Global Energy Monitor

BRIEFING: OCTOBER 2021

NORTH AMERICAN COAL PRODUCERS PLAN $4.8 BILLION USD ON 15 NEW MINES FOR STEEL EXPORT MARKETS

PROJECTS AT RISK OF STRANDED ASSETS UNDER NET-ZERO TARGETS AND DECARBONIZATION POLICIES

Coal producers in the United States and Canada plan to spend $4.8 billion USD on 15 new metallurgical coal mine projects, each intended for steelmaking and mixed industrial consumers, according to a new survey from Global Energy Monitor. The rosy forecasts of capacity-building in the steel industry and a recent spike in metallurgical coal prices have encouraged some producers to mine more metallurgical-grade coal, a primary ingredient for the steel industry's blast furnace-basic oxygen furnace process. But North American investments in new metallurgical coal mines are unlikely to yield anticipated returns, or fulfill promises of 4,000 new jobs. The volatile coal export market, fast approaching net-zero targets, and decarbonization policies leave these projects vulnerable to economic and regulatory stranding. Coal producers plan to produce 38 million tonnes each year from these new mines for export to Asia Pacific countries—more than double North America's current sales to the region. However, the global steel industry faces mounting pressure to shift gears from coal-based steelmaking to electric steelmaking, putting metallurgical coal producers at risk of oversupply and stranding.

Coal Mine Projects Under Development

In the United States and Canada, coal producers are currently planning 15 metallurgical mine projects, amounting to 38 million tonnes of new annual capacity (Table 1 and 2). These mines are concentrated in the coalfields of Appalachia, British Columbia, and Alberta, with Canada proposing 11 new projects, representing 28 million tonnes per annum (mtpa), and the United States proposing 4 new projects, representing 10 mtpa (Figure 1). The new mines plan to open over the next 3-4 years, with the last going into production in 2027.

The capital expenditures necessary to bring all 15 coking coal mine projects into operation is $4.8 billion USD, based on the reported start-up costs at each project. The coal industry has promised nearly 3,500-4,000 operational jobs at these new mines, not including additional employment from construction labor.

TABLE 1. Planned Mine Projects in the United States

Mine	Owner	Capacity (Million Tonnes)	Location	Workforce Size	Development Cost (Million USD)	Export
Blue Creek Coal Mine	Warrior Met Coal	3.9	Alabama	350	600	India, Vietnam, Malaysia, Indonesia
Itmann Coal Mine	Consol Energy	0.9	West Virginia	125	90	India
Longview Coal Mine	AMCI, Itochu POSCO, JAZ	3.6	West Virginia	*	450	Japan, South Korea, and India
Mon Valley Coal Mine	Coronado Group	1.8	Pennsylvania	238	250	India, Domestic

Source: Global Coal Mine Tracker, Global Energy Monitor, October 2021

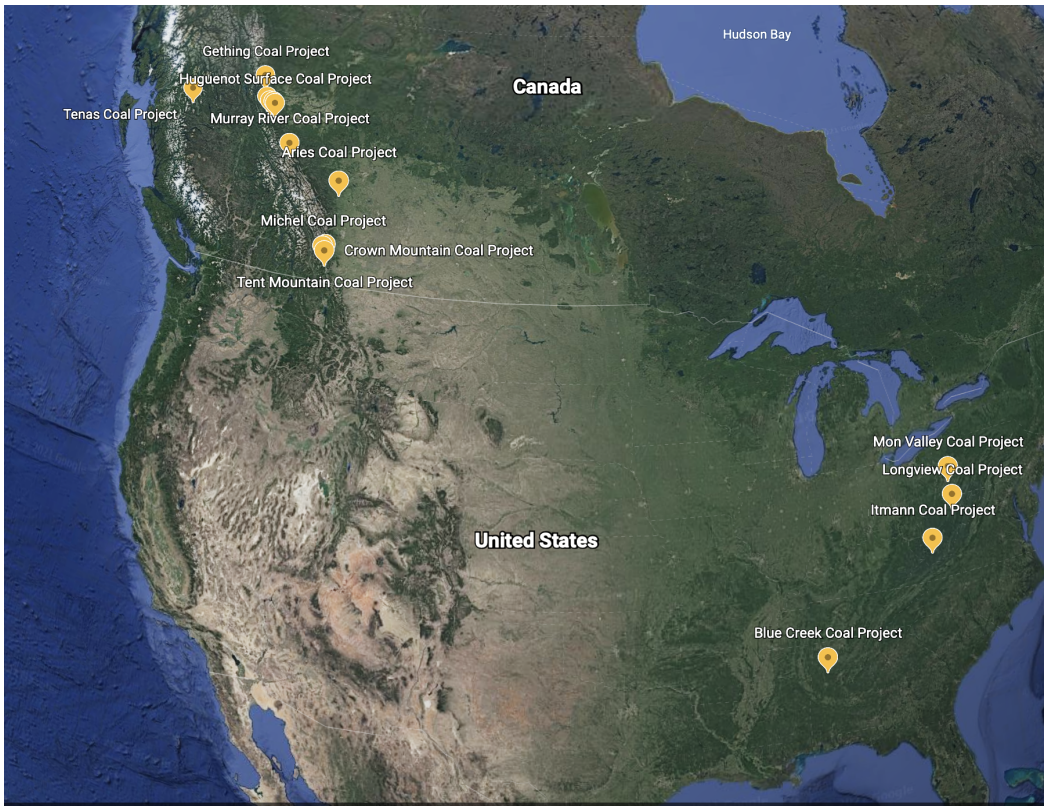
TABLE 2. Planned Mine Projects in the Canada

Mine	Owner	Capacity (Million Tonnes)	Location	Workforce Size	Development Cost (Million USD)	Export
Tenas Coal Mine	Allegiance Coal	0.75	British Columbia	110	66	Northeast Asia
Aries Coal Mine	Ram River Coal	4	Alberta	*	49	Export
Crown Mountain Coal Project	Jameson Resources, Bathurst Resources	1.7	British Columbia	350	330	China
Gething Coal Mine	CKD Mines	3	British Columbia	773	860	Japan, China and Korea
Huguenot Project	Colonial Coal International Corporation	2.7	British Columbia	*	303	Unspecified
Flatbed Project	Colonial Coal International Corporation	2	British Columbia	*	300	Unspecified

Michel Coal Project	North Coal	2	British Columbia	300	280	Unspecified
Murray River Coal Mine	HD Mining	6	British Columbia	780	536	Unspecified
Sukunka Coal Mine	Glencore	3	British Columbia	250	361	Unspecified
Tent Mountain Coal Mine	Montem Resources	1.1	British Columbia	190	168	Unspecified
Wolverine-Hermann Coal Mine	Conuma Coal Resources Limited	1.0	British Columbia	345	*	Unspecified

Source: Global Coal Mine Tracker, Global Energy Monitor, October 2021

FIGURE 1. Map of Proposed Met Coal Mines in the U.S. and Canada



Source: Global Coal Mine Tracker, Global Energy Monitor, October 2021

Unnecessary Build Out

The long-term viability of these new mines and their employment promises remain speculative and uncertain. According to investor presentations and public announcements, these projects are mostly

intended for export to the Asia Pacific region, specifically China, South Korea, Japan, and India--the world's four largest metallurgical coal import markets. But these countries are unlikely to absorb North America's proposed 38 million tonnes of new metallurgical coal capacity. The United States and Canada exported only 34 million tonnes to those four countries in 2020, meaning demand would need to rally 112% to make up for new supply.

The new mines will produce excess coal since they are not intended to replace depleted reserves at existing operations. Coal reserves at existing metallurgical coal mines in the United States and Canada could sustain current production levels until at least 2032, with at least 4.5 billion tonnes of additional mine-level resources that operators could upgrade to prolong the life of mine for decades to come. The 11-12 years of reported mine-level reserves, on top of abundant resources, suggest that some economic stranding might occur even without building new mines.

While seven mine projects in Canada provide no details on specific national or regional markets, there's little reason to believe they are eyeing a new portfolio of consumers. Canada exports almost all of its metallurgical coal, most of it to Japan and South Korea, so there are few domestic consumers to absorb excess production.

Steel's Export Volatility

The United States and Canada are the world's second and third largest suppliers of exported metallurgical coal, comprising 14% and 10% of the market, respectively. But the export-focused metallurgical coal industry is highly concentrated and remains prone to volatility in the global steel market. Demand fluctuations are outside of producer control. In 2019, for instance, metallurgical coal exports from the United States fell 10% after maintenance shutdowns at just three blast furnaces at steelmaking plants in Brazil. The cold realities of the steel export market have encouraged Teck Resources, the largest metallurgical coal producer in North America, to shelve its recent metallurgical coal Quintette Project. The company has no active proposals, just life of mine extensions, signaling hesitancy from large producers about scaling up too quickly.

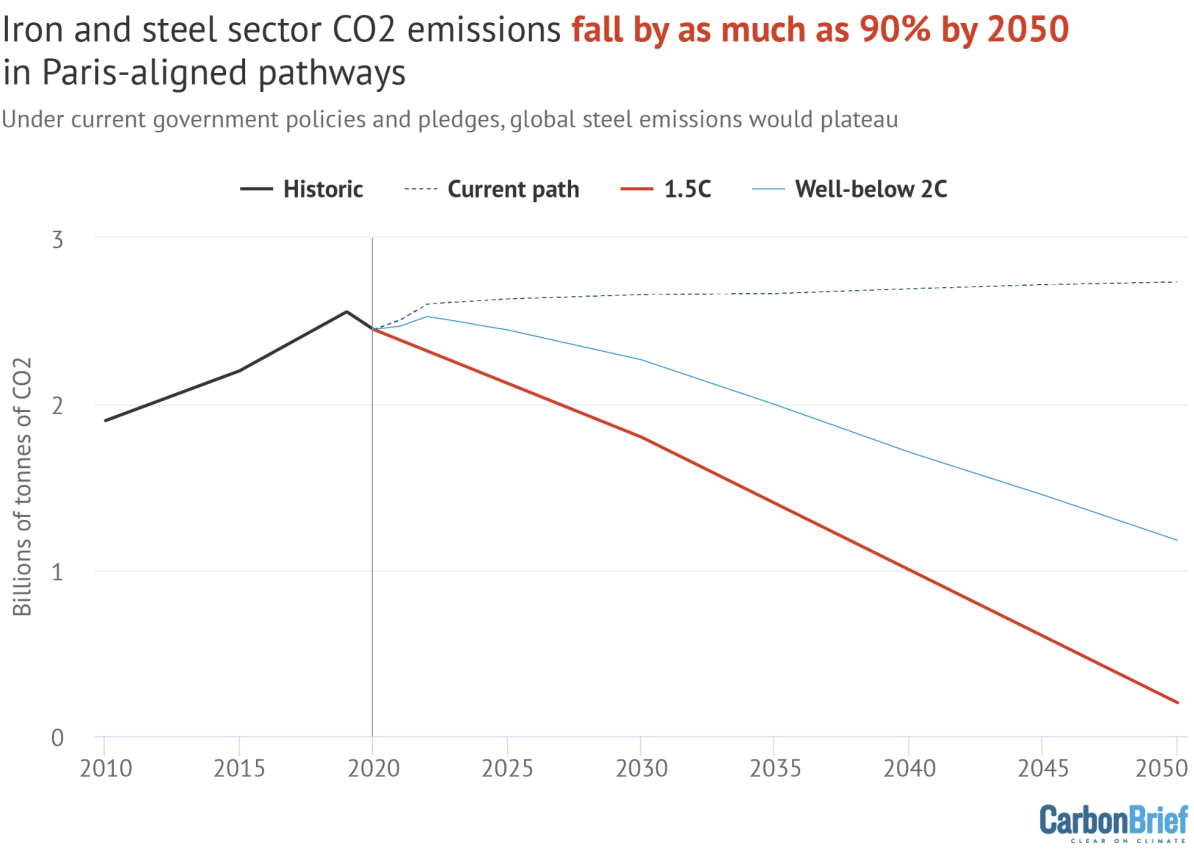
This July, a rally in demand for North American metallurgical coal encouraged producers to pursue new mines, but that renewed activity owes more to short-term geopolitical rows than long-term market dynamics. Last year, China effectively ended trade with Australia, by far the world's largest supplier of coking coal, after a diplomatic dispute over the origins of Covid-19. As a result, China has since encouraged producers in the United States and Canada to boost supply of coking coal to help fill China's import gap. But China's demand for metallurgical coal could fall if the country's steel production limits are realized. The resumption of trade relations between China and Australia to meet China's recent coal shortages could further dampen the import prospects for North America--a reality that may be already underway.

Net Zero Targets on the Horizon

The proposed North American coal mines are not immune to tighter emission regulations or commitments under the Paris climate agreement. The International Energy Agency (IEA) expects steel demand to increase more than a third by 2050 as economies in the Global South mature. To meet the goals of the Paris climate agreement, the IEA's Sustainable Development Scenario models halve metallurgical coal use globally by 2040, equal to a 3.5% annual decline each and every year; its more

ambitious net zero by 2050 scenario nearly phases out metallurgical coal use by 2050 (Figure 2). This means that the steel industry must transition away from the conventional, coal-based steelmaking process to lower-emissions processes like direct reduced iron production and electric steelmaking, which do not use metallurgical coal. The global steel industry is currently responsible for 11% of total global CO_2 emissions. Major importers of metallurgical coal from the United States and Canada have all made some level of commitment to carbon reduction targets, meaning that they will likely need to address industrial decarbonization, including within the steel sector, in coming years.

FIGURE 2. Direct CO_2 Emissions from the Iron and Steel sector 2010-2070, Billions of Tonnes.



Source: 1.5C pathway (IEA Net Zero by 2050), Historic emissions, current path and well-below 2C pathway (IEA Sustainable Development Scenario). Chart by Carbon Brief using Highcharts.

The metallurgical coal mine projects currently under development in North America are susceptible to regulatory stranding. These projects list China, South Korea, Japan, and India as potential buyers, but the long-term demand of those importers is not guaranteed.

China, the world's largest steelmaker, has committed to be carbon neutral by 2060 and China's Ministry of Information and Technology is preparing a five-year plan to lower emissions by switching domestic steelmakers away from coal-based steelmaking to electric steelmaking with increased steel scrap recycling. Baowu, China's largest steel producer, has even committed to achieving carbon neutrality by 2050 with peak emissions expected in 2023. Similarly, South Korea and Japan have announced net-zero

targets for mid-century, and POSCO and Nippon Steel, the largest steel manufacturer in each country, have committed to net zero emissions in 2050. Both South Korea and Japan have also seen stagnating steel production, leading to steel plant closures in Japan, where Nippon Steel has decided to shut down three coal-based blast furnaces over the next few years. Finally, India has committed to a reduction of 33-35% in emissions intensities by 2030 and two of the three largest steelmakers in India, JSW Steel and SAIL, have committed to cutting carbon dioxide emissions 40% and 23% by 2030, respectively.

Shrinking Domestic Coking Markets

The potential for domestic consumption of metallurgical coal in the United States and Canada is even more limited and producers run the risk of economic stranding. In the United States, steel production has been in steady decline, from 102 million tonnes in 2000 to 88 million tonnes of steel in 2019, with the bulk of the declines in higher-emission coal-based steelmaking. ArcelorMittal USA (purchased by Cleveland-Cliffs in 2020) and U.S. Steel idled 4.3 mtpa of coal-based steel production in 2019 and an additional 3.5 mtpa in 2020, which reduced potential US coking coal demand by up to 4.4 mtpa.

Steelmaking Terminology

Blast furnace-basic oxygen furnace (BF-BOF) is a form of iron- and steelmaking that uses coal as the main fuel source, which not only provides heat but also chemical properties that make it hard to substitute coal with alternatives.

Direct reduced iron (DRI) is a form of ironmaking that typically uses gas. The gas can be natural gas or sometimes coal. More recently, projects have begun using hydrogen gas created by renewable energy, making DRI more easily retrofitted for a wider array of decarbonization options than BF ironmaking.

Electric arc furnace (EAF) is a form of steelmaking that uses electricity. The emissions depend on the make-up of the electricity system and raw materials used, meaning emissions from EAF steelmaking can be more easily reduced than from BOF steelmaking.

The shift from coal-based blast furnace-basic oxygen furnace (BF-BOF) steelmaking to electric steelmaking is expected to continue in the US as electric arc furnace (EAF) production continues to dominate the US steel sector and a wave of new EAF mini-mills is set to roll out by 2023. The country's EAF crude steel capacity will grow from 69.4 mtpa to nearly 80 mtpa, according to research from GEM.

What's more, all of the United States's coal-based steelmaking plants (36.2 mtpa crude steel capacity) are now owned by just two companies: Cleveland-Cliffs (22.9 mtpa) and U.S. Steel (13.3 mtpa). U.S. Steel has already said that it will not make further investments in its aging Great Lakes and Granite City coal-based steel mills and will become carbon neutral by 2050, while Cleveland-Cliffs plans to lower their GHG emissions 25% from 2017 levels by 2030. The two companies will therefore likely reduce their BF-BOF capacity and demand for metallurgical coal over the next decade, not grow it.

The United States has also shown promising signs of adopting a federal Buy Clean program, which would reward domestic steel producers for having lower CO2 intensities than foreign competitors, further incentivizing EAF production over BF-BOF facilities.

The Canadian steel industry also shows clear signs of shifting away from BF-BOF facilities and reducing their metallurgical coal demand. Canada currently operates 15.5 mtpa of steelmaking capacity: 9 mtpa BF-BOF facilities and 6.5 mtpa EAF. Although the majority of Canadian steel is currently made through coal-based operations, the Canadian government

and Canadian steelmakers are investing in projects to replace BF-BOF capacity with lower-emissions steelmaking.

ArcelorMittal Dofasco will receive $400 million CAD from Canada's federal government to complete a $1.756 billion CAD ($1.41 billion USD) project to replace their 2.7 mtpa coal-based steelmaking operations with a 2 mtpa direct reduced iron (DRI) plant and 2.4 mtpa EAF capacity. Algoma Steel, which currently operates 3.2 mtpa BF-BOF capacity, will receive $420 million CAD to transition to EAF steelmaking.

The remaining third of Canada's coal-based steelmaking is mainly operated by Stelco at their Lake Erie plant (2.5 mtpa BF-BOF capacity). Though Stelco has not committed to transitioning to EAF production and recently completed an upgrade and relining of their blast furnace, Stelco plans to reduce their coke consumption by using waste railway ties.

Rio Tinto, the parent company of Rio Tinto Fer et Titane, which operates the remaining 0.6 mtpa coal-based steelmaking in Canada, has signed MoU's to research steel decarbonization pathways with other major steelmakers including Japan's Nippon Steel and South Korea's POSCO.

As a result, there is little way for domestic steelmaking consumers to absorb additional met coal capacity from new mines if Asia-Pacific export markets fail to provide greater demand. Only one coking coal project has cited domestic consumers as potential buyers in addition to export markets, and none purport to be intended solely for domestic use. Coronado Coal, a major producer of coking products, has claimed in public statements that its Mon Valley coal mine project is intended for steel mills in southwestern Pennsylvania. But U.S. Steel's Mon Valley Works announced plans to retire their coking plants in 2023 and cancelled plans earlier this year for major investments to upgrade their coal-based steelmaking facilities, citing sustainability goals and the company's net zero 2050 target as reasons for reallocating the funds.

The Move Toward Green Steel

Greener alternatives for steelmaking are available and growing. This trend is driven by a combination of emissions-focused policies and commitments to net zero and fossil free targets from major steel consumers like automotive and construction companies.

Midrex, a company based in the United States, is the leading producer of DRI plants globally. DRI serves as the lower-emissions iron source to coal-based BF-BOF production. Midrex has been commissioned by ArcelorMittal, the world's second largest steelmaker, to build Germany's first industrial scale hydrogen-based DRI plant by 2025, which could operate to produce fully fossil free steel.

In August this year, the Swedish project HYBRIT produced and delivered the world's first fossil free steel to the automaker Volvo Group. Another promising project, Boston Metal, has patented a molten oxide electrolysis technology that can produce carbon emissions-free steel. The company is currently working to scale up their technology for commercial deployment in 2023.

If demand for lower-emissions steel continues to increase, coal-based steelmakers will struggle to compete in the market. The shift from BF-BOF to EAF steelmaking will accelerate, and markets for metallurgical coal will shrink rather than grow in the years ahead.

Background on Global Energy Monitor

Global Energy Monitor is a nonprofit research organization developing information on fossil fuel projects worldwide. Through its Global Coal Plant Tracker (GCPT) project, Global Energy Monitor has provided biannual updates on coal-fired generating capacity since 2015. GCPT data is used by the International Energy Agency (IEA), the OECD Environment Directorate, UN Environment Programme, U.S. Treasury Department, and World Bank. GCPT data is licensed by Bloomberg LP and UBS Evidence Lab, and is used by the Economist Intelligence Unit and Bloomberg New Energy Finance.

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