4%
South Africa	72	63	69	52	-13.5%	10.4%	-9.0%
United States	25	36	35	25	47.4%	-2.8%	-10.7%
Rest of world	33	38	44	40	16.4%	16.5%	-3.1%
World	978	995	1 010	908	1.8%	1.5%	-3.5%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Seaborne metallurgical coal exports (Mt), 2020-2025

Region/country	2020	2021	2022	2025	2020-2021	2021-2022	CAAGR 2022-2025
Australia	176	171	166	179	-2.7%	-3.0%	2.5%
Canada	27	26	28	29	-4.4%	8.8%	1.7%
Mozambique	4	4	6	6	13.1%	34.2%	1.9%
Russia	38	41	35	39	7.2%	-14.4%	3.3%
United States	38	41	41	40	7.9%	0.0%	-1.0%
Rest of world	12	11	12	13	-1.4%	2.9%	3.8%
World	294	295	288	306	0.1%	-2.4%	2.1%

Notes: CAAGR = compound average annual growth rate. Data for 2020 and 2021 are from IEA statistics; 2021 are preliminary; 2022 are estimated; 2025 are forecasts. Differences in totals are due to rounding.

Coal mining projects

Country	Project	Company	Type	Earliest proposed start-up	Proposed full capacity (Mtpa)	Resource	Status
Australia	Angus Place West	Centennial Coal	N	2024+	2	TC	LA
Australia	Baralaba South	Baralaba Coal	E	..	5	PCI	LA
Australia	Belview	Stanmore Coal	N	2027+	2.6	TC, CC, PCI	LA
Australia	Bulga (Mod 3 and Mod 7)	Glencore	E	2026+	6.6	TC	LA
Australia	Burton	Bowen Coking Coal	N	2022	2	TC, CC	MA
Australia	Carborough Downs	Fitzroy Australia Resources	E	..	5	CC, PCI	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	China Stone	MacMines Austasia	N	..	38	TC	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	6	TC	LA
Australia	Dysart East	Bengal Energy	N	2025	1.2	CC	LA
Australia	Eagle Downs	South32 / Aquila Resources	N	2025	4.5	TC, CC	LA
Australia	Elimatta	New Hope	N	2027+	4	TC, CC	LA

Country	Project	Company	Type	Earliest proposed start-up	Proposed full capacity (Mtpa)	Resource	Status
Australia	Galilee Coal Project	Waratah Coal	N	2027+	40	TC, CC	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	Jellinbah Central North Extension	Jellinbah Group	N	2025+	1	PCI	LA
Australia	Ironbark No. 1 (Ellensfield)	Fitzroy Australia Resources	N	2023+	2.7	TC, CC	MA
Australia	Isaac Plains Complex - Isaac Downs Project	Stanmore Coal	N	2024+	2.4	TC, CC	MA
Australia	Isaac Plains Complex - Underground extension	Stanmore Coal	E	2029	1.2	TC, CC	LA
Australia	Karin	Vitrinite / Itochu Corporation	N	..	1.7	CC	LA
Australia	Kevin's Corner	GVK	N	2027+	10.6	TC	LA
Australia	Lake Vermont Meadowbrook Project	Lake Vermont Joint Venture	E	2027+	5.5	CC	LA
Australia	Mandalong Southern Extension Project	Centennial Coal	E	2022+	..	TC	MA
Australia	Mangoola Coal Continued Operations Project	Glencore	E	2023+	5	TC	LA

Country	Project	Company	Type	Earliest proposed start-up	Proposed full capacity (Mtpa)	Resource	Status
Australia	Maxwell Project	Malabar Coal	N	2023+	3.6	TC, CC	MA
Australia	Mavis Downs - Millenium	MetRes	E	2022	1.2	CC, PCI	MA
Australia	Meandu King 2 East Project	Stanwell	E	2024	5	TC	LA
Australia	Minyango	Qcoal	N	2027+	7	TC	LA
Australia	Moorlands	Cuesta Coal	N	2027+	1.9	TC	LA
Australia	Mount Owen (Glendell Mine) Continued Operations Project	Glencore	E	2024+	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	LA
Australia	New Acland (Stage 3)	New Hope	E	2023	7.5	TC	LA
Australia	New Lenton	Bowen Coking Coal	N	2029	1.5	TC, CC, PCI	LA
Australia	Newstan Mine Extension Project	Centennial Coal	E	2027+	1.6	TC, CC	LA
Australia	Northern Galilee Coal Project	TerraCom	N	..	..	TC	LA
Australia	North Surat - Collingwood Project	New Hope Coal	N	2027+	4	TC	LA
Australia	North Surat - Taroom Project	New Hope Coal	N	2027+	8	TC	LA
Australia	North Surat - Woori Project	New Hope Coal	N	2027+	2.5	TC	LA
Australia	Olive Downs South	Pembroke Resources	N	2023	4.5	CC	MA

Country	Project	Company	Type	Earliest proposed start-up	Proposed full capacity (Mtpa)	Resource	Status
Australia	Olive Downs South Stage 2	Pembroke Resources	E	2027+	4.5	CC	LA
Australia	Red Hill Mining	BHP Billiton / Mitsubishi Alliance	N	2027	14	CC	LA
Australia	Rolleston Expansion Project	Glencore	E	2025+	5	TC	LA
Australia	Russell Vale Underground Expansion Revised Project	Wollongong Coal	E	2021	1	CC	MA
Australia	Saraji East	BHP Billiton / Mitsubishi Alliance	N	2024	7	CC	LA
Australia	South Galilee Coal Project	Alpha Coal Pty Ltd and AMCI (Alpha) Pty Ltd	N	2027+	3	TC	LA
Australia	Springsure Creek	Adamelia Group	N	2027+	11	TC	LA
Australia	Spur Hill Underground Coal Project	Malabar Coal	N	2026+	6	TC, CC	LA
Australia	Stratford extension	Yancoal Australia	E	2022	1.2	TC	MA
Australia	Styx (Central Queensland Coal Project)	Central Queensland Coal Pty Ltd	N	2027+	2	TC, CC	LA
Australia	Tahmoor South Coal Project	SIMEC Group	E	2022	1	CC	MA
Australia	The Range Project	Stanmore Coal	N	2026+	5	TC	LA
Australia	Vickery Extension Project	Whitehaven	N	2025	5.5	TC, CC	LA
Australia	Vulcan Mine Complex	Vitrinite	N	2022	1.9	CC	MA
Australia	Wallarrah 2 Coal Project	Korea Resources Corp	N	2027+	4	TC	LA

Country	Project	Company	Type	Earliest proposed start-up	Proposed full capacity (Mtpa)	Resource	Status
Australia	Walton	Aquila Resources	N	2024+	1.6	PCI	LA
Australia	Wandoan	Glencore	N	2027+	22	TC	LA
Australia	Wards Well	BHP Billiton / Mitsubishi Alliance	N	2027	5	CC	LA
Australia	Willunga/Vermont East	Pembroke Resources	E	2029	4	TC, CC, PCI	LA
Australia	Wilton-Fairhill	Futura Resources	N	2023	2.6	CC	MA
Australia	Winchester South	Whitehaven Coal	N	2027+	8.5	TC, CC	LA
Botswana	Boomslang Project	Tlou Energy	N	..	..	TC	LA
Botswana	Mmamabula Coal Project	Maatla	N	2023	1.2	TC	MA
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
Canada	Grande Cache	CST	N	2022	1.7	CC	MA
Canada	Grassy Mountain	Bega Mining	N	2023+	4.5	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	2024	2	CC	LA
Canada	Sukunka	Glencore	N	..	3	CC	LA

Country	Project	Company	Type	Earliest proposed start-up	Proposed full capacity (Mtpa)	Resource	Status
Canada	Tenas	Allegiance Coal / Itochu	N	2024	0.75	CC	LA
Canada	Tent Mountain	Montem	E	2023	1.1	TC	LA
Canada	Wolverine-Hermann Amendment Project	Conuma Coal Resources Ltd.	N	2022	1	CC	LA
Colombia	Canaverales	Yildirim Holding	N	2021	2.5	TC	LA
Colombia	Papayal	Yildirim Holding	N	2022	2.4	TC	LA
Colombia	San Juan	Yildirim Holding	N	2023	16	TC, PCI	LA
Colombia	La Francia and El Hatillo	Colombian Natural Resources (CNR)	E	2021	2	TC	MA
Indonesia	Adaro MetCoal Companies (AMC) Concessions	Adaro	N	..	..	CC	LA
Indonesia	Arthaco Prima Energi	IATA	N	..	..	TC	LA
Indonesia	Bukit Enim Energi	Adaro	N	..	..	TC	LA
Indonesia	Tambang Benua Alam Raya (TBAR) project	Cokal	N	..	..	CC	LA
Indonesia	Tekno Orbit Persada	MEC Coal	N	..	5	TC	LA
Mongolia	Nuurstei Coking Project	Aspire Mining	N	2019	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	2021	19	CC	LA
Mozambique	Moatize Coal Mine	Vulcan Minerals (Jindal Group)	E	2021	15	TC, CC	LA

Country	Project	Company	Type	Earliest proposed start-up	Proposed full capacity (Mtpa)	Resource	Status
Mozambique	Ncondezi	Ncondezi Energy	N	2022	1.5	TC	LA
Mozambique	Revuboe	Talbot Group, Nippon Steel and POSCO	N	..	7	TC, CC	LA
Mozambique	Zambeze	ICVL	N	2023	12	CC	LA
Poland	Jan Karski Project	Prairie Mining	N	..	6.3	CC	LA
Russia	Amaam	Tiger Realm Coal	N	2022	5	CC	LA
Russia	Chernogorsky	SUEK	E	2023	3.5	TC	MA
Russia	Elegest Expansion	Tuva Energy Industry Corporation (TEPK)	E	..	10	CC	LA
Russia	Inaglinsky-2	Kolmar	E	..	8	CC	LA
Russia	Karakansky (Stage III) /Karakansky Globoky	Karakan Invest	N	2019	3	TC	LA
Russia	Pravoberezhny	SUEK	E	2024	3	TC	LA
Russia	West-Taymyr Industrial Cluster	AEON	N	2023	5	CC	MA
Russia	Tikhova Stage 2	Industrial Metallurgical Holding	E	2025	1.3	CC	LA
South Africa	Argent Colliery	Glencore/Shanduka	N	..	1.2	TC	LA
South Africa	Umzila coal mine	Canyon Coal	N	2023	3.6	TC	MA
South Africa	Boikarabelo Stage 2	Resource Generation	E	2025+	6	TC	LA

Country	Project	Company	Type	Earliest proposed start-up	Proposed full capacity (Mtpa)	Resource	Status
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	2023	3	TC	MA
South Africa	Liberty Coal Mine Expansion	Templar Capital	E	..	12	TC	LA
South Africa	Makhado Phase 1	MC Mining	N	2023	1.1	TC, CC	MA
South Africa	Makhado Phase 2	MC Mining	E	2025	0.6	TC, CC	LA
South Africa	New Largo	Seriti	N	..	12	TC	LA
South Africa	Ukwenama coal mine	Canyon Coal	N	..	0.6	TC	LA
South Africa	Weltevreden coal project	Seriti	E	..	..	TC	MA
South Africa	Sukuma coal mine	Canyon Coal	N	2023	7	TC	LA
South Africa	Thuso coal project	Canyon Coal	N	2023	1.2	TC	LA
Ukraine	Lubel	Lubel Coal Company	N	..	5.2	CC	LA
United Kingdom	Lochinvar	New Age Exploration	N	..	1.4	CC	LA
United Kingdom	Woodhouse Colliery	West Cumbria Mining	N	2024	2.5	CC	LA
United States	Blue Creek No. 1	Warrior Met Coal	E	2025	4.3	CC	LA

Country	Project	Company	Type	Earliest proposed start-up	Proposed full capacity (Mtpa)	Resource	Status
United States	Elk Creek	Ramaco Carbon LCC	E	2023	0.9	CC	MA
United States	Itmann	Consol Energy	N	2022	0.6	CC	MA
United States	Longview	North Central Ressources, LLC	N	2023	3	CC	MA
United States	RAM Mine	Ramaco Resources, Inc.	N	2023	0.5	CC	LA
United States	River View Henderson Portal 1	Alliance Coal LLC	N	2025	..	TC	LA

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 previous to 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: Southeast Asia 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.

Southeast Asia: Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic (Lao PDR), Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam. These countries are all members of the Association of Southeast Asian Nations (ASEAN).

Abbreviations and acronyms

API	Argus/McCloskey's Coal Price Index
ARA	Amsterdam, Rotterdam, and Antwerp
CCUS	carbon capture, utilisation and storage
CFR	cost and freight
CIF	cost, insurance and freight
CRU	CRU Group
CV	calorific value
EIA	Energy Information Administration (United States)
EU	European Union
FOB	free on board
GDP	gross domestic product
IEA	International Energy Agency
met	metallurgical
OECD	Organisation for Economic Co-operation and Development
LNG	liquefied natural gas
TTF	Title Transfer Facility (Netherlands)
US	United States
USD	United States dollar
y-o-y	year-on-year

Units of measure

bt	billion tonnes
GW	gigawatt
kcal	kilocalorie
kg	kilogramme
km	kilometre
kt	kilotonnes
MBtu	million British thermal units
Mt	million tonnes
Mtpa	million tonnes per annum
MW	megawatt
t	tonne
TWh	terawatt hours

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