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October 2021

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Metals, demand and decarbonization

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Insight

ISSN 2153-1536 (online)

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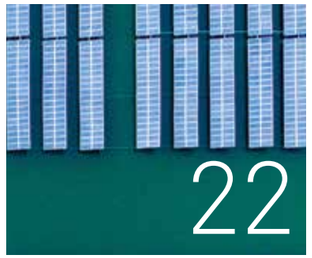
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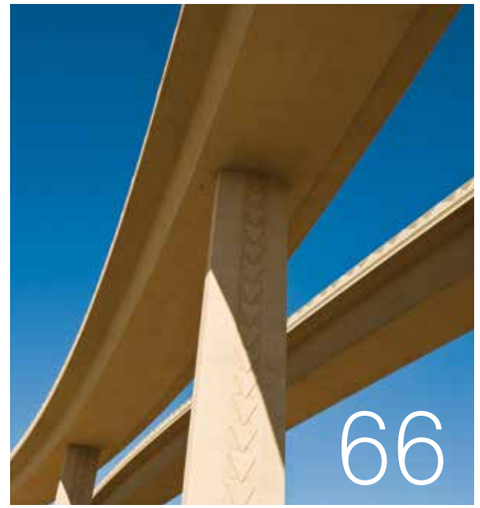
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Celebrating this year's award-winning companies and individuals across 15 categories

Editor's Note

Barbara Lorenzo Caluag

Editor

The world is not completely out of the woods, but now that many economies are learning to manage and live with the coronavirus pandemic, the opportunity to refocus on balancing growth and climate goals has reemerged.

This realignment is apparent across most business and industries but is especially pressing in resource- and energy-intensive sectors like metals and mining.

In this edition, we explore how companies are finding concrete ways to meet climate goals through decarbonization, sustainable solutions, and carbon finance, as well as laying out the challenges ahead.

Paul Bartholomew details how ESG factors are now a major consideration for mining companies developing projects around the world (page 8). Many firms are even aiming to be carbon neutral by 2030.

Setting goals and commitments is a start, but execution will not be easy, particularly for miners. South Africa, for instance, plays a major role in producing platinum, iridium and ruthenium – all essential elements in manufacturing hydrogen-powered vehicles. But there are concerns over the amount of carbon being emitted by miners whose operations are mainly run by coal-fired power generation (page 56).

China continues to dominate the battery supply chain, while Europe and the US are pouring investment into the sector to keep logistical issues at bay as electric vehicle sales are expected to keep growing. Henrique Ribeiro and Jacqueline Holman shed light on the prospects of gigafactories across the world (page 28), and our infographic on page 32 takes a closer look at which companies are taking the lead in this space.

We also look back at the impact of the Soviet Union's collapse on energy markets over the past three decades (page 36). Rosemary Griffin's infographic plots the expansion of ports and pipelines in the region that has diversified energy options for European and Asian markets.

Justine Coyne dissects the US infrastructure bill (page 66), while Meghan Gordon looks at how the Biden Administration is doubling down on its messaging to speed up climate response after a summer of extreme weather in the country (page 70).

Finally, despite the many challenges the metals industry faced during this tumultuous period, many companies continued to grow, evolve and innovate regardless of the difficulties. S&P Global Platts is thrilled to recognize outstanding companies and individuals in the sector at the 2021 Global Metals Awards. You can read more about their achievements from page 84.

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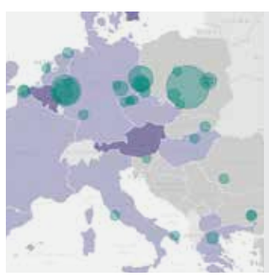

Interactive
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ESG spurs mining evolution

ESG factors are increasingly influencing decisions from board rooms to mining sites. Paul Bartholomew explores the impact on development of ferrous projects around the world

Environmental, social and governance, or ESG, is a broad concept – a set of criteria – that has been around for more than a decade. But it is now of vital importance to the mining and resources sector – and will have a major impact on the development of new projects, and therefore supply and commodity prices.

While ESG is applied to all industries, it is particularly pertinent to mining because of the enormous impact on the environment and local communities. Investors and financiers are putting the sector under far greater scrutiny than in the past and are turning away from projects deemed to be harmful to the environment.

S&P Global Ratings looks increasingly at how ESG factors may have a positive or negative influence on an entity's credit quality when compared with sector peers or the broader resources sector.

Environmental performance is a key plank of ESG. Accordingly, companies that operate in the mining sector have set carbon emissions targets, with most aiming to be carbon neutral by 2030.

Western Australian iron ore miner Fortescue Metals Group looks set to one day become a major producer and exporter of renewable hydrogen through its Fortescue Future Industries entity.

Iron ore companies that sell into China's heavily polluting steel sector are looking to decarbonize and address Scope 3 emissions – or indirect emissions in the value chain of an entity – by investing in green steel technologies.

Rio Tinto has exited the coal business and BHP plans to sell its interests in lower quality metallurgical coal.

Metallurgical coal has become increasingly conflated with thermal (power) coal in the eyes of investors. It is getting much tougher to raise funding for new coal projects.

While Coronado Global Coal managed to raise money to support its Curragh coking coal operation in Queensland, this is extremely rare. As a result, there is very little new coking coal supply in the pipeline – perhaps as little as 20 million mt/year over the next three years – meaning price spikes may occur more frequently. The Australian government's forecasting unit estimates world metallurgical coal trade at 315 million mt this year, 324 million mt in 2022, and 337 million mt in 2023.

The blast furnace route remains the favored way of making steel in Asia, and these operations require coking coal. Though China and India will remain heavily reliant on coking coal for steelmaking for decades to come, tight coal supply could encourage new steel developments planned in Southeast Asia and elsewhere to explore other, cleaner inputs, such as direct reduced iron or using more recycled steel.

Iron ore miners on notice

In the case of iron ore, it is the social, or cultural, component of ESG that is perhaps under most scrutiny.

The sector has experienced several disasters in recent years, such as the tailings dam tragedies at Samarco (a joint venture between Vale and BHP) and Vale's Brumadinho mine, both in Brazil.

In 2020, Rio Tinto destroyed an indigenous sacred site at Juukan Gorge in the Pilbara region of Western Australia, during the expansion of its Brockman 4 mine.

The Juukan Gorge incident attracted international opprobrium and resulted in senior executives, including the CEO, leaving Rio Tinto, largely at the behest of irate shareholders. The Australian Council of Superannuation Investors said a government inquiry into the destruction of the cave had "exposed unacceptable cultural and operational failures by Rio Tinto."

These kinds of incidents can undermine a company's environmental and social credentials, put off investors, and potentially take a long time to recover from.

Development and commissioning of mines often take longer than planned, and S&P Global Platts Analytics believes ESG considerations mean mining projects will take even longer to develop.

New mines are coming online in Western Australia, replacing old mines. These include BHP's South Flank, which is replacing the 80 million mt/year capacity Yandi operation, and Rio Tinto's 43 million mt/year Gudai-Darri mine.

First Nation communities

Mining companies are making efforts to improve the way they work with First Nation communities.

Comments to accompany Rio Tinto's June quarterly iron ore production report reinforced this view. The company noted that tie-in work at new Pilbara mines and ESG factors would constrain output levels over the next 6-12 months. Rio Tinto said it had reduced 2021 production by 2 million mt to protect "areas of high cultural significance" and it was changing "blast management" plans to better protect traditional heritage sites.

BHP and Fortescue Metals Group have also addressed issues of blasting, or the potential blasting, of Aboriginal heritage sites. In the wake of the Juukan Gorge incident last year, it was reported that BHP had planned to destroy up to 40 sacred Indigenous sites during the development of its new South Flank mine in the Pilbara. The Melbourne-headquartered company quickly put these plans on hold.

Fortescue Metals Group, the world's fourth-largest iron ore producer, has always promoted its work with Indigenous communities and businesses. But the expansion of its Queens Valley project threatened up to 70 sacred sites, including a 60,000 year-old rock shelter. Fortescue CEO Elizabeth Gaines told analysts in August 2020 that the miner had "paused" this work.

Companies that operate in the mining sector have set carbon emissions targets, with most aiming to be carbon neutral by 2030

ESG considerations mean there could be a larger gap between one operation stopping and another ramping up.

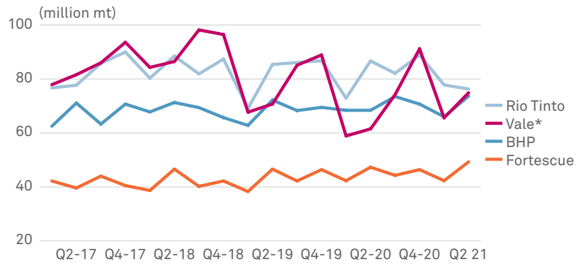
Major producers have barely lifted overall iron ore export levels for four to five years, and until African iron ore is developed the overall global supply situation will remain tight.

China is trying to lower crude steel production to reduce its reliance on imported iron ore, but it is unlikely there will be a major drop in steel production.

Projects in Brazil have in the past been delayed for more than 12 months for environmental reasons, or the discovery of a sacred cave or new species.

It is important to note that some companies do receive go-signals from governments to carry on with their mining projects. For instance, Rio Tinto and BHP have received regulatory approvals from the Western Australian state government under Section 18 of the WA Aboriginal Heritage Act to blast at their respective sites.

Iron ore sales by 'big four' producers



*Includes pellet sales and 3rd party purchases
Source: S&P Global Platts Analytics, Company reports

But companies looking to develop new projects or expand existing ones will need to behave above and beyond what government legislation stipulates one can or cannot do.

Investors will be watching closely to ensure ESG considerations are achieved. ■

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Scrap in the spotlight

Supply bottlenecks continue to buoy scrap steel prices, with additional support from national and industry decarbonization goals. By Viral Shah, Samuel Chin, Adriana Carvalho and Joe Eckelman

Global ferrous scrap prices have soared to record highs in 2021 on a multitude of factors, and with the shift to lower-carbon steel production, high prices could be more likely in the longer term.

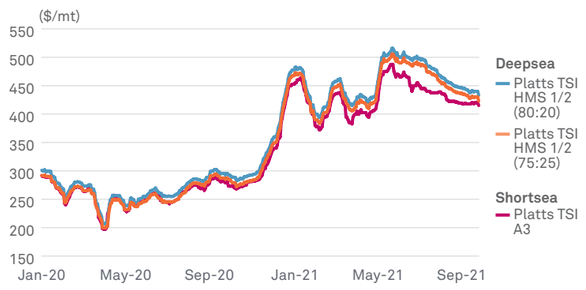
Ferrous scrap prices soared in late 2020 following news of the high efficacy of coronavirus vaccines, fiscal stimulus from governments around the world that boosted economies, and rebounding consumer demand after the initial waves of coronavirus.

The bellwether Turkish deepsea bulk import ferrous scrap market saw prices hit an all-time high, with the Platts benchmark index for premium heavy melting scrap (HMS) 1/2 (80:20) reaching $515.75/mt CFR Turkey on May 24. The index averaged $457.66/mt CFR in 2021 to September 24, compared to an average $267.39/mt CFR over the corresponding period in 2020.

The upward move over 2021 was also supported by bullish signals from China, namely the opening up of the Chinese import market to higher-grade ferrous scrap, referred to locally as recycled steel, on January 1, and the removal of several Chinese finished steel export rebate tariffs on May 1.

While prices of standard ferrous grades like HMS reached record highs, the premium for higher-Fe-yield grades soared well above established norms for product into Turkey. When prices are high, higher-yield scrap is more cost-efficient for producers. For example, shredded scrap, plate and structural scrap, and bonus grade scrap have all been trading at a $15-$20/mt premium over HMS 1/2 (80:20) in the CFR Turkey market this year, as opposed to a $5-$10/mt premium historically.

Turkish scrap prices rise to record highs in 2021



Note: All prices basis CFR Turkey
Source: S&P Global Platts

In the European domestic markets, prices for automotive grade scrap, such as 4A in the UK and E6 in Europe, also reached record highs as supply tightened amid global semiconductor shortages. This hit automakers' production, from which automotive scrap is sourced as offcuts. And car owners were encouraged to hang on to older cars for longer amid delivery delays for new models, which also affected supply of scrap sourced from recycled cars. The push for low-carbon steel production, with several "green steel" projects announced, is likely to keep demand for high-quality scrap firm across Europe.

New competition for material in US

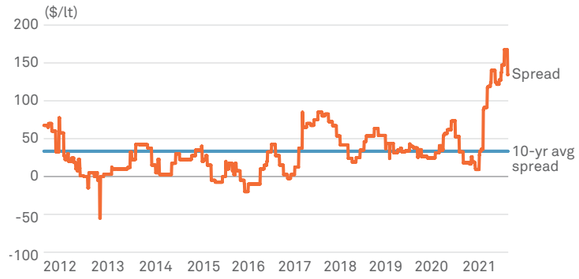
A wave of planned capacity additions in the US is poised to drive up competition for steel raw material inputs. Most immediately, Steel Dynamics Inc., Nucor and North Star Bluescope all have new electric arc furnace (EAF) capacity or capacity expansions slated to start up in the coming months. The additions set the table for new market dynamics in raw material procurement and higher demand in the US, not only for scrap, but for alternative metallics as well.

"The biggest consequence of this capacity expansion in the US is the increase in competition for raw material," Cleveland-Cliffs CEO Lourenco Goncalves said in an interview with Platts. "One hundred percent of the growth is EAF and the scrap and the iron ore unit supply to supply those EAFs is not growing at all."

Cleveland-Cliffs recently announced the creation of Cleveland-Cliffs Services division, which aims to grow the company's presence in the US ferrous scrap market. The company consumes much of its own hot briquetted iron produced at its Toledo, Ohio, facility and now with the services division intends to achieve control of a consistent supply of raw materials, including prime scrap.

Through the first half of 2021, US shredded scrap prices rose approximately $125/lt and prime scrap jumped nearly $250/lt, riding the wave of skyrocketing finished steel prices due to coronavirus-related supply shocks. In recent months, shredded scrap decoupled from finished steel significantly. The shredded scrap price stagnated in June and fell in July and August, while hot-rolled coil prices continued climbing $300/st higher.

US domestic scrap, #1 busheling vs shredded



Source: S&P Global Platts

The push for low-carbon steel production, with several "green steel" projects announced, is likely to keep demand for high-quality scrap firm across Europe

In the case of prime scrap, however, tight supply continued to drive prices higher through July, pushing the spread between prime and shredded scrap in the US to its highest level since the 2008 financial collapse. As a result, mills were altering their melt mixes to ease the overall raw material input costs and take advantage of the arbitrage between the premium and obsolete grades, relieving some of the tightness and starting to narrow the spread.

Despite the recent softening of scrap prices in September, most US market participants said they expect strong steel demand, along with the new finished steel capacity coming online and driving additional raw material demand, to support prices for the remainder of 2021 and into 2022.

Asia's hunger for premium scrap

Northeast Asia's push for a greener industry, following national decarbonization goals set by China, South Korea and Japan, also saw the price spread between obsolete and premium grades widen further.

Imported ferrous scrap will be a key part of the Indian steel industry's raw material mix as it targets crude steel production capacity of 300 million mt by 2030

Blast furnace steel producers sought more premium material, which is considered an easier route to reducing carbon emissions than making more radical changes in infrastructure.

Strong steel margins within Northeast Asia supported greater use of premium recycled steel despite prices at multi year highs that might have otherwise deterred uptake. For instance, Japanese prompt scrap, or shindachi, which is similar to busheling material, in September saw its premium over obsolete grades such as H2 material surge to Yen 17,500/mt ($159/mt). This was a stretch from previous typical levels of around Yen 1,500-3,000/mt ($14-$27/mt) in the first quarter of 2020.

But the higher ferrous scrap demand came amid a shakeup in Northeast Asian vehicle production, with auto manufacturers announcing production cuts over August-October 2021, following earlier reductions in the first quarter driven by the continued crunch in semiconductor chip supplies. The reduced vehicle output translated into a further tightening of prompt scrap supplies.

The decades-old "just-in-time" model for inventory management adopted by manufacturers has proved vulnerable to major global supply chain disruptions, with its drawbacks strongly highlighted across multiple industries.

Additionally, the coronavirus pandemic also exacerbated freight pressures across the globe, particularly for steelmakers that have more difficulty accessing raw materials due to a lack of established domestic recycling infrastructure, and are therefore more reliant on imports. For instance, CFR prices to Southeast and West Asian markets were elevated yet again as the market entered Q4 trades, with little expectation of any cooling amid peak-season shipping demand in both the bulk and containerized scrap markets.

For example, the Platts Indian import containerized shredded scrap index remained at a record-high range of $505-$530/mt CFR Nhava Sheva over June-September 2021, despite the high prices allowing only Indian alloy and stainless steel producers to procure such material.

Imported ferrous scrap will be a key part of the Indian steel industry's raw material mix as it targets crude steel production capacity of 300 million mt by 2030. The country is also looking to boost its domestic scrap industry, with the government introducing a vehicle scrappage policy and domestic steel producer Tata Steel starting up its first steel recycling plant at Rohtak, Haryana, on August 18, with a capacity of 500,000 mt/year.

Brazil ferrous scrap

Brazilian domestic ferrous scrap prices are expected to drop further through October, but could stabilize at a new pricing level at the end of the year as logistics for export options ease and steelmakers digest large inventories.

Around 200,000 mt of imported ferrous scrap entered Brazil from January to August in a strategic maneuver by mills, to balance a market that saw domestic scrap prices rallying 180% in 12 months, bringing the material above the Real 2,000/mt ($383/mt) mark for the first time over July and August.

Customs data suggests ferrous scrap consumption in Brazil may exceed 9 million mt in 2021, 13.1% above 2020, driven by a strong recovery in construction and greater demand for steel. But this would still be far from the peak of 2013, when 11.17 million mt of scrap were consumed, according to data from the national scrap association Inesfa.

The reactivation and expansion of output capacities recently announced by ArcelorMittal, Gerdau and Simec in Brazil should intensify competition for scrap domestically. The country is expected to need at least an additional 1.5 million mt/year of scrap supply by 2023, based on the new capacities due to come online. And even though scrap exports continue to represent 6% of total consumption, dealers may continue to chase opportunities in new markets as they firm up international ties and seek to reduce local dependency.

With mills' yards full of metallics, and finished steel prices in Brazil softening through August-September, steelmakers then focused on reducing their costs. Scrap grades of lower purity, and those that need further processing, were the most pressured.

Despite obsolete scrap prices facing multiple cuts since August, prime grade prices have been sustained as automaker shutdowns resulted in lower supply, in a similar trend to other regions.

Nevertheless, steelmakers began correcting premium scrap prices in tandem with obsolete grades, in an effort to prevent the spread between the two types rising above Real 400-500/mt, in line with the historical spread.

Although mills aim to bring obsolete grade prices down to the very low levels seen in 2019, dealers want to reinforce a new, higher price level for their material, saying operational costs to move or process scrap have quadrupled since the start of the pandemic.

No panacea for decarbonization

In 2020, only 26.3% of all global crude steel production was through the EAF route, down from 27.7% in 2019, according to the World Steel Association. This is partially related to the scarcity of scrap supply, due to the long lifespan of most steel products, leading to a multi-decade journey from the production of finished steel to its recycling.

The EAF route, which can use up to 100% ferrous scrap input, leads to 0.3 mt of CO_2 emissions per metric ton of steel produced, according to the International Energy Agency. In comparison, the blast furnace-basic oxygen furnace (BF-BOF) production route produces 2.2 mt of CO_2 emissions per metric ton of steel produced. While ferrous scrap can also be used in BF-BOF production, it typically only makes up 15-25% of the raw material input.

While ferrous scrap will continue to play an important part in efforts to decarbonize steel production, it is clear that increased scrap consumption alone will not be sufficient, and the industry is also pressing ahead with other technology and processes targeting further emission reductions.

Nevertheless, stronger demand and pricing for higher quality ferrous scrap is expected to continue in the long term as steel mills around the world look for easy first steps to cut carbon emissions. ■

Scrap finds limited avenue into China

China lifted import restrictions on recycled steel materials on January 2021 under the overarching goal of reaching peak carbon emissions by 2030 and carbon neutrality before 2060. While China's reliance on iron ore in steelmaking may seem unassailable in the short term, demand for recycled steel could gradually gain momentum with expansions in electric arc furnace (EAF) steelmaking capacity and increased variety of supply origins.

Recycled steel import volumes are now picking up and a considerable amount of the material will be used as a coolant in basic oxygen furnaces, due to China's heavy reliance on the blast furnace-basic oxygen furnace (BF-BOF) route for steel production. The decision to increase scrap usage in BOFs is an effect of the cost comparison between pig iron production – comprising coke, coal and iron ore costs – and scrap purchasing.

The cost-benefit analysis of ferrous scrap usage in both the BF-BOF and EAF steelmaking processes points to an increased need for scrap supply from domestic and ex-China origins alike. But China's import specifications lean towards prime material, and have effectively weeded out the popular heavy melting scrap grades, leaving buyers with only a handful of origins to source from.

In the first seven months of 2021, China imported 649 million mt of iron ore, more than 1,544 times the import volume for recycled steel raw materials, which reached 420,787 mt over the same period, China customs data showed.

"Ferrous scrap could be a promising substitute for iron ore if regulators expand the types of scrap allowed for import in tandem with the rapid development and replacement of infrastructure helping to increase domestic scrap supply," a procurement source based in China said.

By Yuchen Huo

Renewables face up to new cost pressures

The cost of renewable power generation technologies continues to decline, but surging commodity prices since late 2020 are disrupting this trend. By Bruno Brunetti, Miguel Brito and Toya Latham

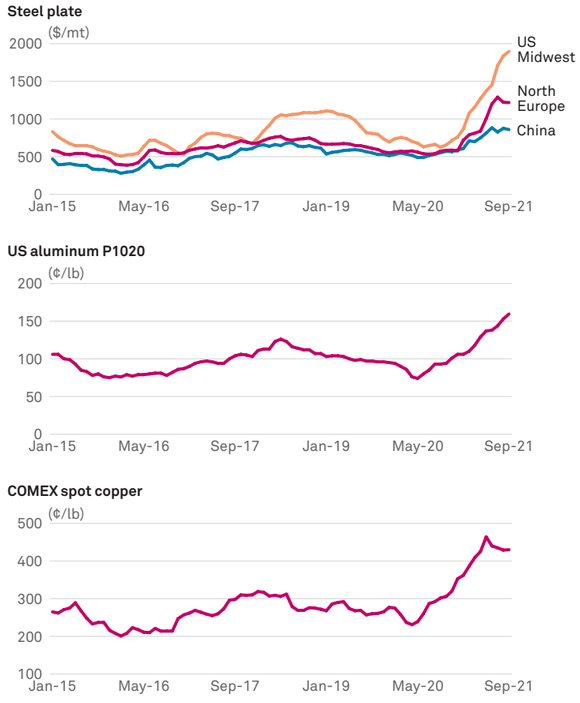
The growth in wind and solar capacity in the past decade has been driven in large part by policy support, but also by plummeting costs for solar modules and wind turbines, alongside a relatively stable commodity price environment.

However, upward cost pressures following the global pandemic are now challenging this trend, with prices of steel, copper and aluminum, key materials used in renewables plants, reaching all-time highs.

With supply chains around the world disrupted by COVID-19 and demand recovering, production has struggled to keep up. Additionally, shipping and freight rates remain elevated. Solar and wind producers are competing for supply of steel and other metals along with all other end-use sectors, which are seeing demand tick up as COVID-19 restrictions ease and the economy recovers. New supply is coming online, but there is nevertheless significant structural support due to a booming economic cycle.

While higher renewable generation is lowering the utilization of thermal plants on average, new-build renewables are at the same time underpinning the need for materials, which in turn results in higher industrial emissions and demand for gas or coal.

Global metals prices since 2015



Source: S&P Global Platts, London Metal Exchange, CME Group

Price spikes and shortages

Cost declines have been a constant feature in the renewables sector over the past decade, especially for solar PV plants. According to the International Renewable Energy Agency, global average installed costs for utility-scale solar PV projects are now in the $900/kW range, having declined from $1,800/kW in 2015 and $4,700/kW in 2010. While learning rates have contributed, it should be noted that these cost declines have occurred in a relatively stable commodity pricing environment. Surging prices for key materials used to build solar PV plants may make further cost declines increasingly difficult in the near term.

Copper, a key material used in modules, wiring, inverters and other electrical components, and steel, used for system support structures and trackers, both reached historical highs in 2021, and overall have traded much higher than last year's levels. In addition, a shortage of polysilicon, a basic raw material used in most solar modules, has led to an increase in solar PV module prices, with bifacial and low-cost modules up almost 6% in June relative to May, bringing the price increases to 6%–12.5% YTD, according to PV Exchange data.

Overall, with surging prices of basic materials and higher module prices, this year could see an increase in solar PV capital expenditure in a competitive industry with margins already thin. The upward pressures on costs will probably start biting down the road, especially for projects that are still looking to secure modules and other structural components.

Although power purchase agreement prices have been rising in the US, projects are at risk of being delayed, given surging costs. Major international solar PV manufacturers also issued a statement at the end of September asking developers to delay projects, given the current shortages.

However, S&P Global Platts Analytics believes Southern European markets could be more exposed to changing costs, notably Spain, given recent government interventions in the power markets, where PPA prices have been depressed since the large auction of January 2021, which allocated 3 GW of renewables, including 2 GW of solar PV capacity. PPAs in Spain are being quoted around Eur 30/MWh, which is well below our estimated levelized cost of electricity for solar PV ranging from the mid-Eur30/MWh to low-Eur40/MWh level. Our modelling work suggests up to 10 GW of solar PV projects in Spain might be at risk, together with 3 GW of projects in Portugal. Up to 10 GW of Italian solar PV capacity might also be at risk, assuming that costs remain elevated.

India's solar PV growth could also be jeopardized in the current market environment even as Reliance recently announced an ambition to bring online 100 GW of solar PV plants by 2030. Some 30 GW of solar PPAs were announced in 2020 in India and it is not clear at which stage these plants are in the development process. Over 20 GW of solar PV projects in India that have been awarded in recent auctions might face some risks of delays, or even cancellation, as PPAs may no longer mirror current prevailing costs.

20 GW
of solar PV projects in India at risk of delay or cancellation

Onshore wind projects more exposed

In their latest financial results, key wind manufacturers have also highlighted increased cost pressures. The price of steel, which is one of the main raw materials used in the construction of wind plants, has more than

doubled in the past year. If commodity prices remained at this level or increased further, projects could potentially suffer capex increases, which could lead to project delays or cancellations in the near term.

Additionally, in general turbine costs also form a greater portion of the total installed cost for onshore projects, therefore raw material price increases could have a proportionally larger impact on them (around +7%) than offshore projects (around +3%), where balance-of-system costs are larger. Some 50 GW of capacity across Western Europe might be at risk by 2030, with projects in Spain (15 GW) and Italy (11 GW) the most exposed to changing costs. Our modelling work suggests a relatively lower sensitivity to increasing costs for projects in Germany and the UK, with only about 6 GW and 9 GW respectively at risk in these countries.

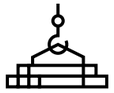
Materials and metals demand

With solar PV and wind plants using a relatively larger amount of steel, copper and other minerals, total material requirements from power sector newbuild activity reached new highs in 2020 and are hovering at similar levels in 2021.

Copper, a key material used in modules, wiring, inverters and other electrical components, and steel, used for system support structures and trackers, reached historical highs in 2021

Platts Analytics estimates that steel requirements from wind and solar PV newbuild activity might be growing at a rate of 18 million-19 million mt/year, based on our capacity forecasts and typical amounts of steel per MW, bringing power sector requirements to over 23 million mt/year. This compares with an average of about 15 million MT over the past decade and about 8 million mt/year on average in the decade 2000-2010.

The increased amount of steel to build wind and solar plants means greater coal use, since metallurgical coal is a key component in coke/steel manufacturing. Although there is a sizeable amount of steelmaking in the US and Europe that uses natural gas, steel production in other markets such as China relies more heavily on blast furnace production, and therefore, coal. Over the past decade, wind and solar plants may have required some 100 million mt of steel, or about 70 million-80 million mt of coal. To put things in context, this is equivalent to coal imports for the whole of the EU over 2020.



100 million tons

estimated steel use for wind and solar in last decade

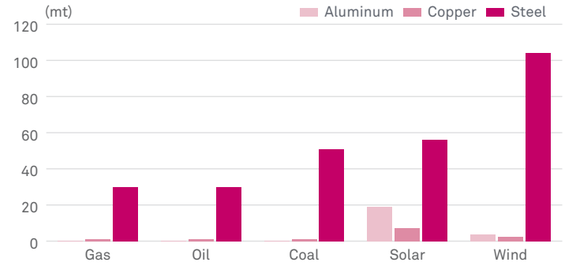
The impact of renewables new build on the copper market has the potential to be even more significant, since wind and solar additions combined may be adding roughly 1.2 million mt/year, which against total global demand of about 25 million mt/year.

In addition, forecasts for materials use in solar PV and wind show limited reductions in tons per megawatt out to 2030. Based on a recent technical report by the Joint Research Centre, the European Commission's science and knowledge service, the steel, aluminum and copper intensity per megawatt of both wind and solar PV installations is unlikely to see significant reductions in the coming years. In the case of solar for example, the report points to a less than 4% reduction in steel and aluminum intensity between 2018 and 2030, while copper intensity is reduced by only 2%. These metals are difficult to replace given their properties and the key role they play in critical components of solar and wind power.

Shortages of both steel and copper will likely carry over well into 2022 as these sectors are already supply constrained following a strong global demand recovery, supported by government stimulus measures. Strong growth in renewables, and therefore in demand for metal-intensive components such as wind turbine towers, will place further strain on supply. In the absence of any big increase in steel plate production capacity, prices are expected to increase markedly and add to installation costs. ■

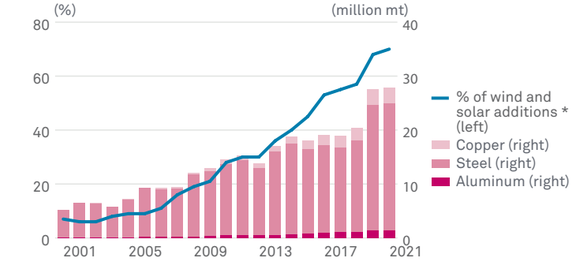
Additional analysis by Morris Greenberg

Power generation and key materials usage



Note: Typical requirement per 1 MW capacity
Source: S&P Global Platts Analytics, IRENA

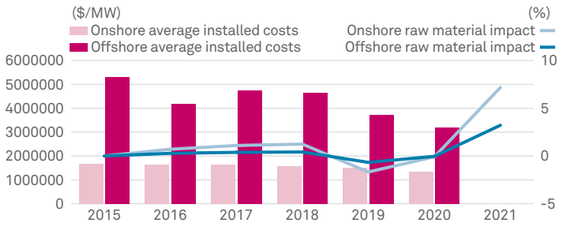
Solar and wind additions need growing amounts of key metals



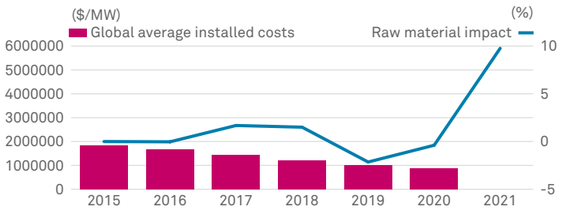
*in total additions across generation types
Source: S&P Global Platts Analytics, IRENA

Global renewables installation costs and raw material cost impact

Wind



Solar PV



Source: S&P Global Platts

The rocky path to regional battery supply chains

Europe and the US are beefing up their battery metals supply chains, but are unlikely to overtake China anytime soon. Henrique Ribeiro and Jacqueline Holman look at the prospects for gigafactories across the world

Increasing investment in so-called battery gigafactories in the West is a natural step towards regionalizing supply chains, but it will take more than just funds to topple China's dominance in the battery industry.

China accounted for 77% of global battery manufacturing capacity in 2020, according to S&P Global Market Intelligence. But supply bottlenecks resulting from the pandemic and a subsidy-driven surge in electric vehicles sales in Europe in mid-2020 raised concerns over the world's supply dependency on a single country.

These factors helped boost investments in battery capacity in Europe, and the difference in battery capacity between Europe and China should narrow substantially by 2030 (see infographic, page 32-33).

Despite a number of planned gigafactories, some remain skeptical that Europe will have enough capacity to meet demand.

EIT InnoEnergy industrial strategy executive Bo Normark told S&P Global Platts he was not sure there would be enough battery production capacity to meet demand, taking into account the EU's "Fit for 55" package under the Green Deal, which aims at a 55% net reduction in emissions.

"If you go back about 12 months, we were looking at 3,000 GWh [of total capacity] by 2030 and today we are looking at about 3,000 GWh by 2025 and maybe 6,000 GWh by 2030... When we were looking at 3,000 GWh by 2030, then I think we were pretty okay. Today, I'm not so sure," Normark said.

He added that it must also be taken into account that the current plans for building new battery factories were on the optimistic side, as not all would be completed – some would fail and many would be delayed.

In addition, these new projects do not cover the full battery supply chain.

For example, about 40%-50% of what is being invested in Europe is directed to battery cell manufacturing only, according to Wolfgang Bernhart, partner at consultancy Roland Berger. Other midstream stages in which key components are produced, such as the cathode, are not attracting the same amounts.

"For Europe, in order to localize supply chains, Eur15 billion to Eur20 billion would be required for the cathode, anode and precursor stages," Bernhart said, adding that another Eur35 billion to Eur60 billion would be required for the mining of raw materials such as lithium, nickel or graphite. "The biggest challenge to complete the localization of supply chains is the economics."

Despite a number of planned gigafactories, some remain skeptical that Europe will have enough capacity to meet demand

Normark agreed there are increasing concerns about raw material supply and refining capacity, with these being the weak link in Europe's battery supply chain.

Although mining and refining these raw materials is the most expensive part of the chain, money alone is just not enough: some geographies are simply more abundant in resources than others.

"In many cases there are limited sites. In other cases there are sites, but concentrations might be low, or they might be byproducts, or contaminants make it uneconomical," said Sam Jaffe, managing director at UK-based Cairn Energy. "And [mining] permits are very difficult to obtain, especially in the US and Europe."

The time required to develop mining assets into battery-grade processed material is also a significant problem.

"You have from between three and typically seven years from when exploration starts until you are able to deliver lithium hydroxide," Bernhart said. And although battery megafactories have been receiving huge investments, the enthusiasm is not as high in the case of raw materials, which could lead to a shortage of key inputs such as battery-grade lithium and nickel sulfate in the coming years.

Reducing risks

Overcoming these barriers would yield Europe and the US significant benefits in their position as the battery industry rapidly gains relevance in the coming years. Jaffe said automakers and battery manufacturers are localizing their supply chains for economic reasons, among other targets.

In Bernhart's view, it "minimizes political risks, price risks, and creates jobs locally."

Moreover, there is a drastic reduction in the shipping risks, said Adam Panayi, managing director at consultancy Rho Motion. "The semiconductor issue is a foretaste of what can happen in the EV industry if there is no localization," he said.

Shorter supply chain distances also reduce cost and lead times – and this is one of the reasons why China developed its battery industry so successfully, Jaffe said.

"Not just [that] they have it within the same country, the entire supply chain is located within a 500km radius from Shenzhen and Dongguan, essentially there is a localized area and you are never travelling more than a couple hundred kilometers," he said.

Jaffe believes the same model could evolve in Europe and the US, perhaps in regions around Germany or from Quebec to Ohio, for an optimized logistic strategy particularly for cathode. "Logistic strategy didn't exist in the battery industry until China started to dominate it," he said, stressing that logistics cost is the most important factor – more than energy or labor – to bring overall costs down.

Environmental aspect

Stricter environmental regulations in the West compared to China are also cited as an important reason for the regionalization of the battery supply chain – but are also a major challenge.

"European automakers have an obligation to try and make their supply chain as accredited as possible; from an ESG perspective, one good way to achieve is bringing it local," said Rho Motion's Panayi. "They are

The rocky path to regional battery supply chains

Transport electrification spawns battery factories worldwide

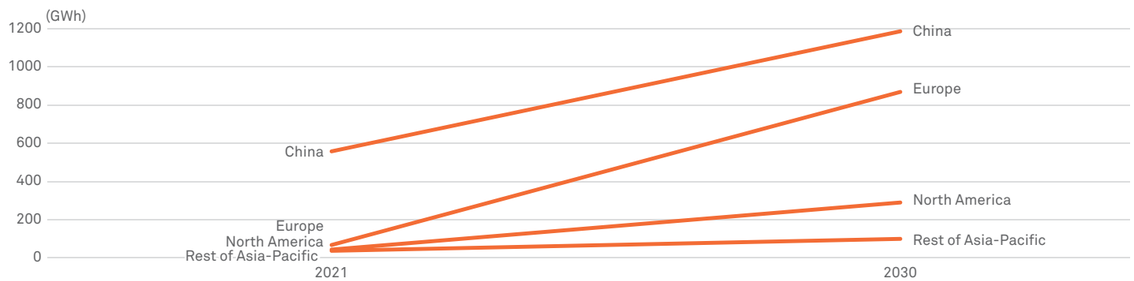
Massive investment in Europe in gigafactories to produce batteries for electric vehicles is set to chip away at China's dominance in this area this decade. Still, Europe is unlikely to become world capacity leader despite its proactive climate legislation and ambitious targets on phasing out internal combustion engine usage. Given accelerating focus on energy transition in transport amid urgent forecasts on global warming, doubts persist about whether battery production capacity can expand quickly enough to meet forecast EV demand and even whether sufficient lithium, cobalt, nickel sulfate, copper and other metals will be available at the right price to make the batteries and infrastructure required.

Gigafactories: capacities announced and projected by 2030

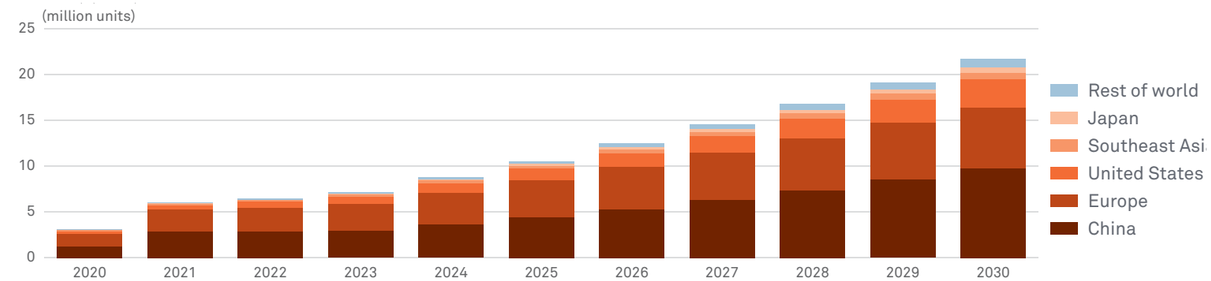
Expected capacity (GWh): 0 10 25 50 100 150+

N. America 190		Europe 845					Asia-Pacific 1,286							
USA		Germany	UK	France	Other		China		South Korea		Japan		Australia	Other
Redwood		Tesla	Britishvolt	Verkor	Northvolt		China other	Lishen	Samsung SDI		Panasonic		IM3	Tata Chemicals
LG Chem		Northvolt	Envision AESC	Saft	LG Chem		CATL	Microvast	LG Chem		Envision AESC		Energy Renaissance	Lucas TVS / 24M Tech.
Tesla		Automotive Cell Co.	AMTE Power	Envision AESC	CEZ		BYD	Tafel	SK Innovation		Lithium Energy Japan			Indonesia Battery Corp.
IM3		Saft			Italvolt		EVE Energy	BAK						LG Chem
SK Innovation		SVolt			Volkswagen		LG Chem	Funeng Technology						Energy Absolute
Kore Power		Farasis			FREYR		Guoxuan	EV Energies						Thailand other
Envision AESC		CATL			Samsung SDI		SVolt	Dynavolt						
Akasol					BASF		Geely	Xingheng Power						
Microvast					SK Innovation		Panasonic	Lithium Werks BV						
SUNLIGHT Battery USA					Northvolt		SK Innovation	Tesla						
Samsung SDI					InoBat		Samsung SDI	Boston Power						
A123 Systems					MES		CALB	Sunwoda						
							Farasis	Jinwei Power Industry						
							Envision AESC							

Regional shares in gigafactory capacity



World plug-in light duty EV sales to 2030



Countries with set targets to **phase out sales of Internal Combustion Engine vehicles**

- **2025**: Norway
- **2030**: Denmark, Iceland, Israel, Netherlands, Slovenia, Sweden
- **2035**: Canada, China, Japan , Thailand, South Korea, UK
- **2040**: Egypt, France, Portugal, Singapore, Spain, Sri Lanka, Taiwan
- **2045**: Law: Germany, Sweden
- **2050**: Costa Rica, Germany
- **2055**
- **2060**

Selected countries with targets to **reach net zero carbon emissions**

- **2035** — In policy: Finland
- **2040** — In policy: Austria, Iceland
- **2050** — In policy: Belgium, Brazil, Netherlands, Portugal, Slovenia, South Africa, South Korea, US; Law: Canada, Denmark,
- **2060** — In policy: China, Indonesia, Kazakhstan, Ukraine

Sources: S&P Global Platts, S&P Global Platts Analytics, S&P Global Market Intelligence, Company announcements

investing billions of dollars [in the EV revolution], they can't afford to have ESG issues, so it's a protection to their investment."

This is critical when it comes to the mining and processing of battery metals. He recalled that most of the world's battery-grade lithium hydroxide conversion takes place in China, and graphite processing is an "extremely dirty business, while Europe has different standards on air quality [compared to China]."

"The other element is that the desire for green, environmental sources of battery materials is very strong, and adds another layer of complexity to this situation," Jaffe said. "Now you not only need a mining asset in your continent, but you also need one that is environmentally friendly."

China to remain #1

Amid western efforts to catch up with the Chinese battery industry's dominance, new projects are also popping up in China, and the country is likely to remain the world's biggest battery manufacturer.

"China is the biggest market for batteries," Jaffe said. "They are the most aggressive in subsidies for EVs, most consumer electronics are made in China, and they have a large stationary storage market."

"The buildout of new capacity is enormous in China, [I expect] 161 GWh to be built in 2022, which is 40% of their capacity today," Jaffe said. "There's no fall down by any means."

He expects battery manufacturing capacity to be on the rise in China at least until 2027 or 2028.

According to S&P Global Platts' data, around 10GWh should be able to manufacture roughly 150,000 EV batteries. This means Asia-Pacific, including Australia, with announced battery capacity of around 1,296 GWh by 2030, should be able to produce approximately 19.4 million EV batteries.

So while investments are higher in Europe at present, there is still a long way to go. The difference between China and Europe continues to be so great that Europe will still remain behind in terms of battery capacity.

"I don't think Europe will catch up, simply because the Chinese demand is bigger – we will have 15 million EVs in China in 2030, which is still more than the forecast 12 million EVs in Europe including plug-in hybrids," Roland Berger's Bernhart said.

Chinese battery demand will keep growing significantly – but even if European demand grows faster, China will still be ahead by the end of this decade, Bernhart said. ■

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Insight from Moscow

Rosemary Griffin

It has been 30 years since the collapse of the Soviet Union transformed global energy markets and set Russia on a pathway to gaining a seat at the OPEC table along with tremendous pricing power over oil and natural gas.

The world's largest exporter of crude and gas to Europe has grown its influence from the shattered remnants of the communist bloc when the future of its energy sector looked in doubt. A year after the period leading to Russia's democratization known as "Perestroika" the country's share of the global oil markets was a fraction of the 12% it currently holds.

"Turbulence in the immediate aftermath of the Soviet Union's dissolution caused the region's crude and condensate supply to fall by 4.2 million b/d between 1990 and 1994 alone," said Paul Sheldon, chief geopolitical adviser at S&P Global Platts Analytics. Today, Russia produces around 9.77 mil b/d, according to the Platts OPEC Survey for August, and Platts assessed Russia's key crude grade Urals CIF Med at $80.63/b on October 5.

At the beginning of January 1984, Platts assessed Russia's key crude grade Urals CIF Med at $28.55/b. On January 31, 1986, prices fell to $19.95/b and remained below $22/b until August 1990 when global prices rose sharply following Iraq's invasion of Kuwait.

"The oil glut of the 1980s, which followed the 1979 oil price shock, was a direct contributor to the collapse of the Soviet Union in 1991. The USSR had just before that become a major global oil producer; lower prices immediately resulted in a substantial loss of hard-currency export revenue, forcing the USSR to deplete its official reserves amid growing deficits of almost everything across the union," said George Voloshin, head of the Paris branch of Aperio Intelligence.

At the beginning of January 1984, Platts assessed Russia's key crude grade Urals CIF Med at $28.55/b. On January 31, 1986, prices fell to $19.95/b and remained below $22/b until August 1990 when global prices rose sharply following Iraq's invasion of Kuwait.

Private investment

This new economic and political reality also created fresh opportunities. Privatization of oil and gas assets allowed foreign investors to enter post-Soviet markets and introduce cutting edge technology to production sites. They also helped to expand the geographical scope of Russian production through new projects developed in eastern Russia including offshore Sakhalin, as well as in the far north of the country.

"Subsequent periods of Russian oil company privatization ultimately triggered more focused investment, increased efficiencies and technological advances, all of which paved the way for nearly unabated production growth since 1998," Sheldon added.

Other former Soviet states followed similar policies. "Outside of Russia, landmark foreign investment deals in Kazakhstan and Azerbaijan continue to bear fruit, helping to lift total FSU production by over 7 million b/d between 1998 and 2019, before OPEC+ cuts caused a rare drop in 2020," Sheldon said.

Export options

Foreign investment has also enabled oil and gas producers to develop new infrastructure projects, transforming the customer base for the region's oil and gas.

"The emergence of new export infrastructure, in addition to the Druzhba oil pipeline which was built in the 1960s, has contributed to the expansion of oil producing areas within Russia," Aperio's Voloshin said.

Key new projects include the Eastern Siberia-Pacific Ocean oil pipeline commissioned in 2009 to export to China and the broader Asia-Pacific region. The Baltic Transport System increased export capacity from projects in the Volga Urals and West Siberia as well as northern Russia. In recent years the government has prioritized development of oil and LNG shipping via the Northern Sea route, which supplies to Europe and Asia through Arctic waters.

"I look at how Putin was able to become friends with China and to send more oil to the east and especially start sending more gas to the East and in the Arctic, you look at what's happening on Yamal, you look at what's happening on the second Arctic project, there's going to be a lot of gas flowing to the East and that's going to be in direct competition with Qatar and Australia," independent economist and energy adviser Cornelia Meyer said.

However, more exports and the battle for market share have led to some problems, particularly over Europe's reliance on imports of gas from Russia as well as the influence the Kremlin has on countries that transit Russian gas to Europe. New export infrastructure has also been a key target for US sanctions introduced in 2014 over Russia's role in the conflict in Ukraine.

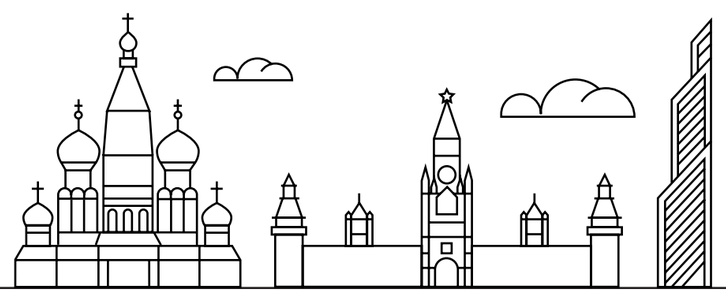
Economic resilience

Russia's dependence on oil and gas revenues has also evolved over the past 30 years. In 1998 a drop in oil demand sparked by the Asian financial crisis led Russia to default and the ruble to significantly devalue.

From 2000, when Vladimir Putin became Russia's president, a steady rise in oil prices allowed the Kremlin to pay off large amounts of foreign debt and establish a stabilization fund as protection against price volatility. This mitigated the impact of the global financial crisis in 2008 and has helped the country cope with subsequent price volatility, including the impact of growing US shale output since the mid-2010s.

In recent years Russia's improved budget resilience has allowed it to bargain for increased output volumes within the OPEC+ agreement, as many other members of the coalition's state budgets are more sensitive to oil price volatility.

As the region marks 30 years since the collapse of the Soviet Union, these trends continue to drive political and commercial priorities. The energy transition will add an extra dimension, as producers attempt to balance plans for new hydrocarbons production and export projects with growing concerns about the environment and the increasingly evident impact of climate change. ■



New infrastructure's transformative impact on post-Soviet energy markets

In the 30 years since the Soviet Union collapsed, Russia and its neighbors have developed major new production and export projects. Several Western majors joined production sharing agreements in the 1990s, and new pipelines have strengthened crude and gas export capacity to Europe, as well as new markets in Asia.

Increased connectivity
Operational year
Post-1991 Pre-1991
Gas pipelines
Oil pipelines
Planned

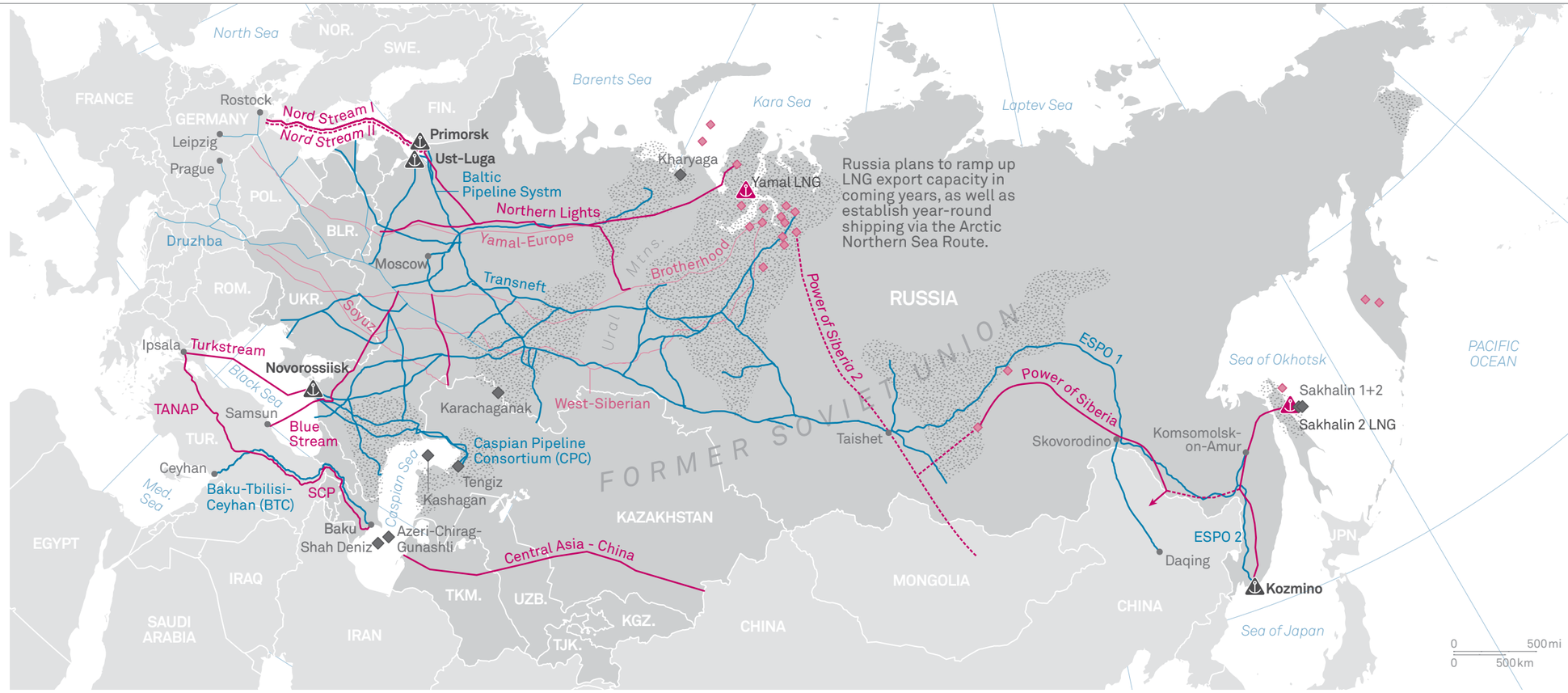
New pipelines have facilitated diversified export options to Europe and new links in Asian markets.

Sea shipping
Ports
LNG terminals

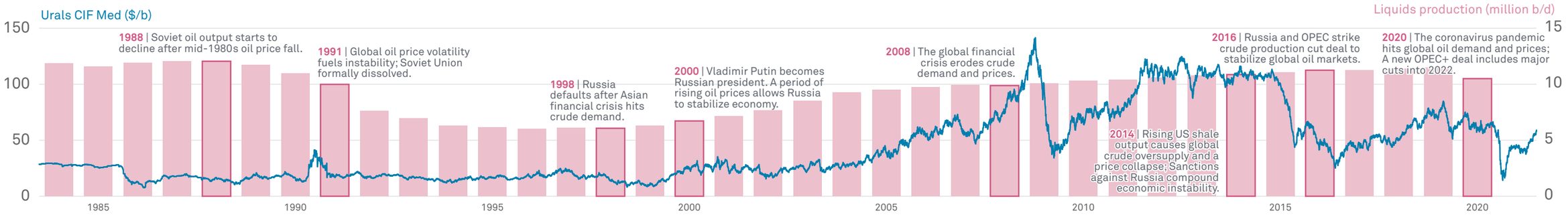
New port infrastructure has given Russia more flexibility on oil supply routes; it has become the world's fourth biggest LNG supplier.

Oil and gas resources
Production sharing agreements (PSAs)
Gas fields
Producing regions

Foreign investment has helped post-Soviet countries to develop production of reserves in major new provinces.



Urals price sensitivity to geopolitics and global economy since the collapse of the Soviet Union



Source: S&P Global Platts Analytics, Transneft, USGS, EIA, Gazprom

Understanding voluntary carbon markets

Trade in voluntary carbon credits is rising as companies look to offset their emissions. Silvia Favasuli and Vandana Sebastian explain how the market works, key players and pricing principles

2021 will probably be remembered as the year when carbon finance emerged as a major talking point among a wide range of industries.

In a market note released at the start of May, New York-based Xpansiv CBL, currently the most liquid carbon credits exchange, shared a figure that made that clear: on May 7, CBL's year-to-date carbon volume of more than 30 million mt of CO2 traded emissions was already approaching 2020's full-year record of 31 million mt.

Among the 2021 new entrants in voluntary carbon markets, oil and gas majors, hedge funds and banks were heard as the most active players, resolutely taking positions in the market.

Many political entities like the EU, the UK or the state of California already have mandatory carbon markets covering specific industry sectors and gases. These form an important part of the effort to meet the Paris Agreement target of limiting global heating to 2 degrees Celsius above pre-industrial levels (with a more ambitious ideal of remaining within a 1.5 C increase), even though some of these markets predate the Paris commitments.

But other sectors have taken a cue from compliance schemes and pledged to offset their greenhouse gas emissions by participating in carbon markets voluntarily. Voluntary carbon markets allow carbon emitters to offset their unavoidable emissions by purchasing carbon credits, which are financial tools issued by a huge array of projects targeted at reducing or removing GHGs from the atmosphere.

Each credit – which corresponds to one metric ton of reduced, avoided or removed CO2 or equivalent GHG – can be used by a company or an individual to compensate for the emission of one ton of CO2 or equivalent gases. When a credit is used for this purpose, it becomes an offset. It is moved to a register for retired credits, or retirements, and it is no longer tradable.

Companies can participate in the voluntary carbon market either individually or as part of an industry-wide scheme, such as the Carbon Offsetting and Reduction Scheme for International Aviation, which was set up by the aviation sector to offset its greenhouse gas emissions. International airline operators taking part in CORSIA have pledged to offset all the CO2 emissions they produce above a baseline 2019 level.

While compliance markets are currently limited to specific regions, voluntary carbon credits are significantly more fluid, unrestrained by boundaries set by nation states or political unions. They also have the potential to be accessed by every sector of the economy instead of a limited number of industries.

The Taskforce on Scaling Voluntary Carbon Markets, sponsored by the Institute of International Finance with support from McKinsey, estimates that the market for carbon credits could be worth upward of $50 billion as soon as 2030.

The participants

Five main players make up the engine of carbon markets.

Project developers

Project developers represent the upstream part of the market. They set up the projects issuing carbon credits, which can range from large-scale, industrial-style projects like a high-volume hydro plant, to smaller community-based ones like clean cookstoves.

There are projects aimed to destroy or manage the direct emissions resulting from industrial processes such as fugitive emissions management, ozone-capture or destruction of ozone-depleting substances, or wastewater treatment. Nature-based projects include REDD+ (avoided deforestation), soil sequestration or afforestation. Other types include tech carbon capture such as direct air capture while new categories are being added constantly.

Each credit has a specific vintage, which is the year in which it was issued, and a specific delivery date, which is when the credit will be available on the market.

Together with their primary purpose of avoiding or removing GHGs from the atmosphere, credit projects can also generate additional 'co-benefits' and help meet some of the UN's Sustainable Development Goals (SDGs). For example, they may contribute to improved

welfare for the local population, better water quality, or the reduction of economic inequality.

Each credit has a specific vintage, which is the year in which it was issued, and a specific delivery date, which is when the credit will be available on the market

End buyers

The downstream market is made up of end buyers: companies – or even individual consumers – that have committed to offset part or all of their GHG emissions. Among the early buyers of carbon credits were tech companies such as Apple and Google, airlines, and oil and gas majors, but more industry sectors, including finance, are joining the market as they set their own net-zero targets or look for a way to hedge against the financial risks posed by the energy transition

Negotiations are under way to set up a framework that would allow governments worldwide to purchase voluntary carbon credits to meet their Nationally Determined Contributions, which are the mitigation goals set by the Paris Agreement for each member party. The imminent COP26 in Glasgow this year may provide some more clarity around this framework and allow the exchange of voluntary carbon credits among governments.

Retail traders

To link supply and demand, there are brokers and retail traders, just as in other commodity markets. Retail traders purchase large amounts of credits directly from the supplier, bundle those credits into portfolios, ranging from hundreds to thousands of equivalent tons of CO2, and sell those bundles to the end buyers, typically with some commission.

While most of the transactions are currently happening in private conversations and over-the-counter deals, some exchanges are also emerging. Among the largest exchanges for carbon credits at the moment are the New York-based Xpansiv CBL and Singapore based AirCarbon Exchange (ACX).

Exchanges have been trying to simplify and speed up the trade of carbon credits – which have a high level of complexity due to the high number of factors affecting their price – by creating standard products, which ensure some basic specifications are respected.

For example, both the Xpansiv CBL and ACX have set up standard products for nature-based credits, CBL's Nature-based Global Emission Offset (N-GEO), and the ACX Global Nature Token. Credit trading under these labels are guaranteed to have set characteristics such as the type of underlying project, a fairly recent vintage, a certification from a restricted group of standards.

Exchanges' standardized products – especially those for forward delivery – are currently preferred by traders and financial players looking to buy and hold in anticipation of skyrocketing carbon credit demand.

End buyers that need to purchase credits to offset their emissions tend to prefer non-standardized products as this allows them to look into the specific characteristic of each underlying project, ensure the quality of the credit being purchased and therefore protect themselves from potential accusations of greenwashing.

Often, the exchanges are used to settle large bilateral deals that have been negotiated offscreen.

In a market note shared in May, CBL said that an ever larger number of bilateral deals negotiated offscreen were being brought by traders to be settled on the CBL platform. These deals made up a significant portion of volumes transacted on CBL.

Brokers

Brokers buy carbon credits from a retailer trader and market them to an end buyer, usually with some commission.

Standards

There is a fifth player unique to carbon markets. Standards are organizations, usually NGOs, which certify that a particular project meets its stated objectives and its stated volume of emissions.

Standards have a series of methodologies, or requirements, for each type of carbon project. For example, a reforestation project will follow specific rules when calculating the level of CO2 absorption of the planned forest and therefore the number of carbon credits it produces over time.

A renewable energy project will have a different set of specific rules to follow when calculating the benefit in terms of avoided CO2 emissions and carbon credits generated over time.

Standards' certifications also ensure certain core principles or requirements of carbon finance are respected:

- **Additionality:** The project should not be legally required, common practice, or financially attractive in the absence of credit revenues.
- **No overestimation:** CO2 emissions reduction should match the number of offset credits issued for the project and should take account for any unintended GHG emissions caused by the project.
- **Permanence:** The impact of the GHG emission reduction should not be at risk of reversal and should result in a permanent drop in emissions.
- **Exclusive claim:** Each metric ton of CO2 can only be claimed once and must include proof of the credit retirement upon project maturation. A credit becomes an offset at retirement.
- **Provide additional social and environmental benefits:** Projects must comply with all legal requirements of its jurisdiction and should provide additional co-benefits in line with the UN's SDGs.

According to data from S&P Global Platts Analytics, the number of carbon credits issued by the largest independent Standards (Verra, the American Carbon Registry, Climate Action Reserve and Gold Standard), totaled 1,242 million mt of CO2 as of July 31, 2021. Of these, 484 million mt were still available at the end of July, while 758 million mt had already been used by buyers to offset their emissions and are therefore retired.

Overlapping roles, bilateral trade

There is an overlapping of roles that is specific to carbon markets.

Many brokers act as traders, and many financiers have both brokering arms and project development arms. End buyers can also finance their own carbon project and decide to keep all or part of the issued credits for their own offsetting needs. All these groups may ultimately market credits to a buyer, or a developer may arrange to sell them direct. All these juxtapositions can have an impact on price, and ultimately affect market transparency.

> Voluntary carbon markets allow carbon emitters to offset their unavoidable emissions by purchasing carbon credits

Pricing a diverse supply

When a company turns to voluntary carbon markets as a potential way to compensate for its carbon emissions, one of the key pieces of information it looks for is the price of carbon credits. With this information, a company can decide how ambitious it can be when setting its emission reduction target and whether voluntary markets can really help in reaching it.

At the same time, a clear price signal for carbon allows players already involved in the market to make sure they are trading their credit at a price that reflects the real market value.

But putting a price on carbon credits is far from a straightforward operation, mostly because of the wide variety of credits in the market and the number of factors influencing the price. Projects issuing carbon credits can be of many different types and sub-types. The nature of the underlying project is one of the main factors affecting the price of the credit.

Carbon credits can be grouped into two large categories or baskets: avoidance projects (which avoid emitting GHGs completely therefore reducing the volume of GHGs emitted into the atmosphere) and removal (which remove GHGs directly from the atmosphere).

The avoidance basket includes renewable energy projects but also forestry and farming emissions avoidance projects. The latter, which are also known as REDD+, prevent deforestation or wetland destruction, or use soil management practices in farming that limit GHG emissions – such as projects aiming to avoid

emissions from dairy cows and beef cattle through different diets.

Cookstove projects, fuel efficiency or the development of energy-efficient buildings also fall under the avoidance basket and so do projects capturing and destroying industrial pollutants.

The removal category includes projects capturing carbon from the atmosphere and storing it. They can be nature-based, using trees or soil for example to remove and capture carbon. Examples include reforestation and afforestation projects, and wetland management (forestry and farming). They can also be tech-based and include technologies like direct air capture or carbon capture and storage.

Removal credit tend to trade at a premium to avoidance credits, not just because of the higher level of investment required by the underlying project but because of the high demand for this type of credits. They are also believed to be a more powerful tool in the fight against climate change.

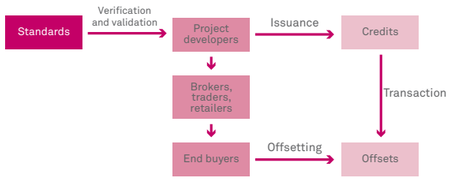
Beyond the type of the underlying project, the price of carbon credits is also influenced by the volume of credits traded at a time (the higher the volume the lower the price, usually), the geography of the project, its vintage (typically, the older the vintage the cheaper the price), and the delivery time.

When the underlying carbon project also helps to meet some of the UN's SDGs, the value of a credit from that project to potential buyers may be higher, and the credit can trade at a premium to other types of projects.

For example, community-based projects – which are usually very localized and typically designed and managed by local groups or NGOs – tend to produce smaller volumes of carbon credits. It is also often more expensive to certify them. However, they usually generate more additional co-benefits and meet the UN's SDGs, contributing, for instance, to improved welfare for the local population, better water quality, or the reduction of economic inequality.

For this reason, credits emitted by community-based projects may trade at a premium to projects that don't meet SDGs, such as industrial projects, which are typically larger-scale and can often produce large volumes of credits with more easily verified GHG offset

The structure of the voluntary carbon market



Source: S&P Global Platts

potential. In current carbon markets, the price of one carbon credit can vary from a few cents per metric ton of CO2 emissions to $15/mtCO2e or even $20/mtCO2e for afforestation or reforestation projects to $100 or even $300/mtCO2e for tech-based removal projects such as CCS.

S&P Global Platts assesses the price of an array of carbon credits and currently produces 20 price assessments including both spot and forward (Year 1) prices. Each price assessment reflects the most competitive credit for each category, based on bids, offers trades reported in the brokered market, or on trading and exchange instruments.

Platts collects bid, offers and trades for carbon credits that have been certified by the following standards: The Gold Standard, Climate Action Reserve (CAR), Verified Carbon Standard (VCS), Architecture for REDD+ Transactions, and American Carbon Registry. Price indications are collected directly from market participants during every trading day.

Platts produces four standalone prices: the CEC (reflecting CORSIA-eligible prices), the CNC (reflecting nature-based solutions with a vintage of each of the past five years and including both avoidance and removal credits), the Renewable Energy Carbon credits price (vintage of each of the last three years), and Methane Collection price, which reflects credits generated by projects aimed at reducing methane emissions such as Landfill Gas Collection, Waste Gas, and Livestock Waste Management projects (vintage of each of the last three years).

There are then two baskets of prices: the avoidance prices and removal prices. The first basket includes the Platts Household Devices price, Platts Industrial Pollutants price, and Platts Nature-based Avoidance

price. The second basket includes Platts Natural Carbon Capture and Platts Tech Carbon Capture.

As well as publishing the price of each assessment contained within the two baskets, Platts also assesses the price of the basket itself, producing a Carbon Avoidance Credits price and a Carbon Removal Credits price. These two basket assessments reflect the most competitive of the prices they contain.

Given the wide array of credits, Platts also reports price indications for each category of projects as they are traded in the broader voluntary market and not just as part of the CORSIA scheme, in an effort to increase transparency.

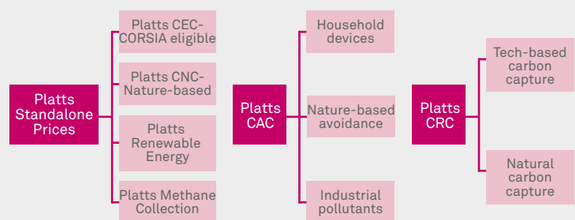
Although the rise of voluntary carbon markets dates back to the early 2000s, following the ratification of the Kyoto protocol, growth was stunted by the 2008 global economic crisis. The new wave of public and private commitments to curb carbon emissions over recent years is now triggering a resurgence of interest in voluntary carbon credits as one way to manage carbon footprints.

While there are no barriers to entry, the lack of transparency in transactions and insufficient understanding of how carbon finance works have kept many potentially interested players at bay.

However, the growing interest in understanding voluntary carbon markets, as well as the efforts of several players to scale and standardize operations, suggests that carbon finance will soon be able to attract new entrants and increase in size. ■

Go deeper

Learn more about S&P Global Platts' Voluntary Carbon Assessments at **plattslive.com/commodity/energy-transition**



Low-carbon metals: a market for premiums emerges

As demand for low-carbon aluminum and steel rises globally, a tiered market is emerging with premiums for products with reduced emissions. By Hector Forster, Diana Kinch, and William Healy

As the need to decarbonize grows across the metals industry, efforts to establish low-carbon credentials and attach a value to them are becoming more widespread.

Europe is at the forefront, but the trend is global, with companies in Asia and the US also introducing lower-carbon products, spurred on by escalating carbon prices as EU allowances broke through successive record highs through 2021.

Aluminum and steel producers that are implementing carbon emissions reductions, such as Rusal, SSAB, Cleveland-Cliffs and ArcelorMittal, are validating those cuts and charging premiums for them.

As well as setting their own individual emissions targets, metals producers and miners want to help their customers slash emissions from procurement and processing to end products, to collectively meet the Paris Agreement's limit of 1.5 degrees Celsius for global warming from pre-industrial levels.

Steel production accounts for around 7%-8% of global carbon emissions and aluminum for around 2%, based on industry estimates.

"For the steel industry to follow a trajectory compatible with the goals of the Paris Agreement, its direct CO2 emissions must fall by more than 50% by 2050 relative to today," the International Energy Agency said in an October 2020 report on steel technology.

Pricing and transparency

Without benchmarking or other points of reference, it is difficult for producers to establish the efficacy of carbon reduction measures or prove them in the market. But recently, a growing global market for carbon prices and voluntary carbon offsets of various types is facilitating discussions around carbon intensity and use of market references for valuations.

Willingness to lock in supplies among buyers may prompt the development of market mechanisms to develop that can help secure low-carbon metals production.

Higher carbon prices in Europe and globally, including the voluntary carbon credit markets, encourage the formation of low-carbon premiums, potentially expanding use of offsets. This means investments need to be more transparent.

For the steel and aluminum industries in the EU, which are subject to Emissions Trading System cap-and-trade rules, the extra costs – for compliance and to make investments to avoid emissions – are clearer than in other global regions.

Emissions savings and carbon markets are generating references for premiums. Differentiated metals products are being offered, typically for contract supplies to buyers who may need time to determine their value as part of longer-term purchasing plans, and for end-user products in automotive applications, packaging and construction.

Aluminum eyes fuel switch

Aluminum production's indirect emissions, those coming from the supply of electricity, currently account for about 70% of total global aluminum emissions and according to the IEA, over half of the power emissions are captive to the aluminum producer – meaning they come from power generation units owned directly by the producer.

According to a decarbonization dataset issued by the International Aluminium Institute September 21, the sector is confident its smelting greenhouse gas emissions could fall as much as 90% by 2050 to around 90 million mt/year, from 2018 levels of 823 million mt, in line with the IEA's Beyond 2 Degrees Scenario. As well as adopting cleaner sources of power generation, the industry is expected to see a 183% increase in aluminum recycling levels over the same timeframe, according to the IAI.

"The aluminum industry is confident that the various actions and initiatives to reduce the greenhouse gas emissions during production and increasing recycling from end-of-life products will put it at the forefront of the extraction industries combatting climate change," said Marlen Bertram, IAI director, scenarios and forecasts.

Upcharges for low-carbon aluminum products are already apparent in the sector, usually on top of contract terms with additional transparency, such as Environmental Product Declarations. For example, Rio Tinto is offering low-carbon aluminum with blockchain-based reporting to track upstream emissions and environmental, social and governance data all the way through to the rolling mill.

Russia's Rusal, majority owned by En+ Group, said the carbon footprint of its low-carbon aluminum is five times lower than the industry average, basis Scope 1 and 2 at the smelter.

Norsk Hydro is leveraging new investments in LNG-based alumina refining, replacing heavy fuel oil, to lower upstream aluminum chain emissions. Hydro is offering Reduxa 4.0, an aluminum product with Scope 1, 2 and 3 emissions of less than 4 mt per ton of metal and plans to offer a product with 2 mt carbon emissions by 2030. Global average emissions are currently 12.5 mt, Scope 1, 2 at the smelter, although this is skewed by higher production using coal-fired power generation in China.

In addition, metals producers demonstrating lower carbon emissions are seeking to differentiate their offering with enhanced data and through participation in industry groups, such as ResponsibleSteel and the Aluminum Stewardship Initiative.

En+ Group chairman Greg Barker stressed aluminum with higher carbon emissions may face discounts to benchmarks as buyers gravitate toward lower-carbon material, factoring in costs of using material with high direct and indirect emissions.

Low-carbon aluminum premiums have already been heard within the European spot market. One producer reported in mid-2021 that their targeted premium was between $30-$40/mt. Premiums for low-carbon aluminum are now commonplace within the value-added products market, but discernible premiums are yet to be regularly observed in the spot market for P1020 ingots, which are processed into products such as billets and extrusions, for further applications downstream.

Premiums in other regions are expected to be slower to develop due to fewer political and market pressures. However, sources see Asia as the next market for low-carbon premiums due to higher average emissions per ton in the region, enabling low-carbon aluminum to generate greater comparative savings.

Reaching carbon neutrality – ideally via use of hydrogen-based technologies and electrolysis – may add 50%–80% to current steel production costs by 2050, much of this to be borne by the consumer

Steel taps renewables, hydrogen

ArcelorMittal, Tata Steel, Salzgitter, Ovako and SSAB are among steel companies carving out a segment for steel premiums linked to carbon emissions, highlighting additional costs that may include new equipment and plant adaptations, renewable power and hydrogen supplies, and carbon procurement and trading, to name just a few.

Even with support from public investment bodies and government instruments, such as contracts for differences, to provide greater certainty for major investments, costs for the energy transition underpinning low-carbon steel are high. Reaching carbon neutrality – ideally via use of hydrogen-based technologies and electrolysis – may add 50%–80% to current steel production costs by 2050, much of this to be borne by the consumer, steelmaking sources have said.

ArcelorMittal, the second-largest global steelmaker, has revealed comprehensive, multi-faceted plans to achieve emissions cuts, both in Europe and at facilities and joint ventures in Asia and the Americas, involving cutting-edge green hydrogen, gas injection, and carbon recycling and upcycling.

The company is making near-term improvements to cut emissions at its works, generating renewables certificates for this work and packaging them as offsets with steel sales, providing an alternative to market-based carbon offsets.

Early this year ArcelorMittal Europe estimated the cost of neutralizing its own carbon footprint by its

target date of 2050 at Eur15 billion-Eur25 billion ($17.6 billion-$29.3 billion) for its Smart Carbon production route initially using carbon capture and storage (CCS) and later hydrogen. It expects using hydrogen in a direct reduction iron-electric arc furnace route would cost Eur30 billion-Eur40 billion. But that's not all: the clean energy infrastructure needed to power these routes in a carbon-neutral way could cost up to an extra Eur200 billion.

In its Climate Action Report 2 published July 2021, the steelmaker said it needs to invest $10 billion to meet its new 2030 group target to reduce estimated CO2 emissions intensity by 25% in Scope 1 and Scope 2, not including government support.

Germany's Salzgitter demonstrated emissions cuts of up to 75% compared with its main blast furnace works, by converting ferrous scrap into flat steel via the electric arc furnace route and using its galvanizing lines. Salzgitter seeks to invest in green-hydrogen DRI and has its own wind generation and electrolyzers to test the concept.

The company, which started shipping green steel to white goods manufacturer BSH Hausgerate in September, is confident the market will support and adapt to the initial premiums for cleaner steel. "In the short term we expect higher prices, or price premiums, for green steel in the EU due to added green value to the customer and a supply shortage up to the mid-2020s," CEO Gunnar Groebler told analysts on a H1 company results call.

"In the medium- to long-term the price premium will diminish following increased supply. There will be higher competitiveness of green vs. gray steel due to CO2 regulations and rising prices generally. Eventually gray steel will be obsolete in Europe due to price pressure on the gray steel given oversupply vis a vis demand," Groebler added.

The low-carbon drive in steel is expanding globally, with steel mills in Japan, South Korea and China such as Baowu Steel, Nippon Steel Group, and POSCO tying up with miners such as BHP and Rio Tinto to enhance raw materials processes to cut emissions, ahead of commercial breakthroughs in areas such as green hydrogen supply and electrolysis smelting.

> "Eventually gray steel will be obsolete in Europe due to price pressure given oversupply vis a vis demand."
>
> **Gunnar Groebler, Salzgitter**

Mining, transportation and processes

Low-carbon metals may benefit upstream from developments in alumina, bauxite, coking coal and iron ore mining, as well as dry bulk transportation fuels evolution, and changes to mining and processing fuels.

Miner LKAB's switch to biofuel-fired pellets from fossil fuels allowed its joint venture with SSAB and energy company Vattenfall, HYBRIT, to deliver hydrogen-based iron for SSAB to make "fossil-free" steel. The first prototype steel plate was supplied to truck maker Volvo Group. Using HYBRIT, SSAB plans to supply auto steel to Volvo Cars and Mercedes-Benz.

New projects and processes using more renewable energy, high-technology anodes, hydrogen, scrap metal and energy recycling can cut emissions to as little as

US steel producers commit to GHG emissions reductions

Premiums for low-carbon steel are yet to gain traction in the US steel market, but producers are taking steps toward a lower-carbon future with recent pledges to reduce their greenhouse gas emissions.

While several steelmakers are eyeing sizeable cuts to their GHG emissions by 2030, some are also planning to achieve carbon neutrality by a later date. This wave of substantial emissions reduction commitments by steel producers did not come out of nowhere: earlier in the year, President Biden committed to decreasing economy-wide GHG emissions by 50&-52% by 2030, using a 2005 baseline. The administration's American Jobs Plan also makes mention of goals to achieve net-zero emissions by 2050.

One of the steelmakers keen on supporting these aspirations is Steel Dynamics. Along the path to carbon neutral electric arc furnace (EAF) operations by 2050, the company has set goals for a 20% reduction in Scope 1 and 2 GHG emissions by 2025 and a 50% reduction by 2030.

"We have been a leader in the area of sustainability for more than 25 years, and we plan to stay right in that position," said SDI CEO Mark Millett during the company's earnings call in July. "We are starting from a place of strength with already industry-low Scope 1 and 2 carbon emissions, yet we plan to do more."

Nucor, the largest US EAF steelmaker, has announced similar targets in an effort to further its commitment to greener steel production. "At our current greenhouse gas intensity, Nucor has already achieved the steel sector benchmark established in the Paris Agreement," said CEO Leon Topalian during the company's Q2 earnings call.

Even so, Nucor plans to lower its Scope 1 and 2 emissions by an additional 35% by 2030, with a goal of net-zero emission steel thereafter.

The political salience and urgency surrounding decarbonization have even made integrated producers in the US eager to board the green steel train in 2021.

Cleveland-Cliffs, the largest flat-rolled steelmaker in North America, has said it will reduce its GHG emissions by 25% by 2030. "Cleveland-Cliffs sees decarbonization as part of our license to continue to exist," said CEO Lourenco Goncalves during the company's earnings call in July.

Meanwhile, US Steel says it intends to reduce its GHG emissions by 20% by 2030, with the aim of achieving net-zero carbon emissions by 2050.

Ingrid Lexova

one-tenth of the typical amount for more traditional primary metals production.

Voestalpine, Cliffs and Kobe Steel are adding DRI-based hot briquetted iron (HBI) into the blast furnace, reducing coking coal use and cutting emissions, while DRI and HBI product are enabling more scrap-based steel to meet a wider range of steel grades.

As the carbon footprint becomes a major consideration for all-in costs, there are also more opportunities for substitution of different steel and aluminum grades, along with recycled materials.

While the challenges to decarbonizing steel and aluminum are far from trivial, particularly around cost, the direction of travel is clear, and the investments already made or planned show the sector's firm commitment to slashing emissions. As the cost associated with high levels of emissions increases, premiums for lower-carbon metals will steadily become more commonplace across the world. ■

Go deeper

S&P Global Platts low- and zero-carbon aluminum price assessments help bring transparency to the rapidly developing accounted-carbon metals sector.
Learn more at **spglobal.com/aluminum-carbon**

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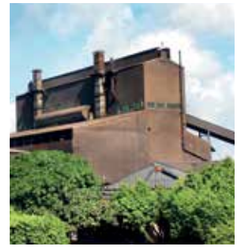

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South African PGM miners eye renewables investments, hone green credentials

Filip Warwick and Chantelle Kotze look at the challenges South Africa's predominantly coal-powered miners face in producing metals for the green revolution

Platinum, iridium and ruthenium are set to play a crucial part in today's rapid uptake of clean energy technologies due to their use in fuel cells in hydrogen-powered vehicles.

But uncertainties have emerged over how green the minerals' own production processes are, with most platinum group metals produced by South African miners whose energy sources are predominantly coal-based.

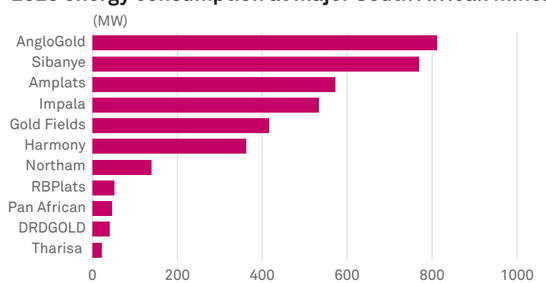
Already constrained by tight power supplies in South Africa, the nation's miners now have a new challenge: to switch to clean and renewable energy sources to keep their ESG credentials intact and their showcase products green.

The mining industry is one of the most energy-intensive industries in the world, responsible for around 7% of global greenhouse gas emissions, according to global business advisory firm FTI Consulting.

In South Africa, the PGM mining sector's deep-level underground mines with cooling facilities and large smelting facilities are no exception – state power entity Eskom supplies most of their energy from coal-based stations, according to Nedbank CIB mining analyst Arnold Van Graan.

With the end of the South African winter in August-September, the country has not experienced serious load shedding for a while, but the electricity system is still constrained by Eskom's aging infrastructure and old coal-powered stations. Eskom's debt currently stands at Rand 401.8 billion ($28.5 billion) with the government having already pumped in Rand 31.7 billion, as promised for the 2022 financial year.

2020 energy consumption at major South African miners



Source: Company reports, Nedbank CIB Markets Research

South African regulations

Bureaucratic red tape and regulations have for years hindered South African miners in their quest to develop their own renewable energy sources. However, a number of them are now taking this initiative and rolling out C02 emission reduction pledges.

"CO2 emission reduction targets, timelines and detailed roadmaps vary significantly between companies. However, on balance, the aim seems to be to reduce CO2 emissions by 10%-30% over the next decade, with much larger reductions beyond that," Nedbank's Van Graan said. "Companies would rely heavily on renewable energy projects, mostly solar and some wind, to achieve these near-term goals."

Helping matters along, South African President Cyril Ramaphosa in June amended Schedule 2 of the Electricity Regulation Act. This move exempts embedded generation facilities of up to 100 MW from the National Energy Regulator of South Africa's licensing requirements – a necessary action to help achieve energy security in the country.

In August, South Africa's Department of Mineral Resources and Energy re-published the exemption in the form of an amendment to Schedule 2 of the ERA, presumably to correct some of the ambiguity in the drafting, law firm Pinsent Masons' legal director Emma Dempster told S&P Global Platts.

A number of South African mining companies have had projects in the pipeline for some time that would generate power on site from low carbon sources, such as solar power plants

"A positive amendment was the clarification that electricity can be wheeled to 'one or more' customers that was not in the [earlier] version," Dempster said.

Renewable projects in pipeline

A number of South African mining companies have had projects in the pipeline for some time that would generate power on site from low-carbon sources, such as solar power plants.

South African miner Impala Platinum (Implats) in September 2020 started to look at building a 10-MW solar plant at its Marula platinum mine, while also keeping an eye on "the fluid regulatory environment to give the company certainty to its planning."

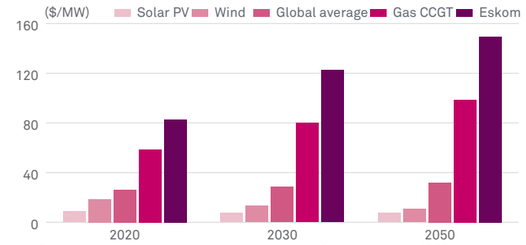
"At Zimplats [Implats' subsidiary in Zimbabwe], we started development in late 2018 and have been doing technical studies, environment and commercial assessments," Impala Platinum's group executive for corporate relations Johan Theron told Platts.

"Given the recent contemplated changes to lift generation licence requirements for power plants less [than] 100 MW in South Africa, we are looking at several options for our Refineries and Rustenburg operations, both behind the meter and wheeling. These options also include combined heat and power solutions," Theron said. "[We are also] studying the implications this regulatory change might have on our Marula solar power plant project."

Overall, nearly 18% of the company's electricity is supplied by renewables. It sees that this percentage could grow to around 50% at Zimplats, 100% at Impala Canada and 21% at its South African operations.

"Given the competitive cost levels of renewable energy technology, maturity of the technology, the supply chain readiness, it is foreseeable that in the next two years we could add new electricity from renewables in our supply mix," Theron said.

Operating cost comparison of different energy sources



Note: Eskom estimate is based on a 4% p.a. above-CPI increase until 2030 and 1% beyond that
Source: Company reports, Nedbank CIB Markets Research

Anglo American Platinum plans to achieve carbon neutrality across all its operations by 2040, Amplats' external communication principal, Nomonde Ndwalaza, told Platts.

"There are several renewable energy projects in the pipeline at Anglo American Platinum, including a planned solar PV project at Mogalakwena of ±100 MW, depending on the final design selected," Ndwalaza said.

The company is aiming to start the plant's operation in the fourth quarter of 2023, pending approvals and project development schedules.

"A 100 MW plant at Mogalakwena will be sufficient to provide ±25% of the complex's daytime electricity demand," she said.

The planned solar plant also forms part of the work the company and its partners are doing to develop the world's first hydrogen-fuelled mine haul truck. The company expects to replace diesel consumption at Mogalakwena with the rollout of 40 hydrogen-powered, fuel-cell mining trucks from 2024. The first truck will be tested in the second half of 2021 with green hydrogen used as fuel source.

The proof-of-concept trucks will be trialed this year, with the ultimate aim of fuelling them with green hydrogen, Ndwalaza said.

Sibanye-Stillwater, one of the world's largest primary producers of platinum, palladium and rhodium, is planning several renewable energy projects at its South African operations.

The company has approved plans to build a 50 MW solar project for its gold operations, with targeted commercial operational date of late 2023. It is also looking at plans for a 175 MW solar facility at its Rustenburg platinum mines to go online early 2025, while a 250 MW wind farm to be operational late 2024.

Going green not cheap

Going green in mining has a significant cost factor involved, Van Graan said.

"Based on our numbers, the upfront costs of a 30% CO_2 emission reduction could amount to 5%-20% of the current market capitalization of the stocks in our coverage universe. This could also materially affect the way companies operate and consume energy, which could in turn impact productivity and profitability," the analyst said, adding that benefits from emission reduction may offset the costs.

"Large portions of the potential costs needed to meet the CO_2 emission reduction targets could be offset by electricity cost savings and lower carbon taxes. The move to renewables could also hold broader benefits for the global mining sector on the back of increased demand for green metals. This could boost commodity prices, further offsetting the costs associated with CO_2 abatement," he said.

The timetable for going green still looks rather hazy for South Africa's PGM sector, despite the regulatory easing and good intentions.

"South African miners have welcomed with open arms the extension of the exemption on self-generation, but still, now the biggest hurdle is regulatory uncertainty," said Indigo Ellis, from risk management consultancy Africa Matters, adding that the industry could in five years' time continue to face the same issues it is facing now.

"Coal will be far from over, and miners will need to invest heavily in securing reliable and sustainable supply chains for key renewables materials. 'Green' minerals have notoriously murky supply chains, and demand is increasing, ensuring costs will remain high to establish self-generation units at individual mine sites," Ellis said. "Perhaps within five years, the Minerals Council will be able to band together mines to generate electricity together." ■

Technologies dictate PGM demand

Platinum, iridium and ruthenium are used in hydrogen fuel cell electric vehicles in the form of autocatalysts in cars and trucks as well as in green hydrogen production in the form of electrolyzers.

South Africa, with some of the world's largest PGM reserves, accounts for 90% of global ruthenium mine supply, 81% of global iridium mine supply and some three-quarters of global platinum supply.

Ruthenium and iridium are a byproduct of PGM mining with only a small number of producers.

"When talking about the future of both iridium and ruthenium, there is a chance that they are both going to be used in the production of green hydrogen via water electrolysis," said Karolina Jackiweicz, trader at UK-based minor metals trading company Lipmann Walton & Co.

"Looking forward, there is a great deal of potential investment around hydrogen with countries worldwide having their own plan on how to become CO_2 neutral," Jackiewicz said. "That technology might help countries towards reaching their [emission] goals in the future, that's why there is a lot of interest from the investors' side in iridium and ruthenium."

Jackiewicz added that while the production of green hydrogen using water electrolysis with iridium and ruthenium is currently a small market, it "might become more significant in the long-term, in the next five to 10 years."

Future platinum demand

Platinum's future usage could shift to power generation using fuel cells, and to produce "green" hydrogen using electrolyzers powered from a renewable energy source, according to Standard Bank SBG Securities resources analyst Adrian Hammond.

Sales of internal combustion engine vehicles are expected to decline from 2025 onwards, as a result of being replaced with battery electric vehicles (which contain no PGMs), in line with various governments' decarbonization policies. Hammond said it is hard to see that current platinum demand can be sustained from fuel cells in heavy-duty vehicles or other modes of transport, or electrolyzers alone.

He sees plug-in hybrid electric vehicles as a "gap-filler" between now and when battery-only electric vehicles fully take over.

"While PGM producers will remain relevant in the world of decarbonization, current production will not be as much needed in the future as it is now, calling into question the viability of certain operations in future, with only the lowest cost producers expected to remain competitive," he said.

Implats' executive for corporate affairs, Emma Townshend, said in the company's 2021 financial year results that there is significant demand from the automotive sector for its PGMs.

"If we look at the make-up of demand for our primary products, you're talking over 80% to 85% palladium and rhodium demand coming from the auto market and over 40% coming from platinum. The bigger picture auto story is of a market recovering from the impact of COVID, which is positive for volumes over the medium term, and it's also a market which is benefitting from tightening legislation," Townshend said.

"It's a bit of a perfect storm at the moment with a couple of very specific demand and supply factors, but it does create increased demand, we think, in 2022/2023 as that very battered auto industry recovers production levels to pre-pandemic levels [and] inventories normalize across the supply chain," she said.

Implats – the world's third largest platinum producer – said that its medium-to long-term view of the automotive sector is "reasonably positive," despite the very well-recognized headwinds that the longer-term electrification of the light-duty vehicle segment represents.

Filip Warwick and Chantelle Kotze

Insight from Dubai

By Dania Saadi

In the 1970s when Abu Dhabi National Oil Co. was looking for a city to house its industrial staff, it chose a rural desert town close to its onshore fields with deep waters for easy access to oil tankers.

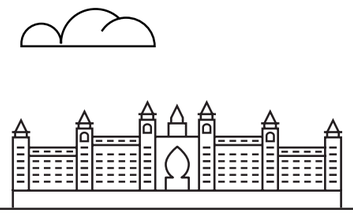
Today, Ruwais is more than just a port city. It is key to ADNOC's oil ambitions, including its quest to turn the newly launched Murban futures contract into an international benchmark for oil headed to Asia.

A $3.5 billion crude flexibility project at Ruwais refinery, Abu Dhabi's biggest with a capacity of 817,000 b/d, will revamp nearly half of the facility to process crudes other than Murban, freeing up the flagship grade that underpins the futures contracts launched on March 29 on ICE Futures Abu Dhabi in the UAE capital. With nine international partners in IFAD, ADNOC and the Intercontinental Exchange are hoping that the futures contract will transform the way of pricing oil produced in the Middle East and sold in Asia.

With the crude flexibility project, which is now more than 85% complete, the Ruwais refinery will be able to process Upper Zakum crude – pumped from offshore oil fields – for the first time. The refinery will also be able to process over 50 other regional and international grades starting in 2022. Full ramp-up is expected by 2023.

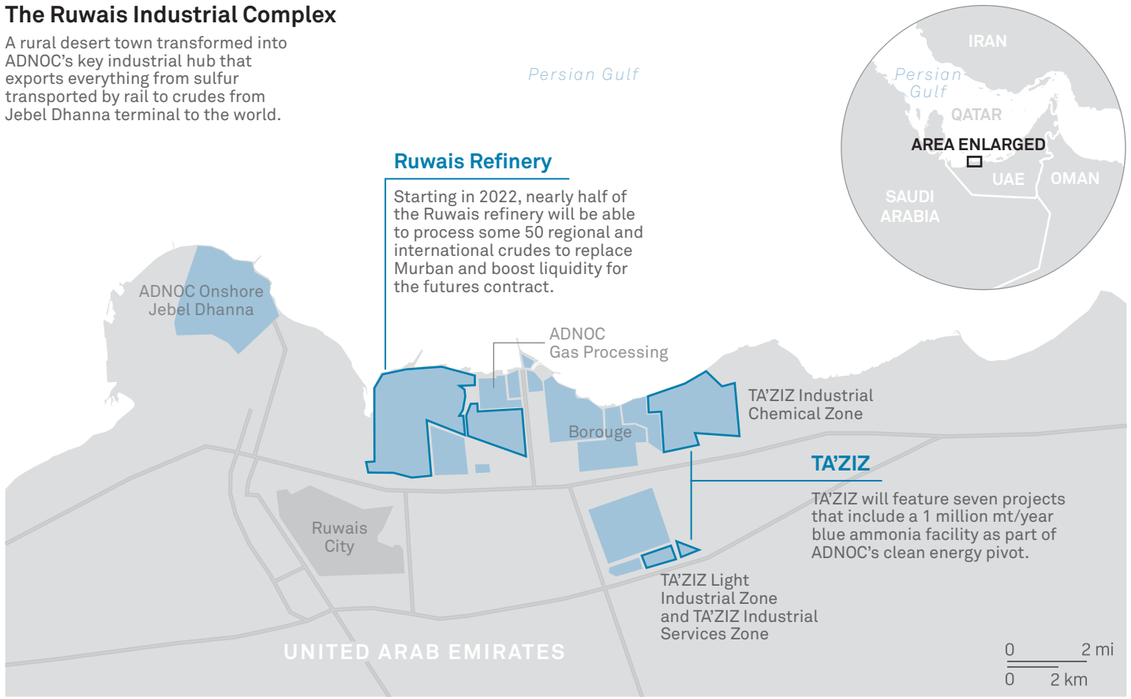
Beyond refinery transformation

But ADNOC is working on more than just transforming its refinery in Ruwais, where over $11 billion worth of projects are currently under development, including the refinery project.



The Ruwais Industrial Complex

A rural desert town transformed into ADNOC's key industrial hub that exports everything from sulfur transported by rail to crudes from Jebel Dhanna terminal to the world.



As ADNOC seeks gas self-sufficiency, it is expanding ADNOC Gas Processing, the company's biggest such facility that handles 8 Bcf or 85% of its gas.

The two multi-billion dollar projects at ADNOC Gas Processing are aimed at boosting gas capacity in Ruwais through the design of a new gas compressor station and pipelines to ramp up sales gas network connectivity.

ADNOC needs to boost its gas processing facility as it ramps up production, especially after disclosing in 2019 that it had some 160 Tcf of unconventional gas recoverable resources, on top of 273 Tcf of conventional gas.

Increasing gas supply will be key to meeting domestic power demand as well as providing feedstock to industrial and petrochemical projects in the UAE.

Driving up petrochemical production is another key plank of ADNOC's downstream ambitions.

Borouge, a joint venture between ADNOC and Austria's Borealis that produces polyolefins, will boost its capacity by 11% to 5 million mt/year by end-2021, its CEO Hazeem al-Suwaidi told S&P Global Platts. Borouge is also working on a mega petrochemical project, Borouge 4, which is currently being considered for investment approval, he said.

The petrochemical maker is also part of a wider ADNOC study on the production of hydrogen.

Clean energy pivot

Producing blue hydrogen and ammonia has become a major pivot for ADNOC, which wants to cater to the rising global demand for clean energy products, also from Ruwais.

ADNOC and its partner Fertiglobe have inked blue ammonia deals with three Japanese customers and more is on the way.

Fertigloble, a 58:42 partnership between Netherlands-listed chemicals firm OCI and ADNOC, will produce the blue ammonia from its Fertil plant in Ruwais.

A joint study agreed in July between ADNOC and state-owned Japan Oil, Gas and Metals National Corp. (Jogmec), INPEX and JERA will explore the possibility of producing 1 million mt/year of blue ammonia in Abu Dhabi and transporting it to Japan, a Jogmec source previously told Platts.

The agreement follows the Japanese Ministry of Economy, Trade and Industry's first fuel ammonia deal in cooperation with ADNOC in January as Tokyo intends to develop its supply chain of blue ammonia, possibly in the Middle East, by the late 2020s.

Fertiglobe has also joined ADNOC and Abu Dhabi sovereign wealth fund ADQ as partner in a greenfield blue ammonia project with a capacity to produce 1 million mt/year. The project is expected to start production in 2025 and will be located in TA'ZIZ, itself a chemical joint venture between ADNOC and ADQ.

Seven projects in TA'ZIZ, including the blue ammonia project, will have an investment value exceeding $6 billion once they are complete, acting CEO of TA'ZIZ Khaleefa al-Mheiri told Platts.

Ruwais through the years

1981	ADNOC opens a refinery in Ruwais, its second overall
	Official start-up of first ADNOC Gas Processing (previously known as GASCO) facility – an NGL fractionation plant at Ruwais
2001	Start-up of first Borouge petrochemical complex in Ruwais
2018	ADNOC reveals plans to invest $45 billion in downstream operations with partners
2019	Sale of 35% stake in ADNOC Refining to OMV and Eni
2020	ADNOC and ADQ announce TA'ZIZ joint venture
2021	ADNOC and TAQA to develop utilities at TA'ZIZ in Ruwais
	Fertiglobe joins TA'ZIZ as partner in world-scale blue ammonia project
	ADNOC and Reliance sign strategic partnership for world-scale chemical projects at TA'ZIZ

Source: S&P Global Platts, Kpler, ADNOC

TA'ZIZ is seeking regional and global partners for the projects, which are expected to have "world-scale" capacity once they start production in 2025, and has already attracted India's Reliance Industries to participate in three.

"With international investors, we are looking to bring in operational capabilities, access to technology and off-takers that would support us in marketing those products," al-Mheiri said.

As ADNOC expands on its downstream plans with projects such as TA'ZIZ, Ruwais will play even a bigger role in transforming the national oil producer into a global energy player vying with Western majors, even in the clean products arena. ■

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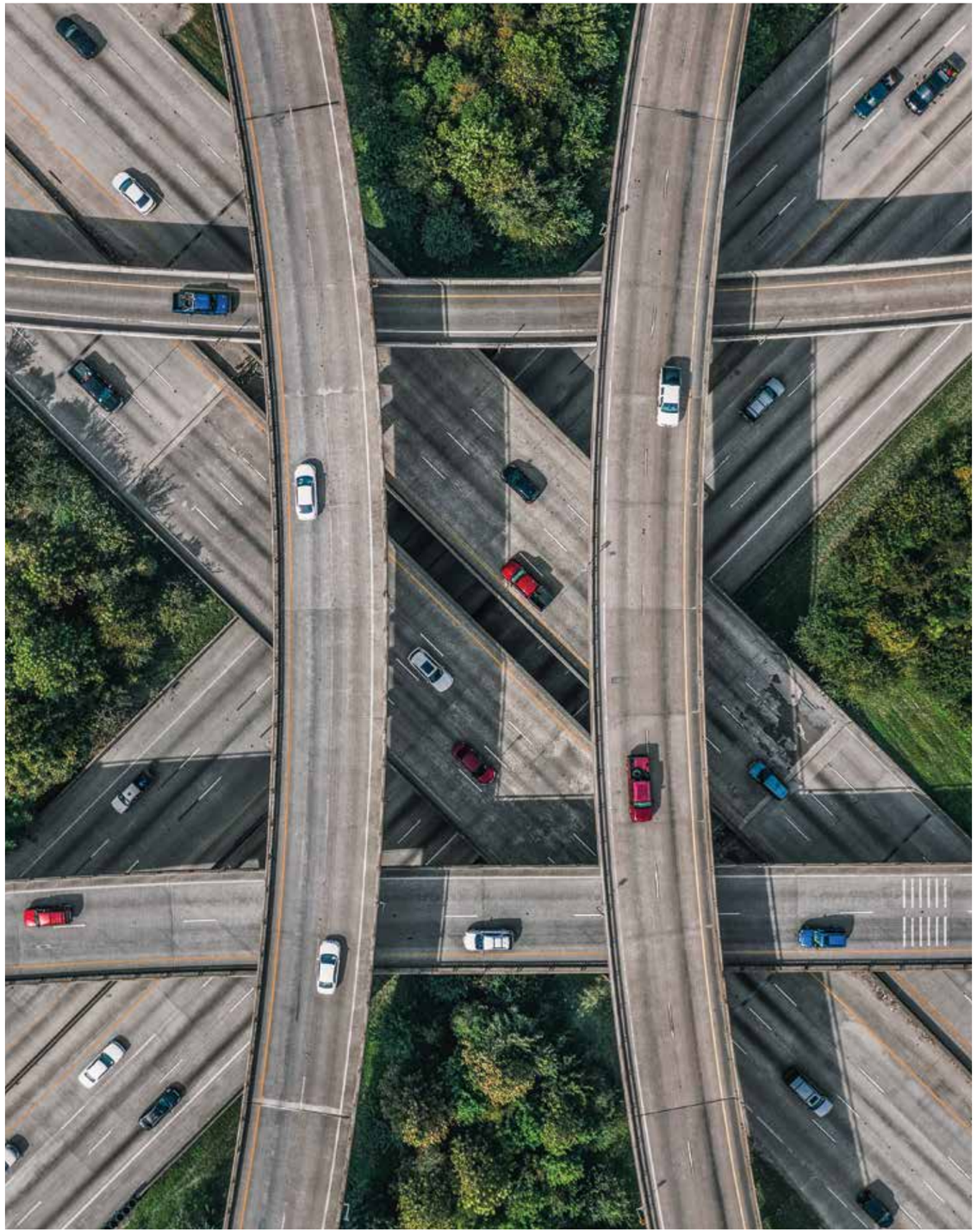


Roads, rail and electric grids

Justine Coyne examines the impact of the long-awaited US infrastructure package, including its 'Buy American' provision, on the steel and aluminum sectors

With the largest US infrastructure package since the Federal Highway Act of 1956 making its way through Congress, steel and aluminum markets are expected to benefit from increased demand amid the country's push to address its crumbling infrastructure.

The US Senate passed the $1-trillion Infrastructure Investment and Jobs Act August 10, with the legislation still awaiting approval from the House of Representatives at the time of writing. While below the $2.25-trillion proposal put forward by President Joe Biden in March, steel and aluminum groups have urged Congress to pass the legislation without delay.

The deal passed by the Senate includes $550 billion in new federal investment in US infrastructure, including $110 billion in new funds for roads, bridges, and major projects. It also reauthorizes the surface transportation program for the next five years.

A total $40 billion in new funding for bridge repair, replacement and rehabilitation is included, marking the largest dedicated bridge investment in the US since the construction of the interstate highway system in the 1950s.

Among the other metals-intensive investments included in the bill, an additional $39 billion is to be used to replace thousands of transit vehicles, including buses, with clean, zero-emission vehicles, as well as $66 billion to be invested in passenger and freight rail to eliminate the Amtrak maintenance backlog, modernize the Northeast Corridor, and bring rail service to areas outside the Northeast and mid-Atlantic.

The bill also includes a $7.5 billion investment to build out a national network of electric vehicle chargers, the first-ever national investment in EV charging infrastructure.

"With approximately $550 billion in new federal spending towards steel-intensive, traditional infrastructure projects, our nation can rebuild roads and bridges, shore up coastlines against

climate change, protect public utility systems from cyberattacks, make drinking water safer, and modernize the electric grid," said Philip Bell, president of the Steel Manufacturers Association, following the Senate's vote to move the legislation forward. "There is something in this bill for everyone."

Bridges, roads to boost steel demand

The US steel industry has long advocated for Congress to pass a large-scale infrastructure bill. Despite widening divisions between US political parties, infrastructure has always had bipartisan support, though getting the two parties to agree on funding has been a persistent roadblock.

Following Senate passage of the legislation, American Iron and Steel Institute CEO Kevin Dempsey said investment in US infrastructure is "long overdue."

The American Society of Civil Engineers graded overall US infrastructure at a "C-" in its latest four-year review, issued March 3. While US infrastructure moved up from a "D" grade range for the first time in more than 20 years, significant work remains, the group said.

Incremental gains have been made in some categories, but the ASCE found the US' long-term investment gap continues to grow. The total investment gap has risen to nearly $2.59 trillion in 2021, up from $2.1 trillion over the past 10 years.

Bridges alone received a "C" grade from the ASCE. Out of the more than 617,000 bridges in the US, 42% are at least 50 years old, and roughly 7.5% – or 46,154 bridges across the US – are considered structurally deficient. The ASCE estimates the nation's backlog for bridge repair alone to be at $125 billion.

In terms of potential for steel demand, each $1 billion in infrastructure spending requires about 50,000 st of steel, and each trillion dollars invested in infrastructure has the potential to create 11 million jobs in the US economy over the next decade, according to the AISI.

"We haven't funded infrastructure properly and it has become a drag on the economy – one that continues to grow with every passing day," US Steel CEO David Burritt said in March following Biden's speech outlining his infrastructure proposal in the company's hometown of Pittsburgh. "If we invest as we should, we will create millions of manufacturing jobs, strengthen US competitiveness globally and save households money, all while setting a new bar for sustainability."

EVs and aluminum demand

With the push toward electric vehicles in the US, greater federal investment in this area would be a boost for aluminum demand.

Aluminum chassis, shock towers, motor and battery housings and internal panels allow electric vehicles to travel farther and more safely. Aluminum is also a key component of the charging networks that allow these vehicles to refuel, according to the Aluminum Association.

"As one of only eight critical mineral commodities recognized by the federal government as essential to all sectors of the US economy, this bipartisan investment will depend on aluminum," said Tom Dobbins, CEO of the Aluminum Association.

Additionally, $65 billion included in the Senate-passed bill for electrical grid modernization would benefit aluminum as it provides better conductivity-to-weight ratio than copper, making aluminum the leading material used in wiring power grids, according to the Aluminum Association.

'Buy American' to limit imports

With both steel and aluminum markets facing issues brought on by global overcapacity, Biden has put forward newly proposed Buy American rules ahead of infrastructure spending. These are aimed at closing loopholes in the existing program to ensure that federal dollars are being spent on materials made in the US.

Biden's proposal, put forward in late July, would increase US content in the products the federal government buys in addition to supporting domestic production of products critical to US national and economic security, according to a fact sheet provided by the White House.

In terms of potential for steel demand, each $1 billion in infrastructure spending requires about 50,000 st of steel

The Buy American statute requires products bought with taxpayer dollars to be "substantially all" made in the US. Under the current regulations, products could qualify if just 55% of the value of their component parts was manufactured in the US. The Biden proposal includes an immediate increase of this threshold to 60% and a phased increase to 75%.

"We strongly support these efforts to ensure federal tax dollars are used to buy products made in America, including by increasing the amount of American-made content that must be contained in a product to be considered made in America," the AISI's Dempsey said. "Strong domestic procurement preferences – including provisions to require the use of American steel – are essential to creating and maintaining good-paying US manufacturing jobs and to protecting our national security." ■

Insight from Washington

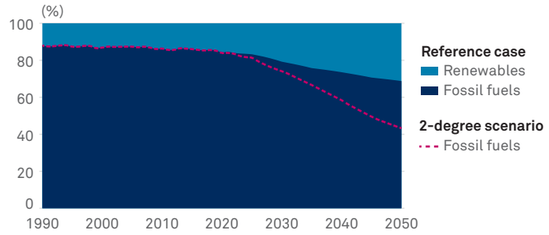
By Meghan Gordon

During a summer of extreme weather events across the US, the Biden administration used each new emergency response to underline the need for rapid action to cut carbon emissions and slow climate change.

Nearly one in three Americans live in a county hit by a weather disaster in June-August, and nearly two-thirds of Americans live in places that experienced a multiday heat wave this summer, according to a Washington Post analysis.

The Biden administration is counting on that growing personal awareness of the changing climate to drive action in Washington, as it proposes a sweeping list of measures to slow emissions, transition to cleaner fuels, harden infrastructure and other goals. The White House proposals touch nearly every sector of the economy.

Fossil fuels' shrinking share of US energy mix



Source: S&P Global Platts Analytics

Many of the Biden administration's climate proposals require approval by the closely divided US Congress, a challenge that will only increase as the November 2022 midterm elections approach.

"It's encouraging to hear that the dialogue is back on, and the desire to take action is certainly there," said Chris Midgley, global director of analytics at S&P Global Platts. "But we already know that there is always the competing challenge between economic growth and dealing with and tackling this climate emergency."

"The reality is that it's going to be a tightrope between those two," he continued. "We want to address it, we want to have an energy transition, but we don't want to let go of the economic model of perpetual growth."

Here's a snapshot of a few of the climate-related policies being considered by the Biden administration and Democrats in Congress:

Limiting fossil fuel production

The US Interior Department is reviewing its leasing program for oil, gas and coal extraction on federal lands and waters for climate and fiscal concerns. Although oil-producing states have successfully sued to block the leasing moratorium, the administration has responded to court orders and appears to be in no hurry to restart lease sales.

Democrats in Congress also aim to bar new leasing off the Atlantic and Pacific coasts, in the eastern Gulf of Mexico, and in the Arctic National Wildlife Refuge.

The proposals include a host of economic changes to federal leasing, including raising royalty rates to 20% from 12.5%; assessing royalties on all methane extracted, no matter if it is consumed, vented, flared or leaked; shortening lease terms; imposing a slew of new fees, and ending non-competitive leasing.

"At a high level, the changes would not fully end federal fossil energy leasing, but they would narrow available acreage and impose new conditions that could significantly diminish the appeal of the leases themselves," said Kevin Book, managing director of ClearView Energy Partners.

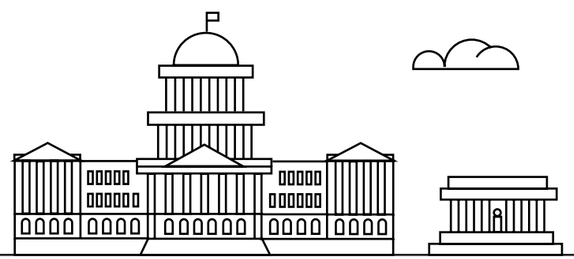
Still other proposals would strip producers of key tax benefits, including the pass-through exemption from corporate income tax for partnerships that derive at least 90% of gross income from natural resources; use of percentage depletion for oil and gas wells; expensing of intangible drilling costs; capital gains treatment for royalties; enhanced oil recovery credit; $3.90/b credit for marginal oil wells; expensing of exploration and development costs, and other tax incentives.

Clean energy incentives

To promote clean electricity generation, Democrats have proposed a new Department of Energy program that would likely exclude some natural gas facilities but may include gas plants equipped with carbon capture technologies. The Clean Electricity Payment Plan would provide grants or payments to generators based on how much clean electricity they supply to customers, complementing existing clean energy tax incentives.

The program is aimed at helping the US achieve Biden's goal of producing 80% of power from carbon-free generators by 2030.

While conservation groups recently launched a campaign aimed at excluding natural gas from the program, some industry members have said such climate targets and anti-gas campaigns are unreasonable, noting the important role natural gas could play in the transition to cleaner energy sources while ensuring a reliable power supply.



To curb emissions related to air travel – seen as one of the hardest-to-decarbonize sectors – the Biden administration proposed a series of measures to spur development of sustainable aviation fuels, including through a $1.50-$2/gal blender's tax credit. The plan aims to cut US aviation emissions by 20% and boost SAF production to 3 billion gal/year by 2030.

The tax credit would require at least a 50% reduction in lifecycle greenhouse gas emissions, with greater reductions receiving a bigger tax incentive. The proposal set a 2050 target of meeting all US aviation fuel demand by SAF – an estimated 35 billion gal/year by 2050.

Corey Lavinsky, global manager of biofuels analytics at Platts, said market dynamics could spur rapid expansion of SAF if incentives shifted away from renewable diesel. A $1/gal tax credit for blending renewable diesel expires at the end of 2022.

"If SAF gets a more favorable blending credit, or if the renewable diesel blending credit is allowed to expire, or both, SAF production can be off to the races," Lavinsky said.

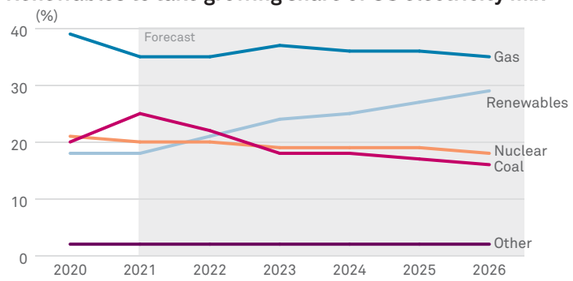
Assessing risks to financial markets

Treasury Secretary Janet Yellen has taken a number of steps to start assessing climate-related financial risks to the US government and the US financial system, including in her role as chair of the Financial Stability Oversight Council.

ClearView's Book described the efforts to require disclosure protocols, stress tests, new insurance premiums as "indirect financialization" of climate risk.

"By highlighting potential risks that climate mitigation and adaptation could pose to investors, financial regulators could drive an increase in the cost of capital for fossil fuels and shift investment allocations from higher- to lower-emitting sectors," Book wrote in a September 8 note.

Renewables to take growing share of US electricity mix

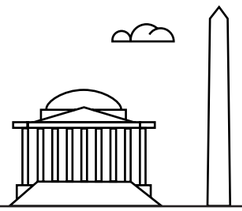


Source: S&P Global Platts Analytics North American Electricity Five-Year Forecast

The Treasury Department will also end international financing for fossil fuels through multilateral development banks, "except in exceptional circumstances while helping developing countries build a strong and sustainable future," Yellen said in August. Treasury said it would oppose new oil and coal projects and narrow its support for natural gas.

Yellen asked MDBs to "rapidly align" their portfolios with the Paris Agreement, prioritize innovation and mobilize capital to meet climate goals, develop targets for green bonds, and boost private financing for climate adaptation.

The guidance expressed support for carbon capture, utilization and storage, and methane abatement projects as standalone investments for existing fossil fuel projects, "assuming they do not expand the capacity of the existing project or significantly extend its operational life." ■



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Steel vs plastics: race to sustainability

The challenges and opportunities of striving for a circular economy are becoming clearer. Samuel Chin and Miranda Zhang examine how the steel and plastics sectors are forging the path to sustainability

The steel and plastics industries, as some of the leading carbon emitters, have come under increasing pressure since the 2015 Paris Agreement, with China's banning of 24 types of solid waste imports in 2018 proving a watershed moment for both sectors.

With the recycling of steel and plastic materials seen as a key path toward decarbonization, and growing legislative efforts globally adding further pressure, demand for sustainable plastic and steel products is currently outpacing supply, creating both considerable opportunities and challenges for producers.

Price transparency is a key element that will drive development, along with technological innovation and changing consumer mindsets – but who makes the first move in upending longstanding practices, producers or legislators?

China's pivotal move in early 2018, which included a ban on imported waste plastics, was followed by a ban on another 16 categories of waste in late 2018, including steel scrap, and a further 16 types in late 2019.

Even though China had already imposed some controls on waste imports from 2013 under its Operation Green Fence policy and its subsequent 2017 National Sword policy, the 2018 move was the proverbial straw that broke the camel's back.

The world's recycling trade literally broke, forcing waste-exporting countries to revisit their policies on disposal, processing and dumping, and intensifying scrutiny of the international trade in recycled materials.

Fast forward to 2021, and recycled plastics and steel have made significant strides forward, finding new trade flows and weaving through new rules and regulations. There has also been an increase in infrastructure and trading investments and greater importance placed on the development of these markets.

As pressure from climate action initiatives has intensified, more emphasis has been placed on achieving a circular economy, in which recycling materials plays a larger role in reducing carbon emissions in production cycles.

Rethinking processes

Since China clawed its way back from a steel export flood in 2015, Asia has seen an increase in new production capacity. More electric-arc, induction and blast furnaces have come online, with the industry now facing overcapacity.

Some of Asia's steel development stems from Chinese backed infrastructure projects under the Belt and Road initiative, which aided in the expansion of steel production by Chinese companies overseas in recent years, particularly in Southeast Asia.

Growth in production capacity and output inevitably leads to higher usage of raw materials, and unfortunately, greater carbon emissions as well.

The World Steel Association in 2020 estimated that Asia was responsible for 74% of the 1.88 billion mt/year of crude steel produced globally – with China alone contributing 1.06 billion mt – up from 68.5% of global output of 1.62 billion mt in 2015.

This growing dominance has fueled greater scrutiny of Asia's role in the climate crisis.

Each metric ton of crude steel produced in 2020 emitted 1.85 mt of carbon dioxide, representing 7%-9% of the world's anthropogenic CO2 emissions, according to WSA estimates.

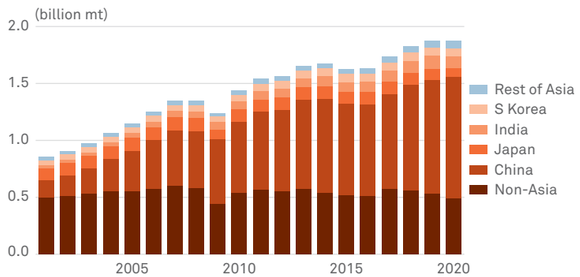
Asian production infrastructure is far younger than that in the West, so perhaps the best, or greener, way forward for its steel industry may be to strive for improvements in current processes rather than make any radical structural changes.

Decarbonization goals, stricter pollutant emission standards, the introduction of carbon trading, improving raw material and energy efficiencies, adopting usage of longer-lasting or high-strength lightweight steel, emphasis on hydrogen-based steelmaking, improving carbon capture use and storage, leveraging higher scrap usage and the greater utility of electric-arc furnaces are just some of the ways the industry is evolving to lower emissions.

Although momentum is growing for greater usage of recycled steel, a sudden swing in its demand could, paradoxically, add more friction.

Due to the lack of supply to meet global crude steel production, any sudden surge in scrap demand would lead to unsustainable prices and increase economic barriers for steel producers seeking to make the change.

Crude steel production



Souce: Worldsteel Association

As Asian economies grow, consumerism and waste generation increase in tandem. This brings greater potential for the development of recycled steel resources, which may ease, but not solve, pressures on demand.

Legislation vs economics

Steel

Looking ahead to 2050-60, legislation that pushes for decarbonization goals from steel producing giants in Asia will heighten focus on use of steel scrap.

China's recycling industry is estimated to see growth of 10 million-15 million mt/year in steel scrap generation from its current 2021 estimate of 270 million mt, according to the China Association of Metalscrap Utilization.

This would equate to scrap generation of about 350 million-380 million mt by 2030 - the same year China aims to reach peak emissions.

Supportive legislation for decarbonization, similar to the Blue Sky policy in 2018-2021, may further propel China's recycled steel usage to 40%-50% by 2030. This is more than double the scrap utilization rate achieved during the 13th five-year development plan over 2016-2020.

Legislation plays a crucial role in driving up usage of recycled materials. However, in reality, Asia's recycled steel usage is mostly pivoting around the margins, as there are not many carbon laws in place that would drive scrap utilization to the levels seen in the US or Europe.

Most of Asia's steel is produced via the basic oxygen route. The alternative, via the use of scrap in the electric-arc furnace process, would in theory result in a significantly lower carbon footprint.

The WSA notes that every metric ton of scrap used for steel production saves 1.5 mt of carbon dioxide emissions, as well as the usage of 1.4 mt of iron ore, 0.74 mt of coal and 0.12 mt of limestone.

But in Asia, electric-arc furnace producers often find themselves competitively overshadowed by younger blast furnace-based steelmakers, which have considerable production-cost advantages, hence economically capping the growth of electric-arc furnace utilities.

About 83% of steel from major Asian producers uses the basic oxygen furnace process, and only 17% the electric-arc furnace process. In the EU, the ratio tilts toward 58% to 42%, according to the WSA.

With margins being more of a consideration than environmental benefits, the "chicken or egg" paradox for decarbonization may persist – between whether there should first be state support, infrastructurally or financially, to lessen the disadvantages for first movers, or companies should take the lead in overhauling their production lines.

As pressure from climate action initiatives has intensified, more emphasis has been placed on achieving a circular economy

The process of decarbonizing the steel industry may see a bumpy road ahead, as it is a complex global market with low profit margins – despite the recent boom in steel margins arising from disruptions stemming from the coronavirus pandemic. Complexities arise as the steel industry is deemed politically important to governments wanting to project the image of an industrial powerhouse and as a sector that provides jobs.

The development of pro-climate legislation in Asia is an issue to watch, as it has greater potential, if developed in tandem with economic motivations, to help spearhead a more rapid transition to a lower emissions industry and support the growth of Asia's recycled steel markets.

Plastics

Legislation has been and will continue to be crucial in driving up usage of recycled plastics, though it needs to come in line with fundamental market conditions like

variations in supply availability across the Asian region and the current infrastructure base.

Use of recycled plastics has been developing for years in Asia but mainly for lower-value applications such as fibers, rubbish bags, construction materials and other non-food applications.

Price sensitivity is key for these markets, and often price comparison to virgin plastics becomes the dominant factor in recycled material usage.

Legislation can enforce a certain volume of demand for recycled plastics quite quickly, but it also needs to be matched with supply growth – and that is where the challenge lies.

For example, announced legislation in the US and Europe may increase demand for Asian recycled materials as local recycling in Europe and the US cannot satisfy these targets.

Recycled plastics supply has faced severe shortages globally amid the pandemic, adding to legislation-driven demand pushing up recycled plastics prices to multi-year highs, especially in Europe and the US.

Under current global supply shortage and logistics challenges, there are concerns over whether such a supply chain model would be sustainable for businesses in pricing, logistics or even carbon emissions.

With that, more focus is shifting toward local recycling for local production and consumption.

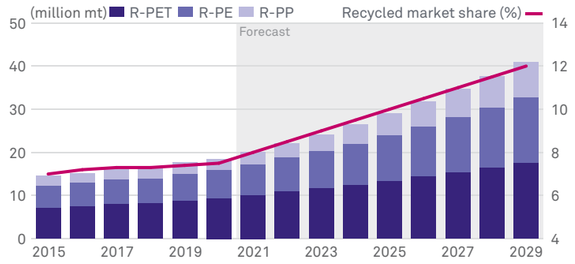
Another example of legislation driving demand would be allowing recycled plastics for food packing applications, but it has a long way to go in Asia, where discussion, if any, is at a preliminary stage.

Food packaging is one of the largest consumption sectors of plastic, so allowing recycled plastic to be used in this sector would drive up demand significantly.

But once again, the supply of such premium-grade recycled material is scarce and, in some countries, regulators may only allow chemically recycled plastics that are near or equal in terms of quality to virgin material. It is typically capital and technology intensive to build chemical recycled plastics plants, which restrains growth in the short-to-medium term.

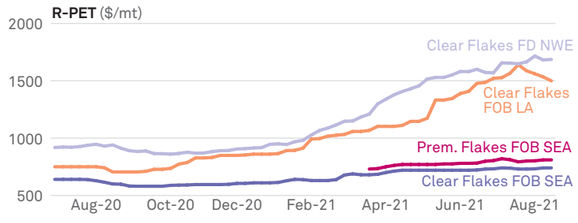
It is also fundamentally almost impossible for recycled plastics to fully replace virgin plastics in the near term because there is simply not enough supply given the current infrastructure, technological and economic challenges and, most importantly, customer behavior.

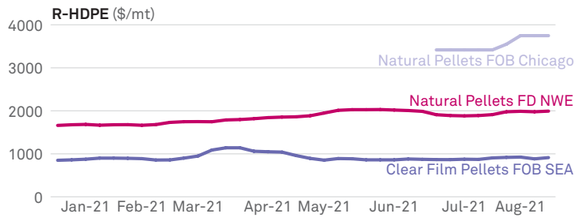
Global recycled plastics set for continued growth



Data source: S&P Global Platts Analytics

Supply tightness drives global recycled plastics prices





Note: S&P Global Platts started assessing R-PET Prem. Clear Flakes FOB SEA on March 24, 2021, and R-HDPE Natural Pellets FOB Chicago on June 23, 2021.
Source: S&P Global Platts

Striving for industrial upgrade

Recycled plastics are embracing optimistic growth and industrial upgrade in the longer term via legislation, increasing public awareness, extended producer responsibility and evolving technologies.

New projects, especially mechanical recycling projects for high-quality and even food-grade recycled plastics, are in the pipeline across Asia, with Southeast Asia gaining particular attention from investors to tackle ocean plastics pollution.

Unlike traditional small- and medium-sized recycling companies, most of the new projects in Southeast Asia are led by international waste management companies, petrochemical companies and major brand owners such as Veolia, Indorama and Coca-Cola.

This signals potential demand growth that may promote a more efficient, standardized and cost-effective recycling value chain in the long term.

However, in the near term, supply remains tight, especially for high-quality plastics waste. In Southeast Asia, recycled PET flakes have risen more than $100/mt since S&P Global Platts first launched an assessment in July 2020.

Efficient waste management systems are crucial to ensure the availability and affordability of plastic waste to achieve sustainable growth. So far, overall recycling rates and plastics waste quality remain low in many developing and even some developed countries, limiting the supply and development of recycled plastics.

However, the development of chemical recycling may have an important role to play in Asia's overall mixed-plastic waste system and in the production of high-grade recycled plastics.

Japan has taken the lead in driving chemical recycling technology as one of the deliverable solutions to meet its 2030 goal of reducing disposable plastic waste by 25% and achieving carbon neutrality by 2050.

Exciting as these technologies are, they should not be taken as the definitive solution without resolving the underlying root-issue of sustainability – over-consumption and the misuse of natural resources.

Efficient waste management systems are crucial to ensure the availability and affordability of plastic waste to achieve sustainable growth

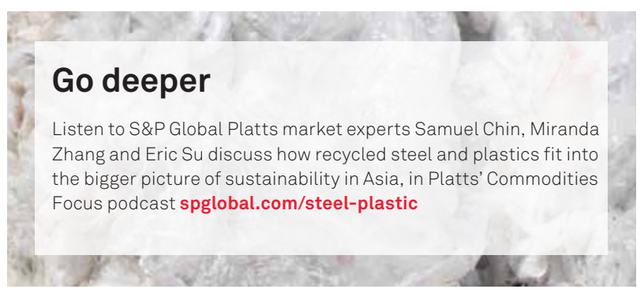
With growing interest in using recycled materials in consumer products as a path toward decarbonization, demand for sustainable products is expected to rise.

Legislation will aid demand growth for recycled products but will need to be matched with an increase in supply and infrastructure.

Price transparency is another key aspect for the growth of recycled markets – to help producers, consumers, regulators and investors better understand the market and take necessary actions to drive development.

For producers, the adoption of new technologies to improve processes and lower carbon emissions will also be an important step toward decarbonization.

Finally, for end-product sectors, changing consumers' mindset will be critical to raise awareness of sustainability, reduce over-consumption and shift the use of consumer products made from recycled materials from hype to normal practice. ■



Go deeper

Listen to S&P Global Platts market experts Samuel Chin, Miranda Zhang and Eric Su discuss how recycled steel and plastics fit into the bigger picture of sustainability in Asia, in Platts' Commodities Focus podcast **spglobal.com/steel-plastic**

Feeling the heat: 5 key features of iron ore markets in 2021

After a rollercoaster year in the iron ore sector, Niki Wang takes stock of some of the biggest themes that emerged in 2021, from price volatility to an increased focus on specifications

High volatility

Iron ore prices have been on an uptrend since late 2018. Improving steel mill margins since China's steel sector supply-side reform – the attempts to eliminate excess steel capacity – have boosted iron ore demand and prices.

Temporary imbalances of supply and demand over the last three years have resulted in a highly volatile market. The benchmark Platts 62% Fe IODEX hit an all-time high at $233.1/dmt on May 12, 2021, before plunging back to $130.2/dmt in August.

Over the first eight months of 2021, the annualized volatility of the iron ore benchmark has been close to 48%, higher than that of most other metals. However, volatility has been a regular feature of the iron ore market and is merely returning after an extended period of stability in 2015-2018, at the bottom of the cycle.

IODEX: volatility and record-high prices in 2021

Source: S&P Global Platts

Supply struggles to catch up

Firm iron ore demand from China has been a key contributing factor in rising global iron ore prices since 2018. China's crude steel production has risen steadily to 1.065 billion mt in 2020, from 928 million mt in 2018, despite the disruption caused by COVID-19.

The strength has extended to 2021, with a record 563 million mt of crude steel produced in the first half, supported by healthy downstream demand, including from machinery, manufacturing and construction.

India, while certainly on a smaller scale, has also seen strong growth in the steel sector, resulting in the country's annual crude steel production hitting the 100 million mt mark in 2019. Since then, growth has been impacted by COVID-19.

However, iron ore supply is lagging the rising demand. Brazil, in particular, has struggled to meet its stated targets, thwarted by mining accidents, extreme weather and unexpected maintenance, as well as the pandemic.

According to Platts cFlow iron ore shipment data, export volume from Brazilian miner Vale was down by 18.9% in 2019 and 2.4% in 2020, in year-on-year comparisons. And the top four Australian miners combined were unable to fully compensate for the lower volume from Brazil, their own exports rising by 0.5% in 2019 and 3.2% in 2020.

Still, Vale remains the main source of expected growth in the coming years, as the miner aims to reach a production capacity of 400 million mt of iron ore by the end of 2022. With demand having risen so dramatically, many observers expect the market to remain tighter than in the past, at least until sizeable new production starts coming of out West Africa.

Traders have been forced to take a more brand-differentiated approach to their strategies than in the past

China policy

Steel mills in China now change their preference for different grades of iron ore faster than ever, on the impulse of policy changes and fluctuations in profitability. Over recent years, mills have been expected to respond quickly to a range of policies, from localized output and logistics controls, clear skies rules, and nationwide capacity reductions, to unscheduled inspections for ecological and environmental protection reasons, as well as strategic long-term macroeconomic or environmental targets.

More recently, the situation has primarily been one where output has been curbed but profit margins have been high, resulting in preferences for high-grade and low-contaminant iron ore aimed at maximizing pig iron production.

Platts 65% Fe and 62% Fe indexes increased in value by 46% and 42% respectively from the start of 2021 up to May, before they started to retreat, while the 58% Fe index was up by 29% during the same period.

The preference for premium cargoes has led to much better spot market liquidity for high- and medium-grade iron ores than for the lower grades.

Specs and performance

The pandemic has impacted regional steel markets in different ways. Variations in the pace of recovery between countries and regions have resulted in a staggered rebound in iron ore demand. Sellers have been required to ship cargoes first to the regions fastest to recover to meet blast furnace appetite, while other regions were still suffering lockdowns and plant closures.

This has meant that beyond just China, traders have had to keep a sharper eye on global trends. With variation in global burden mix preferences and demand for specific types of ore, traders have been forced to take a more brand-differentiated approach to their strategies than in the past. This in turn has led to a need for in-depth understanding of global brand specifications and of the respective technical performance of each iron ore product.

Decarbonization

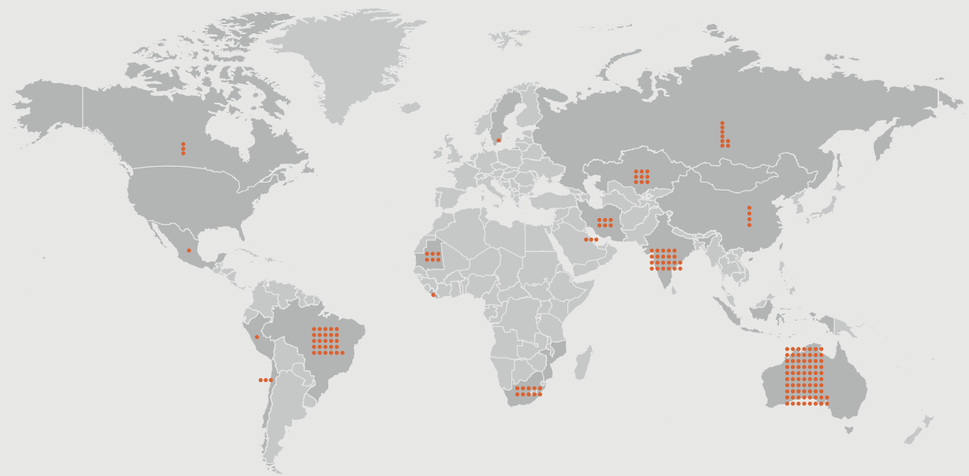
Every actor in the supply chain is increasingly turning their attention to the challenge of decarbonization, from mining to shipping to steelmaking. Under the impulse of their ESG-conscious investors, miners are painstakingly reviewing their operations, including truck fleets and power sources.

The scale and difficulty of the challenges for mills are greater, though, and will require either critical technological breakthroughs or abundant availability of cleaner hydrogen. Steel emissions are a global problem requiring both global and local solutions. Increased scrap use, use of higher-grade raw materials in production and technology upgrade are some of the likely steps on this arduous path.

In September 2020, China announced its goal of becoming carbon-neutral by 2060, indicating that the largest steel producer in the world is prepared to embark on this transformative journey. It will be interesting to see how much of a leadership role the Chinese steel industry will play in this global effort. ■

Go deeper

For a granular view of the vast range of iron ore and met coal products traded in the global market, visit S&P Global Platts Iron Ore and Metallurgical Coal Specifications Tree **spglobal.com/Specifications-Tree**



2021 S&P Global Platts Global Metals Awards

Thriving in the face of adversity

By Anthony Poole

The S&P Global Platts Global Metals Awards celebrates its ninth anniversary in unusual circumstances once again, as the global pandemic moves through its second year.

Last year, circumstances resulted in Platts launching its first ever Virtual Global Metals Awards, as people, businesses, governments and industries around the world adjusted to the new normality brought on by the need to contain the spread of COVID-19. But virtual did not in any way diminish the significance of the awards.

COVID-19 has brought some extraordinary challenges to the metals and mining industry. At first, global lockdowns caused an overnight collapse in demand for commodities, followed a few months later by a global e-commerce boom – from fashion items to laptop computers – as a majority of the workforce and students worked remotely and studied at home. As the demand for manufactured goods soared, demand for metals and raw materials recovered dramatically and that recovery has continued into 2021.

Steel prices have been at record highs, as have some raw materials; US Midwest aluminum premiums have also continued to ascend into record territory. Producers and traders of metals commodities, shipping overseas, have faced soaring freight costs and sky-high container freight rates, as well as a chronic, global shortage of containers. Global supply chains have become stretched to breaking point, leaving the prices of some commodities extremely vulnerable to even minor disruptions that, in normal times, would be absorbed by the market with little impact.

Despite this, life has gone on and businesses in the metals and mining space have thrived and made progress by leaps and bounds with their environmental, social and governance credentials, while maintaining financial strength.

Judging Panel

2021 S&P Global Platts Global Metals Awards

Alberto Hassan
Former President and CEO, Orinoco Iron

Michael Setterdahl
Member of the GFG Alliance Global Advisory Board and former CEO of Liberty Steel Holding USA

David E. King
Former CEO and Director, LME

Rana Som
Former Chairman, NMDC and Hindustan Copper

Jim Lennon
Former Chairman of Commodities, Macquarie

Dr. Joanne Warner
Independent Director, First Quantum Minerals & Geo40 Limited and ASX listed Deterra Royalties.

METALS COMPANY OF THE YEAR

CLEVELAND-CLIFFS
United States of America

This is the one award for which there are no nominations. Instead, the judges select the Metals Company of the Year from the entire list of Global Metals Awards finalists. The award is given to one company that stands out for excelling in industry leadership and real innovation.

This year's winner is Cleveland-Cliffs, which has become the largest producer of flat-rolled steel in North America. In 2020, Cliffs acquired AK Steel and ArcelorMittal USA, enabling the company to vertically integrate its traditional iron ore mining and supply business with quality-focused steel production, with a large market share in the automotive market. Cliffs employs 25,000 people across its mining, steel and downstream manufacturing operations in the US and Canada.

Major transformations, such as the one led by Cleveland-Cliffs, are rare in the metals and mining space. The AK Steel and ArcelorMittal USA acquisitions transformed a relatively small mining company, with 2,000 employees and $2 billion in annual turnover, into an industrial powerhouse with $17 billion in pro-forma revenue. And it was accomplished during the pandemic in one of the most difficult years the metals and mining space has seen in decades.

Also in 2020, Cleveland-Cliffs completed the construction of its new direct reduction plant – a $1 billion project begun in 2017. The plant produces hot briquetted iron, an environmentally sustainable alternative to ferrous scrap and imported pig iron. The judges were impressed with the deal-making abilities of Cleveland-Cliffs and its CEO Lourenco Goncalves, as well as its project-management skills, with two major acquisitions and the completion of a new project achieved while implementing measures to keep its workforce safe during the pandemic.

CHIEF EXECUTIVE OF THE YEAR

Lourenco Goncalves
Cleveland-Cliffs
United States of America

Under the leadership of Lourenco Goncalves, Cleveland-Cliffs has grown from a relatively small mining company to become the largest flat-rolled steel producer in North America, through last year's acquisitions of AK Steel and ArcelorMittal USA.

Pulling off two large acquisitions like that during a global pandemic was as audacious as it was unexpected. The volatility alone of steel demand and pricing during 2020 might have been enough to put off any would-be investor, but Cleveland-Cliffs hung in.

During the year, Goncalves made a deal with employees above a certain pay level to take a pay cut during the pandemic, with a promise of repaying them by the end of the year, which he kept.

The production for Cleveland Cliff's new $1-billion hot briquetted iron plant in Toledo, Ohio, is going into its newly acquired blast-furnace operations, transforming them into some of the lowest pollutant-emitting blast furnaces in the world and providing those assets with an environmentally sustainable alternative to iron ore and ferrous scrap.

These acquisitions enabled Goncalves to realize a vision he had had since coming to Cleveland-Cliffs in 2014, which was to integrate vertically some of the country's biggest blast furnace operations and regain the competitive advantage with electric-arc furnaces.

Goncalves spent his first five years at Cleveland-Cliffs in strengthening the company's balance sheet and eliminating mineral assets with little, or no realistic possibility of achieving viable commercial production.

The judges had enormous respect for the deal-making talents of Goncalves and for steering a relatively small mining company into becoming a world industrial powerhouse.

LIFETIME ACHIEVEMENT AWARD

David DeYoung
Alcoa
United States of America

One of David DeYoung's greatest achievements in a long and distinguished career at Alcoa was spearheading the breakthrough of Alcoa's inert anode technology, marking the pinnacle in his 39-year career with the company when he retired in 2020. Inert anode technology can replace the use of carbon anodes in the smelting process and eliminate CO2 emissions into the atmosphere, replacing them instead with oxygen emissions. It could prove to be the most disruptive technology in the aluminum industry in its 130-year history.

In May 2018, Elysis, a new joint venture company with Rio Tinto, was formed to scale up Alcoa's technological discoveries to an industrial scale and make it a commercial reality, with the aim of selling licenses by 2024. Since 2009, the inert anode technology has been producing primary aluminum on a research and development scale in the Alcoa Technology Center near Pittsburgh, without releasing CO2.

DeYoung was involved in the research of this technology from his first day at Alcoa in 1981, and later went on to head up the whole of the research. Other notable achievements by DeYoung include increasing the safety and efficiency of aluminum production and eliminating beryllium and chlorine from the aluminum casting process; improving the sustainability of hard alloys; and developing a metal purification process for a carbothermic alloy.

DeYoung has been selfless with his time and knowledge, inspiring and encouraging the industry's innovators to discover the next breakthrough. Most recently, DeYoung received a TMS Fellow Award for the class of 2021, which recognizes members of The Minerals, Metals and Materials Society (TMS) for outstanding contributions to the practice of metallurgy, materials science and technology, and is the pinnacle TMS honor. DeYoung has been a TMS member since 1981.

CORPORATE SOCIAL RESPONSIBILITY AWARD

PJSC Magnitogorsk Iron & Steel Works
Russia

PJSC Magnitogorsk Iron & Steel Works, also known as MMK, is one of Russia's largest steel producers and produced 11.6 million mt of steel in 2020 and sold 10.8 million mt of steel products. Its group revenue for 2020 was $6.4 billion and EBITDA was $1.5 billion. The company is also a pillar of the economy of the city of Magnitogorsk, employing around 18,000 people.

Historically the company has given around Rb2.5 billion ($34.3 million) annually to charity and social projects. In 2020, that amount increased to Rb2.9 billion, up 15% compared with 2019, to help Magnitogorsk fight the coronavirus. The funds were used to buy medical equipment, pay bonuses to doctors and purchase computers and tablets to provide distance learning for school children during the pandemic. Social investments amounted to 0.6% of MMK's revenue for 2020 and 6.35% of its net income.

MMK was one of the organizers of the "We Stand Together" program, which worked to ensure that the most vulnerable in Magnitogorsk's population – pensioners, people with disabilities, low-income families and low-income individuals – received food packages and personal protection kits. The "We Are Together" program delivered more than 300,000 packages to the most needy and 55,000 sets of PPE.

Every year, the company invests heavily in charitable and social projects, supporting employees' health, funding housing and youth programs, as well as maternity support programs, organizing cultural leisure activities, and more. In addition, MMK invests in environmental protection, reducing its carbon footprint and reducing its impact on the environment.

Last year's increase in social spending was made to help MMK's own workforce and other citizens of the Magnitogorsk, even though, at the time the spending decision was made, MMK did not know what the economic impact of the pandemic would be on it.

DEAL OF THE YEAR

Cleveland-Cliffs
United States of America

The backdrop of global economic uncertainty in 2020 and the initial collapse in demand for industrial goods makes two audacious acquisitions made by Cleveland-Cliffs all the more remarkable.

On March 23, 2020, Cleveland-Cliffs completed the $3.3 billion acquisition of AK Steel, transforming it, overnight from a relatively unknown mining company, into one of the largest operators of blast-furnace steelmaking in North America. Then on Dec. 9, Cleveland-Cliffs completed the $3 billion acquisition of ArcelorMittal USA turning the combined group into the largest flat-rolled steelmaker in North America.

Cleveland-Cliffs has now positioned itself as a major force in North American steelmaking, having targeted high-quality assets with a strong focus and presence in the automotive sheet market. Its total portfolio includes, among other products, custom-made iron ore pellets and hot-briquetted iron; flat-rolled carbon steel; stainless steel; electrical steel; steel plate; tinplate; long products; carbon and stainless tubing. Within the space of a year, Cleveland-Cliffs also went from approximately $2 billion annual revenue to annual pro-forma revenue of $17 billion and has set guidance to achieve EBITDA of $4 billion by the end of 2021, which would be more than twice its previous record.

A large part of the success of the integration of the acquired assets was the realization of a long-held ambition of Cleveland-Cliffs CEO Lourenco Goncalves of integrating the iron ore production and hot-briquetted iron assets of Cleveland-Cliffs with the downstream assets of AK Steel and ArcelorMittal USA. With the electric-arc furnace steel production having become established as the dominant technology in US steelmaking, availability of ferrous scrap has become tighter and the cost has risen. By combining the iron ore assets with the blast furnace assets, the company has the opportunity to compete on a cost basis with the EAF producers, with a fixed-cost structure versus the variable cost structure of EAF production, which is scrap-reliant.

PHYSICAL METALS SERVICE PROVIDER OF THE YEAR

Reliance Steel & Aluminum
United States of America

Founded in 1939 and headquartered in Los Angeles, California, Reliance Steel & Aluminum Co. has evolved into the largest metals service center company in North America. The company provides value-added metals processing services and distributes a full line of 100,000 products, including alloy, aluminum, brass, copper, carbon steel, stainless steel, titanium and specialty steel products to more than 125,000 customers in a broad range of industries.

Reliance has more than 75 distinct and independently operating brands. Its subsidiaries and divisions form a global network of approximately 300 locations in 40 US states and 13 countries outside the US.

Despite the extraordinary challenges 2020 presented on a global scale, Reliance remained operational as an essential business and delivered a solid financial performance, demonstrating the resilience of its long-standing business model. In 2020, Reliance metals service centers wrote and delivered over 4,603,000 orders (averaging 18,190 per day), with an average price of approximately $1,910 per order. About 98% of orders were from repeat customers.

The 98% repeat customer achievement is a strong testament to the quality of Reliance's customer care. The company prides itself on quick delivery, metals processing and inventory management services. While the company serves many large OEMs, the majority of its customers are small machine shops and fabricators, requiring smaller quantities than mill-specified minimums, and intermittent deliveries over irregular periods.

FINANCIAL METALS SERVICE PROVIDER OF THE YEAR

Bank of America
United States of America

Bank of America is widely known as one of the world's leading financial institutions, serving individual customers, small- and middle-market businesses and large corporations with a full range of banking, investing, asset management and other financial risk management services and products. In the metals and mining space, BoA has been a key financial partner for many participants for over 40 years, giving the bank the full experience of the range of several economic cycles, including through the COVID-19 pandemic. The bank provides over $17 billion to companies in the sector, ranging from middle market to large corporations.

Bank of America was the lead arranger for Cleveland-Cliffs acquisition of both AK Steel and ArcelorMittal USA last year, in combined deals worth $6.3 billion. The bank was also the joint lead arranger for US Steel's acquisition of Big River, helping the former to execute its "best of both" strategy. It was also the lead underwriter for green bonds to support the Phase 2 expansion of Big River Steel, completed in 2020.

The bank has been leading global research in the sector, and its key analyst Timna Tanners is well known in the business and has been repeatedly recognized as the top analyst in the metals and mining sector by Institutional Investor.

Bank of America has a goal deploying $1 trillion by 2030 in its Environmental Business Initiative aimed at accelerating the transition to a low-carbon, sustainable economy. The bank is among the top issuers of Green, Social and Sustainability bonds, with close to $10 billion issued so far.

INDUSTRY LEARDERSHIP AWARD MINING & RAW MATERIALS

Alcoa
United States of America

Alcoa is widely known outside of the metals business as a major producer of primary aluminum, but it is also one of the largest producers of bauxite in the world.

While many companies have concentrated on reducing their carbon footprint in the production of aluminum, Alcoa takes that approach all the way upstream to alumina refining and bauxite mining as well as to the downstream smelting and casthouse operations.

In September 2020, Alcoa introduced its low-carbon, smelter-grade alumina brand, EcoSource. This is alumina produced with a maximum of 0.6 mt of carbon dioxide equivalent per metric ton of alumina produced, which is two times better than the industry average of 1.2 mt.

Alcoa also markets and sells Ecolum, a brand of low-carbon aluminum products that guarantees no more than 4 mt of carbon dioxide emissions per metric ton of metal produced.

Alcoa is a member of the Aluminum Stewardship Initiative. In February 2020, the ASI certified Alcoa to market products under the Chain of Custody standard.

INDUSTRY LEADERSHIP AWARD ALUMINUM

EN + Group
Russia

EN+ Group is one of the world's largest producers of low-carbon aluminum and the largest independent operator of hydroelectric power assets in the world, with 15.1 GW of installed capacity. EN+ Group is also the largest aluminum producer in the world outside of China.

Addressing climate change has been the main focus of EN+ Group's sustainability efforts for more than a decade as it continues on what it calls its "Net Zero" journey. Its core operational hub is in Siberia where its largest smelters and hydro plants are located. Its use of renewable energy has enabled the company to reduce emissions and costs significantly. It is in the first decile in the global cost curve of production. It has limited carbon emissions to less than a quarter of the global industry average and has become the first aluminum company to successfully introduce an inert anode cell into the pilot stage of the production process.

Since 2017, RUSAL has offered customers its proprietary brand of low-carbon aluminum, made with renewable power, known as ALLOW. ALLOW comes with an average carbon footprint of 2.4 mt of carbon dioxide per mt of aluminum produced (Scope 1 and Scope 2 at smelter), below the threshold for the market's requirement of 4 mt C02/mt Al and several times below the industry standard of 12.5 mt C02/mt Al (Scope 1 and 2 at smelter).

EN+ is also the only vertically integrated company to be able to meet all of its alumina and hydropower requirements and has 80% self-sufficiency in bauxite and nephelines, representing two-thirds of its costs.

The pandemic in 2020 brought about many operational challenges, including a drop in demand for aluminum and a sharp drop in prices. Nevertheless EN+ Group maintained a strong financial margin, including sustaining an EBITDA margin of 18%.

INDUSTRY LEADERSHIP AWARD BASE, PRECIOUS AND SPECIALTY METALS

Hindustan Zinc
India

Hindustan Zinc, part of the Vedanta Group, is India's only integrated producer of zinc, silver and lead, and is the world's second-largest producer of zinc, with silver and lead as byproducts. The company was ranked first in Asia-Pacific and seventh globally in the Dow Jones Sustainability Index 2020 in the metal and mining sector. It is also a certified water positive company, and a member of the FTSE4Good Index.

HZL is one of the world's lowest-cost producers of zinc, silver and lead, with metal production capacity of 1.1 million mt/year. Its reserves of 443.4 million mt mean that HZL's exploration program is integral to its growth and future expansion.

The company is financially strong, with impressive ESG credentials, and is a great believer in using technology to streamline the development of new mines. In digitalizing the Rampura Agucha and Sindesar Khurd mines, HZL developed a 35-km network of high-bandwidth WiFi, enabling the company to track real-time data from all of its equipment. Real-time tracking of equipment reduced the underground ramp-up duration by 50%. The use of predictive maintenance models for critical components of loaders and trucks has resulted in a 2% improvement in fleet reliability.

Since being privatized in 2008, the company has accomplished significant growth, bringing it from a modest-sized mining group into one of the world's biggest. In the past, mines were not fully utilized and now they are, achieving optimal levels of production.

INDUSTRY LEADERSHIP AWARD SCRAP & RECYCLING

Schnitzer Steel Industries
United States of America

Since its foundation in 1906 in Portland, Oregon, Schnitzer Steel Industries has evolved into one of the largest manufacturers and explorers of recycled metal products in North America. The company has close to 100 metals recycling and auto parts facilities located in 23 states, Puerto Rico and Western Canada.

Despite the challenges posed by the global pandemic, Schnitzer came through it in good shape and in financial strength. Its safety record in 2020 was the best in the company's history, a testament to the workforce's unwavering focus on safety even in the face of disruptions.

The company has made significant strides in its multi-year sustainability goals and exceeded its 90% carbon-free electricity goal ahead of schedule and is now on track to achieve 100% net carbon-free electricity usage by the end of fiscal 2022.

Schnitzer was recently recognized in the 2021 World's Most Ethical Companies by Ethisphere, is a 2021 Sustainability Yearbook member and was named an Industry Mover by S&P Global and one of "America's Most Responsible Companies" by Newsweek.

The company has also recently seen one of its strongest financial quarters since 2008.

INDUSTRY LEADERSHIP AWARD STEEL

SSAB
Sweden

In 2019, SSAB announced a target of being one of the first steel companies in the world to offer fossil-free steel by 2026. The company believes that, in taking the lead and showing the way to decarbonize the steel industry, other steelmakers will follow suit.

SSAB believes the growing population and increasing urbanization will create a lot of new demand for steel by 2050. But recycled scrap will not be enough to meet the growing demand for steel and SSAB believes the world needs sustainable solutions for making steel from iron ore.

In 2020, SSAB began a pilot project to produce fossil-free sponge iron in Luleå, Sweden. It is also building a hydrogen storage facility in Luleå and has begun building a production facility for demonstration industrial production of sponge in Gällivare, Sweden.

Using its Hydrogen Breakthrough Ironmaking Technology (HYBRIT) SSAB's aim is to revolutionize steelmaking by replacing coking coal with hydrogen, resulting in the world's first fossil-free steelmaking technology, with virtually no carbon footprint. In 2016 SSAB, iron ore producer LKAB and electricity generator Vattenfall joined forces to create Hybrit.

SSAB aims to cut its carbon-dioxide emissions in Sweden by 25% by as early as 2025, through conversion of the blast furnace in Oxelösund, Sweden, to an electric-arc furnace, which will use HBI from the HYBRIT demonstration plant together with recycled scrap.

Between 2030 and 2040, SSAB plans to convert the company's other blast furnaces in Sweden and Finland and eliminate most of the remaining carbon dioxide emissions and reach the target of being completely fossil-free by 2045.

RISING STAR COMPANY AWARD

POSCO Chemical
South Korea

In the last five years, POSCO Chemical has built a large, successful business in the lithium-ion battery market and forms a crucial part of POSCO Group's value chain integration for green mobility solutions.

POSCO Chemical has strong ESG credentials, integrating it into its management policies. To that end it publishes a sustainability report every year. Its ESG rating has improved from B+ (fiscal year 2018) and B+ (FY2019) to A (FY 2020).

The company has a significant presence in the secondary battery materials business, which it has identified as a new area of growth.

POSCO Group has a fully integrated supply system for secondary battery materials, comprising lithium, nickel, and graphite, as well as cathode and anode materials.

POSCO Chemical has recently completed a prototype test of nickel, cobalt, manganese and aluminum (NCMA), manufactured by adding aluminum to existing nickel-rich NCM cathode materials.

In 2020, all companies struggled with COVID-19, but POSCO Chemical recorded its highest sales and made a successful paid-in capital increase.

In 2020, the secondary battery materials business accounted for 44% of total sales, amounting to $476 million. In 2021, it estimated sales reaching $745 million for secondary battery materials to meet rising demand through continuous expansion of production facilities.

POSCO Chemical has a 2030 target of achieving a 20% global market share in the secondary battery materials business with annual turnover of $21 billion.

RISING STAR INDIVIDUAL AWARD

Emilie Schouten
Coeur Mining
United States of America

As senior vice president of human resources at Coeur Mining, Emilie Schouten stands out among her peers in the industry as a champion of creating diverse and inclusive culture, which is rare in the mining industry. Schouten leads a team of human resource professionals across the US, Mexico and Canada.

She has spearheaded efforts to recruit and advance the careers of women at Coeur; her innovative recruiting tactics have increased the proportion of women in Coeur's workforce by 20% over the last three years, including a majority female internship class for the summers of 2020 and 2021. Schouten also serves as a mentor and webinar presenter for the national organization Women in Mining.

Schouten has over 18 years of HR experience and has served as Coeur's senior vice president of Human Resources since May 2018 and the leader of Coeur's Human Resources organization since 2015.

She led Coeur in conducting its first culture survey in 2019, in which employees underscored that Coeur is a safe, ethical and proud company. A resounding 90% of employees surveyed said that they are proud to work for Coeur.

Schouten designed and implemented the Coeur Heroes program, which has provided almost 90 current and former US military personnel career opportunities at Coeur since its inception in 2018.

In her 18-year career, Schouten has brought a new culture to a very straight, traditional mining company.

ESG BREAKTHROUGH AWARD

Aço Verde do Brasil
Brazil

Aço Verde do Brasil is part of the Ferroeste Group and is a competitive pig iron and steel producer with the philosophy of sustainability at its core. Many think of pig iron production as a dirty, polluting industry, but when its production involves the burning of charcoal from managed, sustainable and renewed forestry, it is a much more environmentally sound process than putting coke and iron ore into a blast furnace.

Aço Verde has become one of the first companies to produce steel without using fossil fuels. It avoids the emission of millions of tons of carbon dioxide into the environment by using sustainable charcoal derived from eucalyptus and process gases. Eucalyptus has the advantage of growing seven times faster in Brazil than anywhere else.

The company is also producing its "green steel" using 100% renewable energy. The group has invested heavily in forestry and the modernization of its Long Steel Plant - Aço Verde do Brasil, in Açailândia, in the state of Maranhão.

AVB is a fully integrated steel mill, operating since 1990, employing 2,300 people directly. It has favorable logistics for raw materials, railroads, highways, ports and electricity. The company started production of billet in December 2015 and rolled products in July 2018, with an installed capacity of 600,000 mt/year.

NEW TECHNOLOGY FOR THE METALS & MINING INDUSTRY AWARD

Boston Metal
United States of America

Boston Metal has embarked on a mission of delivering a future of emissions-free steel production. Its core technology uses molten oxide electrolysis to reduce iron ore into pure molten iron. No carbon is used in the reduction process and no carbon dioxide is emitted. The by product is oxygen.

Compared with an integrated steel mill, the MOE process replaces the sinter/pellet plant, coke oven and coke/coal storage, blast furnace and basic oxygen furnace.

The company was founded in 2012 to commercialize the technology developed at the Massachusetts Institute of Technology. It has raised more than $100 million from a world-class syndicate of investors, including Vale, BHP, Breakthrough Energy Ventures, BMW, Fidelity and many more.

The technology is not just confined to iron. In 2020, Boston Metals announced it was applying its technology to the production of ferroniobium with CBBM in Brazil, which has an 80% share of the niobium market.

In early 2021, Boson Metal commissioned an industrial-scale pilot cell for the production of emissions-free steel at its headquarters outside Boston. The company expects to bring its first pilot plant online in 2024.

Mario Sergio Ramírez Zablah Zimery
Executive President
ARZYZ Metals

ARZYZ Metals: Innovation and Leadership in the Production of Secondary Aluminum

ARZYZ Metals is a Mexican company, founded in 1980, that has become one of the biggest companies in the country in the sector of non-ferrous metals, particularly in the manufacture of aluminum alloys and the trading of non-ferrous metals. At our company, we work to boost the circular economy, and that's why we have the commitment to become more environmentally sustainable, being able to manufacture products that can be made of up to 100% recycled aluminum, depending on our clients' needs.

We offer aluminum alloys in a wide array of presentations, such as: continuous casting ingots, molten metal, slab, billet, flat-rolled products, deoxidizers, among others, of which enable us to serve and add value to the global supply chain of different sectors, for example: automotive, energy, construction, steel, home appliances, and others.

Our main facilities are equipped with state-of-the-art technology for the recycling of aluminum scrap and its transformation into high quality alloys. We have the capacity to recycle annually more than 260,000 metric tons of scrap and to manufacture 240,000 metric tons per year.

We are convinced that continuous improvement must be part of our DNA as a company, so we are ISO 9001 certified and in the process of being certified by the Aluminum Stewardship Initiative (ASI), which will make us more competitive and valuable for our customers.

As our objective is to have greener products, we built our new facility aligned to it. In our newest productive plant Cienega de Flores, located in Nuevo León, México, we implemented sustainable practices along our operations that allow us to decrease the carbon footprint of our products. The innovation that is found in the design of the plant, is one that will follow all our future projects, always aiming to have a closed circular economy.

Our infrastructure is sustainable due to the:

- Machinery that helps in the process of saving energy consumption by using organic material as fuels
- Anti-pollution systems that help us mitigate emissions generated throughout the production line
- Water and waste treatment plant where the rainwater and sanitary services water is reused

In our path towards achieving our vision, we invested in the top-of-the-line continuous casting ingot machines to offer value-added ingots that help our clients maintain the quality necessary for their processes.

Some of the advantages this product provides are the following:

- Better control and homogeneity in the mechanical properties of the alloy
- More stable microstructure and less segregation of elements
- Zero porosity
- Less impurities and dross generation
- 25% less space required for storage

At ARZYZ Metals we strongly believe that the success of an organization depends on the employees' engagement and participation, therefore we strive for our team satisfaction, by innovating our organizational culture and valuing the individuality of each one of us.

Statistics:

Mexican company
Established: 1980
President: Mr. Mario Sergio Ramírez Zablah
Employees: 1,000+
Productive capacity: 240,000 metric tons/year
Scrap recycling capacity: 260,000 metric tons/year
Operations: 2 plants located in Northeastern Mexico

Ricardo Carvalho Nascimento
Chief Executive Officer
Aço Verde do Brasil

Silvia Carvalho Nascimento
Chairwoman
Aço Verde do Brasil

Aço Verde do Brasil is the world's first carbon neutral steel plant

The Brazilian company works exclusively with renewable energies, without any fossil fuels and reuses its co-products

To produce with sustainability. It was with such objective that Aço Verde do Brasil (AVB), a company of the Ferroeste Group started in the 1990s. Initially as a pig iron producer and in 2015, AVB started it´s long steel mill, with the constant search for innovation, quality of products and processes. The result was the achievement of the certification as the world's first carbon neutral steel company in the world with the recognition issued in 2020 by Société Génerale de Surveillance, an international audit company specialized in greenhouse gases inventory validation.

To achieve clean steel production, an AVB has adopted a series of measures that reduce impacts on the environment. Among them, the choice for the integrated steel production route based on reforested charcoal in place of coke (coal). Various technologies were also implemented, such as the reuse of process gases, to eliminate the use of fossil fossils and the reuse of production residues.

The indicator verified in AVB's production, which confirmed that the steel company is carbon neutral, was the ratio of tons of CO_2 emitted divided per ton of crude steel produced. The values for the years 2019 and 2020 were respectively 0.06 and -0.04 t CO_2 / t steel. Worldwide, the values of integrated steel mills range from 1.56 to 3.38 tons of CO_2 per tons of crude steel, according to the World Steel Association. The certification followed the methodologies internationally recognized by the World Steel Association and by Brazilian Program GHG Protocol - maintained by FGV, which holds a database of Brazilian industries GHG Inventory.

"This achievement was the result of a lot of work and planning during the entire engineering phase of the long steel plant, when the importance of the theme of sustainability for our products was seen more than ten years ago," says the CEO of AVB, Ricardo Nascimento.

However, this low CO_2 emission index could be even better if the current GHG inventory methodology considered the additional benefit of CO_2 sequestration by the forest areas in its calculation. In that case, AVB could be considered a carbon negative steel plant to issue and sell carbon credits. This is because the company has a large forest area with commercial plantations and preserved areas. Native forest and planted forests that, through photosynthesis, sequester large amounts of CO_2 from the atmosphere.

AVB also seeks Zero Waste certification

Winning the certification granted by the Société Générale de Surveillance (SGS) is just the first step. AVB continues to invest in the implementation of innovations in the steel plant located in the northeast of Brazil, aiming at a sustainable business also based on the principles of circular economy. In addition to carbon neutrality, the company seeks to be the first zero waste, with 100% of solid waste being reused. To this end, it is developing, among other initiatives, a project that will double charcoal conversion yields in relation to traditional processes, reducing CO_2 emissions. Charcoal smoke, which is currently being discarded, will be converted into electricity, tar and pyroligneous acid which later will be sold.

AVB will also generate renewable energy through a green thermoelectric plant using process gases from its blast furnaces. The operation will start in 2022 and will supply 30% of the electrical energy consumed by the plant.

Other actions include the production of cold briquettes, reusing all wastes from the operation. The use of these briquettes will reduce the consumption of iron ore and charcoal by 10% and will make waste yards no longer necessary. The forecast is that the briquettes plant will also start operating in 2022.

Tadeu Carneiro
Chairman and
Chief Executive Officer

Boston Metal – Decarbonizing primary steel production

Boston Metal is delivering a future where steel production is free of carbon emissions. The company's Molten Oxide Electrolysis (MOE) has emerged as one of the most promising technological solutions to decarbonize primary steelmaking.

Powered by renewable electricity, MOE converts iron ore into liquid metal and oxygen. Importantly, the Boston Metal process converts low- and mid-grade iron ore fines directly into high purity molten iron. This enables the broadest possible supply of feedstock and protects against the relative scarcity and price volatility of premium ore products. The MOE platform eliminates the carbon intensive steps of coke production, iron ore pelletizing, blast furnace reduction, and basic oxygen furnace refinement.

Highly energy efficient, the modular, scalable platform technology produces liquid metal that can be delivered directly to ladle metallurgy, thus eliminating the need for reheating in an electric arc furnace.

Founded in 2012 to commercialize technology developed at MIT, Boston Metal now has over 60 employees and has raised over $100 million from a world-class syndicate of investors. In 2021, the first industrial-scale MOE steel cell produced liquid metal at the company's facility in Massachusetts, and Boston Metal aims to commission the first commercial pilot plant in 2024.

Learn more at www.bostonmetal.com.

C. Lourenco Goncalves
Chairman, President & CEO
Cleveland-Cliffs

Cleveland-Cliffs Inc.

In 2020, Cleveland-Cliffs transformed into the largest flat-rolled steel producer in North America with the acquisitions of two prominent steel companies, while maintaining its status as the leading producer of domestic iron ore. The Company also began production at its new Direct Reduction Plant in Toledo, Ohio in 2020. The plant is considered the most modern, efficient and environmentally responsible plant of its kind in the world. Through this transformation, Cleveland-Cliffs is now vertically integrated from mined raw materials and direct reduced iron to primary steelmaking and downstream finishing, stamping, tooling, and tubing. The Company has the unique advantage of being self-sufficient with its production of raw materials for its steel manufacturing, which includes iron ore pellets, hot briquetted iron (HBI) feedstock and coking coal.

Cleveland-Cliffs is a leading producer of flat-rolled carbon, stainless, electrical, plate, tin and long steel products, and a provider of carbon and stainless steel tubing products, die design and tooling, and hot- and cold-stamped components. The Company serves a diverse range of markets due to its comprehensive offering of flat-rolled steel products and is the largest supplier of steel to the automotive industry in North America. Cleveland-Cliffs holds strong positions in other important U.S. downstream markets such as construction, appliances, infrastructure, machinery and equipment.

For more than a century, Cleveland-Cliffs has an extensive history of being an innovator. From upstream research and development, to downstream applications, the Company has dedicated technical and engineering resources that begin with improving customers' production and manufacturing performance to applications for their end-product use. The Research and Innovation Center (RIC) is known for its capabilities to bring new steel products to the marketplace and to meet customers' most demanding requirements. Within the automotive industry, the Company produces a wide range of steel offerings for automotive applications in body panels and structures, specialty exhaust system steels, and materials for hybrid and electric vehicle drive trains. These products include next-generation advanced high strength carbon and specialty steels to help automotive customers design lighter, more fuel-efficient vehicles that maintain superior strength and safety performance. The Company produces products for the appliance, industrial and construction markets, including a variety of specialty stainless steel products and world-class electrical steels used in motors and transformers for power distribution and generation.

Cleveland-Cliffs' operations have a proud history of corporate responsibility, environmental stewardship and safe operations. The focus is on sustainability improvements across the lifecycle of its manufacturing processes – from raw materials to finished steel products. With Cleveland-Cliffs' expanded footprint, the Company recognizes its increased role in addressing climate change and has set a target to reduce its greenhouse gas emissions by 25 percent by 2030. This goal represents combined Scope 1 (direct) and Scope 2 (indirect) greenhouse gas emission reductions on a mass basis (metric tons per year) compared with 2017 baseline levels. It starts with Cleveland-Cliffs' environmentally friendly iron ore pellets and hot briquetted iron, the raw materials that enable the production of cleaner, more sustainable steel in the United States. HBI also enables reductions in GHG emissions with downstream usage in Cliffs' blast furnaces and EAFs.

Founded in 1847, Cleveland-Cliffs is headquartered in Cleveland, Ohio, and employs approximately 25,000 people across its mining, steel and downstream manufacturing operations in the United States and Canada.

Gregory Barker
(Rt Hon The Lord Barker of Battle)
Executive Chairman,
En+ Group

En+ Group is showing ambitious sector leadership in the biggest environmental issue of our time

En+ Group is the global leader in low-carbon aluminum production and renewables. We combine power plants with a total installed capacity of 19.6 GW (including 15.1 GW of hydropower assets), and 3.9 metric tons of annual aluminum production capacity through a controlling stake in UC RUSAL, the world's largest aluminum producer (ex. China) which is the major consumer of En+ Group's hydroelectricity.

Our climate change targets and the roll out of a detailed roadmap to meet them, are yet more tangible evidence of our commitment to lead the global aluminum industry into the low-carbon economy.

Demand for aluminum metal has accelerated in the last decade due to its acceptance as the material of choice for applications requiring light weighting, corrosion resistance and formability. As climate change and resource scarcity gained global acceptance influencing both geopolitical and socioeconomic trends, the criticality of reducing GHG emissions across the global industrial base was adopted with a renewed sense of urgency. The focus on mobility, the circular economy, and climate change during the post-pandemic recovery, translate directly across to the transport, packaging, renewable energy, and infrastructure sectors, as additional demand growth for the metal.

Looking forward to 2030, the global aluminum market is set to grow by 33 mt, led by the transportation, packaging, and infrastructure sectors, which on a combined basis, will achieve an average CAGR of 3% over this period. In each of these sectors, the intensity of use of aluminum has increased above the long-term consumption growth trend, due to the industrial commitment to reduce carbon footprint across the entire manufacturing supply chain. This creates additional demand and use for low- carbon aluminum as a further opportunity to decarbonize and lower emissions.

En+ Group's business advantage comes from the full integration of world class hydropower assets that reliably and sustainably supply the electricity required for the production of aluminum. That means more control to drive cost-efficiency, to innovate and to reduce emissions.

The Group runs the New Energy programme that is designed to increase the power generation by 2.5 billion kWh per year with the same amount of water passed through the hydro turbines of the HPP and significantly reduce the impact on the environment, in particular, to prevent greenhouse gas emissions from the CHP plant. For primary aluminum production the Group has used more than 95% of electricity produced at carbon free or low -carbon sources of power generation. Most of all from large scale hydropower stations. En+ Group understands that keeping of electricity consumption from renewable sources and especially from hydropower stations for primary aluminum production is important part of low- carbon pathway to achieve net zero emissions by 2050.

It's clear that no one renewable technology will allow to achieve 100% carbon free generation. To provide transparency of aluminum carbon footprint the Group decided to measure a real anthropogenic GHG emissions from HPPs reservoirs in accordance with the principles of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Our goal is to become net zero by 2050 and reduce GHG emissions by at least 35% by 2030. By setting such ambitious climate targets, we hope to build upon our two decades of sustainability leadership in the aluminum sector while setting new environmental standards for our industry that support all of our partners across the entire value chain.

En+ Group - Leading the fight against climate change.

Mohammed Jahangir Alam
Managing Director
GPH Ispat Limited

GPH Ispat Limited

GPH stands for God Fearing, Plain Living and High Thinking, holding this philosophy in mind the company started its journey in 2006. Growth mind set and adoption of latest technology have made the GPH as one of the leading steel manufacturers in Bangladesh. GPH promises a robust future and economic growth with world class steel products. The company listed with DSE and CSE which current market capitalization USD 300 million (approx.). It's an ISO 9001:2008 certified company and process the Integrated Management System (IMS) of ISO 9001: 2015, 14001 & 45001:2018 certification as a continuous effort for sustainable development of the company. GPH is AA rated company which short term rating is ST-2.

GPH Ispat has embarked on a new journey with cutting-edge innovation in the history of steel manufacturing, and has proudly introduced Asia's first Quantum Electric Arc Furnace (QEAF) and Winlink rolling Technology, that ensures annual steelmaking one million ton plus per annum as well as production of rebar and medium section from billet to rolled finished products and our level-2 automation system ensure desired quality & quantity of production. Its ERP- SAP system also guaranteed the level -4 automation for entire organization. GPH can produce long steel product up to 980 MPa i.e. class -4 grade steel in its production facility.

GPH not only pursue financial outcomes but also invest in the sustainability and preservation of natural resources for well-being of our society with green production facility. GPH applies Rain Water harvesting and avoid use of underground water in production process. Water Treatment Plant (WTP) has been designed with Zero Discharge system that ensures 100% recycling of used water. GPH is enriched world latest and efficient De-dusting system which is complied with World Bank standard for emissions and sound control. During the pandemic we supplied huge amount of liquid oxygen for the COVID patient across the country from our ASU plant, which is the largest one in our country.

We make significant investments in R&D to deliver innovation that satisfy our consumer in regards of quality, strength and sustainability and generates growth for the business. We ensure, national and international product standards like: BDS, ASTM, BIS, DIN, GIB etc. in our manufacturing process. We have well-equipped in-house quality testing laboratory to ensure the product quality and jointly collaborate with the BUET /CUET for the quality test and other research activities.

Continuous improvement in our products portfolio, along with success in value creating initiatives for customers, allows us to serve global growth markets. We started regular export of MS billet to global market including China. We are passion to create foreign market for steel and contributing to the first growing economy of Bangladesh.

We take great pride that GPH is one of the most preferred employers in the country. It is the people who bring their different ideas and perspectives every day which make GPH a great place to work. Our employee supports our strategic ambitions of achieving sustainable growth and working more productively by opening up new ways of working, helping to define new product areas and providing new opportunities for our people.

GPH Vision:

To provide the foundation for building the infrastructure of Bangladesh towards High-Income-Country (HIC) with the true GPH philosophy.

GPH Mission:

The trusted brand of Bangladesh leading the steel sector with innovative products leveraging cutting edge technology.

GPH Values: AGILE

1. Appreciate what is given to us by Almighty.

2. Grow through learning best practices home and beyond.

3. Innovation is key to our product and service delivery.

4. Leverage the power of teamwork.

5. Empower people to deliver excellence.

Arun Misra
Chief Executive Officer
Hindustan Zinc

Hindustan Zinc: Innovating for a Sustainable Future

India's only and the world's leading zinc-lead-silver producer, Hindustan Zinc is an industry leader with over five decades of experience and expertise in mining and smelting. The Company is a fully integrated player with strong focus on holistic value delivery across its stakeholder fabric. With its sharp strategic thrust on continuous evolution in an ever-transforming business environment, Hindustan Zinc has a powerful edge that drives its growth and expansion.

Technology and innovation are the key propellers of our unprecedented growth, while people safety and natural resource conservation are the mantras of our holistic value proposition. As a socially and environmentally committed corporate, with focused responsibility towards value creation for all stakeholders, Hindustan Zinc stands out as an organization rooted in business excellence. We are cognizant of our environment, social and governance commitments, as well as our sustainability goals.

While staying on course to deliver responsible, sustainable and value-led growth to our stakeholders, we stood firm on our commitment to our people and the communities around us. We actively pursued our CSR agenda and COVID-19 related initiatives to support them through these challenging times. We embrace a conducive environment for encouraging innovation that leads to a zero-harm environment and exemplifies optimal utilization of natural resources, improved efficiencies and recoveries of by-products.

With stakeholder relationships integral to our business plans, we work closely with customers, communities, people, suppliers/vendors, government and regulators, to drive sustainable value accretion for all. The quality of these relationships helps us stay relevant in the evolving business and industry environment. Our deep-rooted engagement with our stakeholders helps us make a studied assessment of their needs and aspirations and formulate our strategies accordingly. Among the predominant areas of our social and stakeholder relationships are education, sustainable livelihood, women empowerment, health, water and sanitation, sports and culture, environment and safety.

Our Environmental, Safety & Governance (ESG) focus has enabled us to deliver sustained performance and growth across key ESG metrics. We are continuously working towards reducing our Carbon Footprint and lowering the impact of our business on environment through our concerted efforts. These efforts are aimed at improving operational efficiencies, ensuring optimal utilization of natural resources, and increasing the use of renewable energy in our plants and processes. Safety and health of our workforce, and at our workplace, is central to our ESG strategy.

Transitioning to a circular economy is a strong imperative for the mining industry. It requires adoption of strategies designed to lower the rates of extraction and reduce the use of natural resources for improved resource efficiency, besides promoting the efficient management of sustainable materials. We are using technology and innovation to reduce-reuse-recycle waste and restore natural systems, including water and land, as part of our efforts to transition to a circular economy. We are increasingly adopting lowcarbon and less-emission technologies, enhancing our renewable energy capacity, and constantly reducing the GHG emission of our operations. We are also expanding our local sourcing network to bolster local economy and community well-being.

Statistics:

- **India's only and world's 2nd largest** zinc-lead miner
- **World's 6th largest** silver producer
- One of the **lowest-cost producers of zinc globally**
- Among the **Top 15 CSR spenders in India**
- Ranked **1st in Asia-Pacific by the Dow Jones Sustainability Index**
- Part of the coveted **CDP 'A List' for action against Climate Change**
- **A 2.41x Water Positive Company**

Craig Mathiason
CEO
Jemison Metals

Jemison Metals

Jemison Metals is a leading North American supplier of carbon, stainless and aluminum flat-rolled products, as well as select fabricated metals. Specifically, Jemison Metals is focused on developing strategic partnerships throughout the supply chain in an effort to eliminate inefficiency and deliver our strategic partners a transparent and competitive cost-structure, along with a world-class service experience.

Obviously, 2020 presented many challenges – but for the Leadership team at Jemison, these challenges were embraced as an opportunity to test the Strategic Vision of the Company and its' ability to deliver for ALL stakeholders – including Customers, Suppliers, Employees and Owners. The Strategic Vision guiding Jemison Metals is the passion for delivering an Optimal Supply Chain. It is in the pursuit of an Optimal Supply Chain that Jemison Metals continues to create innovative and proprietary technology solutions, develop and deploy our Long-Term Capital Investment Strategy and ultimately deliver on our Human Capital strategy to better identify, develop and realize the full potential of people – from existing employees through to our respective communities.

As we look beyond 2020 – Jemison Metals is eager to continue the pursuit of Optimality and delivering permanent cost-reductions to potential and existing customers. Our ability to produce Industry Leading Performance in key metrics (Return on Invested Capital, Inventory Turns, Operating Expenses) amidst a challenging environment is a testament to the value of our People and Technology.

Through the technology, tools and strategies developed - Jemison Metals is fortunate to have the dedicated team of people united behind a Strategic Vision focused on turning our customer's Supply Chain Cost into a Competitive Advantage. We look forward to continuing the work with all of our valued Supply Chain Partners as we continue to pursue Optimality.

Leon Topalian
President and
Chief Executive Officer
Nucor

Nucor

Nucor entered the steelmaking business in 1969, providing long products to our fledgling steel joist business in South Carolina, Vulcraft. Since that time, the company has undergone dramatic growth, becoming the largest and most diversified steel and steel products manufacturer in North America. The business is organized into three segments: raw materials, steel mills and steel products.

Nucor's raw materials segment provides scrap and direct reduced iron (DRI), both of which feed the company's steel mills, and acquires additional metallic inputs from the marketplace, as needed. Utilizing Electric Arc Furnaces (EAF), Nucor's steel mills produce a wide range of primary steel shapes for sale to outside customers as well as to its downstream steel products companies. Approximately 20% of the steel mill production is converted into a wide range of items by Nucor's steel products group, including steel tubing, electrical conduit, joists and joist girders, steel deck, steel fasteners, fabricated rebar, steel grating, metal buildings, insulated metal panels, racking systems, wire and wire mesh. This integration, from raw material through to final product, allows Nucor to operate more sustainably and provide the supply chain transparency that steel customers are increasingly interested in, enhancing its position as a supplier of choice in the industry. Nucor's EAF-based steelmaking facilities, averaging more than 70% recycled steel, generate the lowest greenhouse gas equivalent emissions per ton in the steel industry.

Today, Nucor operates at more than 300 locations and employs more than 27,000 teammates. The company's 24 scrap-based steel production mills have an annual production capacity of almost 27 million tons. Nucor is also North America's largest recycler, processing approximately 20 million tons of ferrous scrap annually to produce new steel that is 100% recyclable at the end of its useful life. Nucor, through The David J. Joseph Company, brokers ferrous and nonferrous metals, pig iron and HBI/DRI; supplies ferro-alloys; and processes ferrous and nonferrous scrap. Nucor's headquarters are located in Charlotte, North Carolina.

Boris Eykher
Chief Executive Officer
Open Mineral

Open Mineral

Open Mineral is the first and only B2B managed platform that, powered by technology and market intelligence, enables profitable and efficient trade of raw material commodities.

Founded in 2016 by a team of commodity trade industry professionals in Baar, Switzerland – the Open Mineral (OM) platform has now registered more than 900 metal & mining companies from 40 different countries from an industry with a turnover of over $200 Billion. The company already recognized for innovation at the 2018 #DisruptMining awards has since won several prestigious awards including 2019 WEF Technology Pioneer and 2020 Rising Star Company by S&P Global Platts Global Metals for its work and potential to transform the trade of minerals and improve society for years to come.

"The trade of base metal raw materials such as concentrates and secondaries have long remained an opaque and tremendously complex process," said Open Mineral's CEO Boris Eykher. "At Open Mineral, we saw how data and technology could deliver tangible benefits, data-driven conclusions and efficiency to the mining and smelting industry. Just as eBay revolutionized retail purchasing by bringing more choices to buyers and sellers, we aim to do the same for physical commodity producers in a curated, trusted environment of the Open Mineral platform. Our goal is to give more information, traceability and fair market terms to miners and smelters so they can make better decisions and ultimately become more profitable."

The company has developed propriety pricing algorithms to estimate the value of thousands of concentrates at current market terms. To drive broader value creation through the commodity supply chain, OM has developed automated blending/smelter material optimization solutions which enable more efficient, informed, and profitable trade of physical metal raw commodities. In addition, the company is actively collaborating with third-party providers to incorporate ESG metrics across the sell-side (supplier product offers) and buy-side (downstream processing) and developing the architecture to facilitate concentrate swaps in the prevailing costly freight environment. Collectively, these will be important steps in supporting the metal and mining industries ambition of transitioning to a lower carbon world and provide an additional lever/certification for the transparency and footprint of the trade.

OM continues to digitize the tendering process, negotiations, contracts, and calculations, enabling parties to easily and fairly trade.

OM is providing the entire ecosystem with exclusive, transparent, and accessible market intelligence, empowering miners and smelters to make data-based business decisions. The company has managed to register 45% of the sellers and buyers across the industry and saw robust growth in platform traffic during lock-down times, suggesting the industry is beginning to embrace a more digitized future. "We value the type of connectivity that technology has showed us to have during these times," said Boris. "This is why we have such a great passion for technology – because we see the difference it makes every day."

Statistics:

+900 metal & mining companies from 40 countries
15,626 customized offers sent through the platform
2.5 million tons of raw materials offered
2.97 US$ billion value of raw materials offered

Jeong-Woo Choi
Chief Executive Officer
Posco

POSCO

Established in 1968, POSCO is the world's sixth-largest steelmaker, based on annual crude steel production. The company's recently adopted management philosophy, 'Corporate Citizenship: Building a Better Future Together,' stresses social responsibility and community growth, emphasizing ESG management.

Worldwide, POSCO has 28,814 employees operating across 162 plants and offices in 52 countries. In Korea, POSCO has two integrated steelworks that rank as the world's largest and second-largest mills. Gwangyang Steelworks (21.7 million tons per annum production capacity) specializes in automotive steel. In contrast, Pohang Steelworks (18 million tons) has an extensive product portfolio, including hot-rolled and cold-rolled coils, wire rods, electrical steel, and stainless steel. There are two integrated steelworks overseas, one in Indonesia and another in Brazil; each has an output capacity of three million tons.

Flanked by 20 affiliated business entities engaged in trading, infrastructure, materials and chemicals, energy, and ICT, POSCO has a presence in non-steel sectors, too. By harnessing the collective expertise and synergy generated across these businesses, we have delineated three strategic sectors: Steel, Global Infrastructure, and New Growth Business. Global Infrastructure focuses on smart and eco-friendly engineering for future city-building. Most notably, the New Growth Business sector aims to create an integrated value chain for electric vehicles (EVs). Hence, product lines range from core secondary battery materials to high-strength steel products. Moreover, POSCO has committed to becoming carbon neutral by 2050. We will gradually shift to hydrogen-based steelmaking and intensify our engagement in the hydrogen supply chain.

POSCO is poised to move beyond steelmaking as we continue to evolve in the global market.

Eco-friendly Smart Steel Business

As a business group, POSCO prides itself in technologies representing Industry 4.0 that help enhance production efficiency and optimize resource utilization. Our goal is to be recognized as the world's leader in eco-friendly products that will serve diverse industries. For example, e-Autopos products enable green mobility by offering high-strength steel for EV body and chassis, battery pack, energy-efficient steel for traction motors, and bipolar plates for fuel cell EVs. Additionally, POSCO's INNOVILT solutions provide breakthrough eco-friendly products designed to serve the construction industry. Finally, in cooperation with stakeholders across the global steel industry value chain, we plan to develop CCUS technologies and transition into a hydrogen-based steel production scheme.

Eco-friendly materials for EV batteries

The competitiveness of an electric vehicle (EV) relies heavily on the performance of its secondary battery, which accounts for 40% of the total cost of an EV. POSCO Group uniquely positions itself as the only company that operates across the entire EV battery value chain. Assets ranging from salars to lithium, nickel, and graphite mines promise a secure supply of raw materials as well as cost competitiveness. In addition, POSCO Chemical produces both anodes and cathodes for EV batteries in collaboration with key EV battery producers and major automakers.

Towards a Hydrogen Economy

By 2050, POSCO will complete its transition to hydrogen-based steelmaking. We estimate to reach 2 million tons of hydrogen production capacity by 2040 and 5 million tons by 2050. This will position POSCO as a leader in the hydrogen economy as the sole largest producer and consumer of hydrogen in Korea.

Guided by the three pillars of the 'With POSCO' vision, POSCO creates values for its business partners through the 'Business with POSCO' principle. In line with 'Society With POSCO,' POSCO dreams of a better future for the community it serves. Through 'People With POSCO,' we aspire to build a culture that values trust and creativity.

Tamara L. Lundgren
Chairman and Chief Executive Officer
Schnitzer Steel Industries, Inc.

Schnitzer Steel Industries, Inc.

Founded in 1906 and headquartered in Portland, Oregon, Schnitzer Steel Industries, Inc. (NASDAQ: SCHN) is one of the largest manufacturers and exporters of recycled metal products in North America with operating facilities located in 23 states, Puerto Rico and Western Canada. Schnitzer has seven deep water export facilities located on both the East and West Coasts and in Hawaii and Puerto Rico. The Company's integrated operating platform also includes 50 stores which sell serviceable used auto parts from salvaged vehicles and receive approximately 5 million annual retail visits. The Company's steel manufacturing operations produce finished steel products, including rebar, wire rod and other specialty products. In fiscal 2020, the Company sold 4.0 million tons of recycled ferrous metal, 551 million pounds of recycled nonferrous metals, and 505 thousand short tons of finished steel.

At Schnitzer, we operate at the intersection of metals recovery, reuse, recycling, and manufacturing. Galvanized by a commitment to take actions that sustain future generations, our people work responsibly to provide products and services that our customers and communities trust – as we have since 1906. Together, we are recycling today for a sustainable tomorrow.

Statistics:

4.0 million tons of ferrous scrap metal recycled in fiscal 2020
551 million pounds of nonferrous scrap metal recycled
505 thousand tons of finished steel produced from recycled scrap
316 thousand end-of-life vehicles purchased and recycled
4.4 million recycled auto parts sold retail from end-of-life vehicles

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En+ GROUP

Committed to people and the planet

At En+ Group, we are committed to integrating sustainable development principles and values into our daily operations. In January this year, we announced our ambition to become net zero by 2050 and to reduce greenhouse gas emissions by at least 35% by 2030. We are determined that En+ Group will continue to lead our industry, not just with the sector's most ambitious stretch targets for climate action and decarbonisation but with new standards for a host of other crucial environmental and biodiversity metrics too.

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Platts LIVE is here to connect the people who are navigating the biggest global challenge of our generation: the evolution of energy.

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