constructsteel

Monthly update for the construction industry
June 2022

Construction market trends

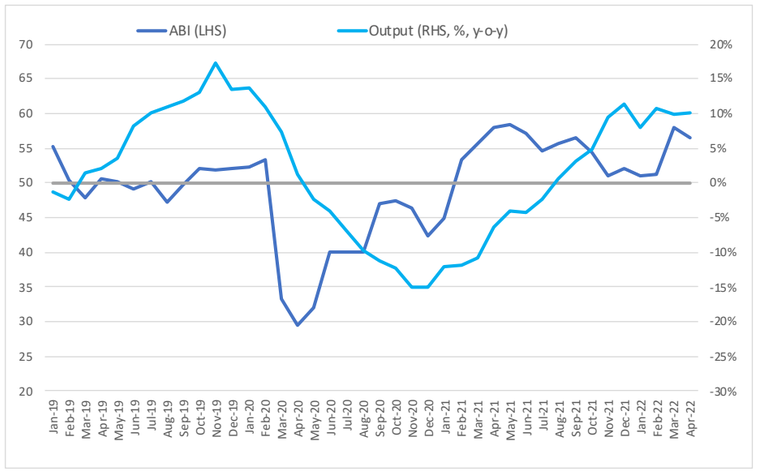
United States

Housing market slowing with rising mortgage rates leading to reduced affordability for first time buyers; Private non-residential output slowing.

Private residential output up 0.9% m-o-m (18.4% y-o-y) in April; building permits down -3.0% m-o-m (3.3% y-o-y). Private non-residential output down -0.2% m-o-m (10% y-o-y). Architecture Billings Index (ABI) fell to 56.5 in April from 58 in March (>50, expansion).

Private non-residential permits vs output

Source: US Census, American Institute of Architects



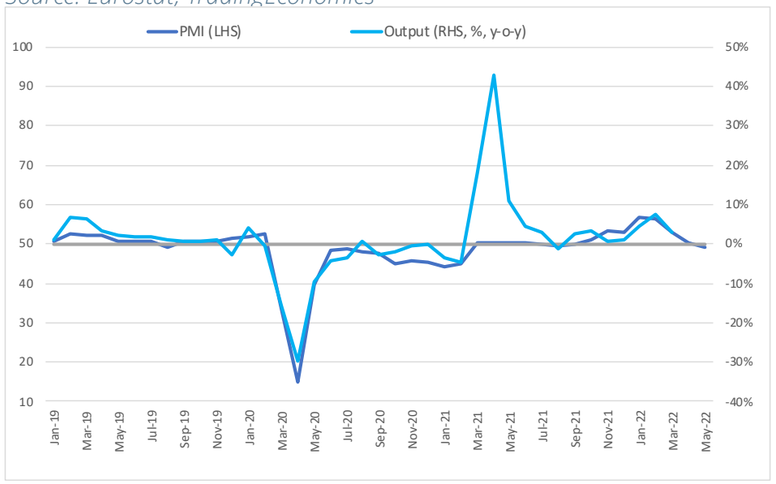
Europe

Construction slowing amid inflation and increased uncertainty; Construction PMI contracts to 49.2 in May (<50=contraction) and for first time since August 2021.

Eurozone construction output in March sees no change over February but increases 2.9% y-o-y; Buildings down -0.1% m-o-m (2.8% y-o-y); Civil works up 1.5% m-o-m (3.0% y-o-y).

Eurozone construction output vs PMI

Source: Eurostat, TradingEconomics



Knowledge partner:
McKinsey & Company

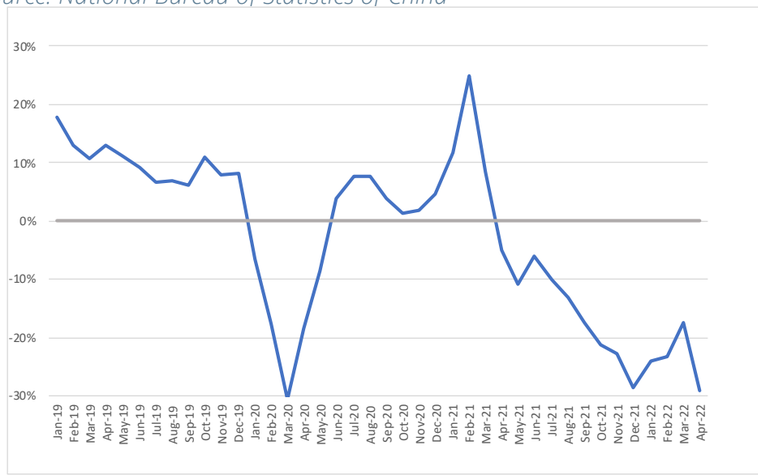
China

Real estate sector negatively impacted due to new COVID-19 restrictions and city lockdowns; People's Bank of China announces a reduction in mortgage loan interest rates for first-time homebuyers.

The 3 month moving average y-o-y growth in floor space was down -28.9% in April; floor space sold down -23.3% y-o-y.

Floor space started (3 month moving average, %, y-o-y)

Source: National Bureau of Statistics of China



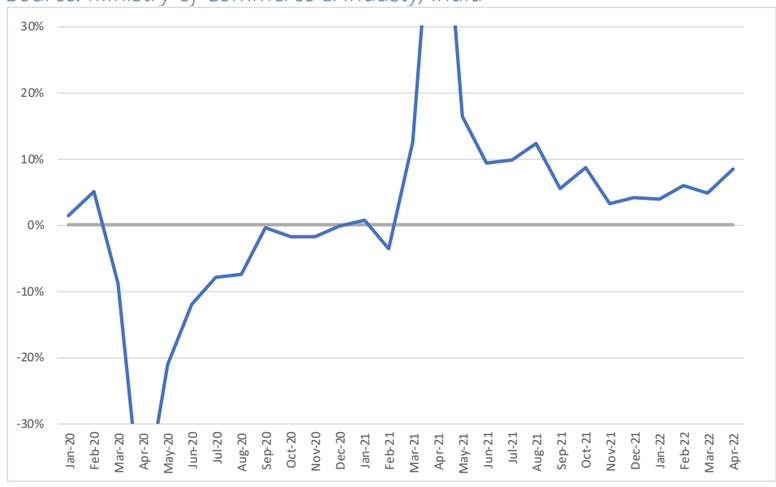
India

The core industries sector growth saw a pickup in economic activity in April driven by oil sector growth.

Weighted average of eight core industries output up to 8.4% y-o-y in April from 4.9 % in March; production of steel down -0.7%; cement up 8.0% y-o-y.

Weighted average of eight core industries industrial production (%, y-o-y)

Source: Ministry of Commerce & Industy, India



Special topic:
Continuing to create sustainable buildings using steel

Dr. Kazuaki Suzuki
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NIPPON STEEL

Japan is one of the most earthquake-prone countries in the world. Having experienced the Great Hanshin-Awaji Earthquake in 1995 and the Great East Japan Earthquake in 2011, we have been promoting the construction of buildings that are resistant to earthquakes and tsunamis. We believe that we are working towards a sustainable society by constructing buildings that are resistant to earthquakes and tsunamis, and, even if destroyed, can be easily repaired and continued to be used after the disaster. In addition, the recent climate change has led to an increase in number of disasters on a scale larger than previously anticipated, such as giant typhoons, torrential rains, river insurgencies, and landslides. The demand for disaster-resistant buildings is continuously increasing amid efforts to make Japan's social infrastructure sustainable.

We, steel manufacturers, have been striving to realise a sustainable society (infrastructure) by developing and providing high-performance steel materials for disaster-resistant, steel structural buildings, as well as design and construction technologies for utilising such materials.

To improve the earthquake resistance, we have developed steel materials for earthquake-resistant building structures and standardised to JIS, including requirements to set upper and lower limits for strength specifications and ensure that yield ratios do not exceed 80% to ensure high plastic deformation capacity and energy absorption performance. We have often seen damage sustained in major earthquakes cause rupture at welded joints at the ends of steel beams, leaving the buildings unusable. Therefore, we have created and issued guidelines that clearly define the required performance of welds and steel materials for column-beam joints. Our newly generated idea suggests preventing damage to columns and beams by incorporating energy-absorbing dampers into the building frames. The steel material for dampers (low-yield-point strength steel) developed for this purpose has high fatigue strength and seismic energy absorption performance, and helps reduce damage to buildings. In this way, various efforts have been made to ensure the seismic performance, quality, and safety of steel structures.

Japanese steel-framed buildings are not entirely made of steel, but often have composite structures that combine concrete and steel. For example, most columns in Japanese skyscrapers are CFT columns. CFT columns are constructed by pouring concrete into circular or square steel tubes to form columns. By combining the strengths of concrete and steel, which are resistant to compression and tension, respectively, the columns achieve high bearing capacity and deformation performance with small cross-sectional areas, resulting in a large living space. In addition to high-strength, thick-walled, large-section steel tubes for CFT columns, we also provide high-strength, high-toughness steel for welded box section columns, which are widely used in Japan, as well as steel for electro-slag welding with high heat input. Used in CFT columns, these high-strength steels can reduce the cross-sectional size and steel weight of the columns, thereby helping to reduce CO_2 emissions.

Used for flooring structures, composite floor beams combine concrete flooring and steel beams. This method is widely used worldwide, although the design approach differs slightly depending on the environment and design requirements of each country. Therefore, it is necessary to review existing design standards and technologies and develop new technologies to maximise the performance of composite floor beams. The year before last, we began providing rolled wide flange beams with a height of 1200 mm. This product helps streamline the production of built-up H section beams, which are conventionally assembled by welding. The rolled wide flange beams can be used along with the technology that utilises the combined effect with concrete floor slabs to increase the buckling resistance of steel beams, helping to reduce steel beam weight and CO_2 emissions.

The development of composite structures combining steel and concrete, which maximise the performance of the materials and create a synergistic effect, makes it possible to achieve a rational structure that fully utilises resources. This mechanism applies not only to steel and concrete, but also to steel and timber. Aiming to optimise and maximise structural efficiency by combining different materials will help reduce the materials used and achieve sustainability. We believe that aiming to optimise structures by utilising these materials is one way to reduce CO_2 emissions by driving sustainability.

Technical trends:

Net-zero steel in building and construction: The way forward

McKinsey & Co., views from Metals & Mining, Sustainability Practices and the Energy Transitions Commissions

Rising demand for greener approaches creates an imperative for the industry to seize the moment, adopt new mindsets, and set standards for the transition to a greener future.

As the world transitions to lower greenhouse-gas emissions, construction companies have a major role to play. In making the green buildings of the future, they have a chance to tap into demand that spans geographies and architectures. Indeed, greener business models are potential magnets for trillions of dollars earmarked for sustainable investment. In addition, companies that adapt effectively will ensure they are aligned with an increasingly stringent regulatory agenda.

The decisions made by construction executives now will determine how they are positioned for the transition over the coming decade. Those that prepare astutely are likely to seek out emerging pockets of innovation and dial up investment in sustainable technologies and capabilities. To be sure, new materials such as green steel are more expensive, and will therefore demand a new pricing model. However, they can significantly reduce embodied carbon—in commercial buildings by as much as 70 percent by 2030.

Amid tight industry margins, a priority for decision makers will be to ensure that there is a solid business case for change. The key in that regard will be to establish market position, while adjusting to a new cost base. They must also ensure that greener business models are aligned with demand that will rise at an uncertain pace over time. A tricky calculation is required, but the prize is a chance to get ahead in a market that is set for a potentially rewarding future.

Construction industry emissions

From houses to bridges, hospitals, and skyscrapers, the construction industry is responsible for approximately 25 percent of global greenhouse-gas emissions. A third of these are associated with materials and the construction process, or so-called “embodied carbon.” One reason for the industry’s high emissions is that it is a voracious consumer of steel, accounting for more than 50 percent of global demand. Due to the energy required for its production, steel is a carbon mega-producer, accounting alone for around a quarter of emissions in the construction process. Given these metrics, decision makers in both steel and construction need to take stock, consider their options, and plot a realistic path toward a lower climate impact.

Under the Paris Agreement on climate change, governments pledged to keep global warming below 2°C higher than preindustrial levels, and ideally 1.5°C. To achieve that goal, human emissions of greenhouse gases (GHG) must fall to net zero by 2050. In the construction sector, massive changes are required to align with that pathway. However, by shifting from high-emissions steel to near-zero emissions steel, the industry could take a significant step forward.

Decarbonising steel

Partial steel decarbonisation is possible through wider use of modern furnace technologies, the most efficient of which are powered by natural gas and use energy-efficient direct reduced iron or hot briquetted iron (NG DRI/HBI+EAF) to make steel. These emit much less GHG than traditional coke-fueled blast furnaces or basic oxygen furnaces (BF/BOFs). However, the latter still account for approximately 73 percent of global production and are dominant in Europe and China.

Another route to lower-CO2 steel would be to retrofit BF/BOFs for carbon capture and storage (CCS) or carbon capture and utilisation (CCU). These would theoretically enable sequestration of about 85 percent of CO2 emissions from coke feedstock. However, the approaches are not yet proven at scale. The North Star for decarbonisation would be to scale hydrogen-reduced DRI/HBI EAF furnaces powered with renewable energy. With this combination, producers could make steel with a carbon intensity of less than 0.2 tCO2 per metric ton of steel, compared with a global average of 1.8 tCO2 with today’s cleanest technologies. Still, the cost would be high. The steel would need to command a “green premium” of 20–25 percent over 20 years to fund construction of the DRI plant and EAF (not including capital expenditure for hydrogen production, transport, and storage) (Exhibit 1).
In switching to hydrogen-powered furnaces, a significant factor would be the availability of low-carbon hydrogen. Despite being among the most abundant elements on Earth, the gas barely exists in its pure form and must be extracted from compounds in an energy-intensive process. Most hydrogen production consists of “grey hydrogen,” made through steam methane reforming (SMR). This creates a gas composed of about one-tenth hydrogen and nine-tenths CO2. By contrast, cleaner “blue hydrogen” involves combining fossil fuels with steam to produce hydrogen and CO2, and then storing the CO2 underground. A still cleaner approach is to use electrolysis to separate hydrogen from water, producing “green hydrogen.” However, this costs around $5 per kilogram to produce, a prohibitive amount in the context of current industry economics. In addition, there are challenges associated with availability and quality of scrap, especially outside the United States, and limited access to renewable power.

The required green premium for a new-build hydrogen DRI/HBI+EAF mill would be 20 to 25 percent over 20 years.

Preliminary, illustrative North America example

	Capital expenditure (capex) included[1]							Included capex, $ billions	Needed green premium[6] for breakeven vs ongoing BF/BOF[7]
Route	EAF[2]	DRI[3]	CSP[4]	Hot mill	Cold mill	Galvanized line	CCS[5]		
Ongoing BF/BOF route[8]									
Hydrogen DRI/HBI+EAF route with EAF capex[9]	●	*Assumes DRI will be purchased in the market*						0.8	5–10%
Hydrogen DRI/HBI+EAF route with EAF and DRI capex	●	●						1.2	20–25%
Hydrogen DRI/HBI+EAF route with integrated facility capex	●	●	●	●	●	●		2.2	40–45%
Ongoing BF/BOF route with CCS capex							●	0.6	40–45%

1. “Metals & Mining Insights,” McKinsey, accessed in September 2021; “Real Estate Insights,” McKinsey, accessed in September 2021. Based on 2017 emissions.
2. “Steel facts,” World Steel Association, accessed January 26, 2022.
3. A significant portion of steel consumption in building and construction is from “long” products, which—in the United States—are most commonly produced through electric arc furnaces (EAF) that have a lower CO2 emissions intensity per metric ton of steel.
4. International Energy Agency, October 2020.
5. Zhiyuan Fan and Julio Friedmann, “Low-carbon production of iron and steel: Technology options, economic assessment, and policy,” Joule, April 2021, Volume 5, Number 4.

Still, as green-hydrogen technologies mature over the coming years, costs are expected to fall. Indeed, more than 25 projects are under development, suggesting there is a reasonable possibility of scaled production in the years ahead.

Navigating hurdles

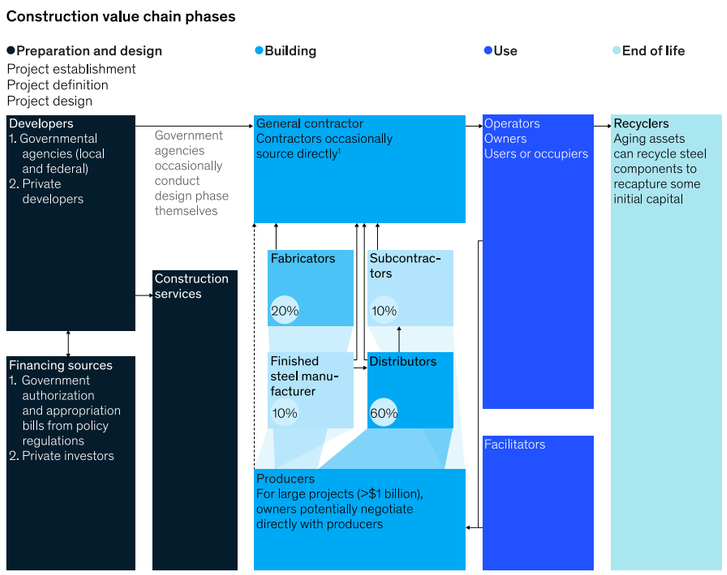
Against this background, what are the key hurdles to the construction sector moving to green—or greener—steel? The reality is that, beyond technical challenges, companies face significant commercial and structural barriers. Certainly, the sector's generally low margins are a limiting factor, dampening producer appetite for green technologies. Established approaches produce steel for approximately $400 to $500 per metric ton at the slab level. Near-zero emissions steel is more expensive, albeit with significant variations based on technology, location, and project.

Another barrier to adoption is that individual developers do not routinely count emissions from the steel they consume. This is due to a combination of factors, including a lack of industry standards, patchy regulation, and the absence of tools to measure embodied carbon (contained in construction materials from extraction to use). Indeed, no certification or grading system has been widely adopted to date. Furthermore, the steel industry services a highly fragmented construction landscape. In North America and Europe, the value chain is characterised by multiple intermediaries—with thousands of companies competing for business—and supply chains consisting mainly of small manufacturers and merchants (Exhibit 2). Against this backdrop, effective change at scale is more difficult to achieve.

Commercial sector opportunities

Despite many challenges, economically feasible progress is possible. To demonstrate the potential for the construction industry to adopt greener steel, McKinsey analysed an illustrative marginal abatement cost curve for materials and construction associated with an eight-story commercial office building. In a business-as-usual scenario, total embodied carbon in the construction phase would be about 1,900 tCO2, of which approximately 85 percent would be from materials. Of that total, some 25 percentage points would be associated with steel (and 37 percentage points with concrete). The analysis shows it would be possible to reduce the building's embodied carbon by about 1,250 metric tons (or 70 percent). This would be through alternative technologies, materials, and steel-production methods that we expect to be widely commercially available by 2030.

A fragmented value chain is a barrier to the construction industry's adoption of greener steel.



Note: Percentages are the share of steel produced.
¹Generally, finished steel, rebar, rods, rolls, and sheet metal.

In modelling the office building's decarbonisation pathway, we assessed more than 25 individual levers. These can be grouped in five categories. The first is to prioritise efficiency in construction materials and design. This would be a no-regret move that, by definition, would lower material and construction costs. The second would be to migrate to lower-CO2 steel. Moving from BF/BOF to EAF steel, for example, would have an immediate abatement impact on embodied carbon (more than 100 metric tons of embodied CO2 in our example, or more than 8 percent of total abatement potential). There are further gains available through low-CO2 concrete, flooring, and tiling. And replacing structural steel with glulam beams and cross-laminated timber (CLT)—in addition to replacing concrete slabs with CLT or using timber instead of concrete for load-bearing walls—would further reduce embodied carbon. Finally, companies could embrace electrification of on-site equipment, such as generators and machines.

In conclusion, the construction sector presents a significant abatement challenge, but also a real opportunity to tackle one of the major industrial sources of emissions. To get there, the sector should start moving toward greener technologies, and planning for realistic economic scenarios that will enable a more profound transition. With that goal in mind, an early priority should be standardisation of measurement and labeling systems. These would enable companies to more easily price and streamline their green procurement decisions. In a similar vein, construction companies would benefit from methodologies to track levels of embodied carbon, with thresholds embedded in rating systems such as such as Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Method (BREEAM). This would enable decision makers to more confidently set targets and plot decarbonisation pathways.

On the demand side of the equation, near-zero emissions steel cannot yet compete with established technologies on the basis of price alone. To unlock demand, developers, operators, owners, and large occupiers could consider forming buyer's clubs to aggregate purchase commitments. In addition, they could commit to offtake agreements with near-zero emissions mills and seek out dedicated green funding for specific projects, as some construction companies are already doing. Financers could facilitate that process by setting up systems to track and report on funding of embodied carbon, and by leveraging environmental product declarations and life cycle assessments to support quantification. They could, in parallel, orient toward more green bonds, green loans, or green revolving-credit facilities. Finally, as in most green transition scenarios, there is power in knowledge. Almost everybody who works in hard-to-abate industries is on a journey of learning about sustainability issues, and industry participants should not be reluctant to call for more education, research, and collegiality. Through joint efforts, stakeholders can promote sharing of perspectives, case studies, and data.

Through this range of efforts, greener technologies could enable a significant reduction in steel industry emissions, and therefore a more sustainable construction industry. In the context of a fast-warming planet, these would represent important achievements. The imperative for decision makers, therefore, should be to seize the moment, adopt a radical mindset, and take concrete steps to transition to a greener future.

6. Dyna Mariel Bade, "US Department of Energy announces green hydrogen cost-cutting goal," Institute for Energy Economics and Financial Analysis, June 8, 2021.
7. "Scrap use in the steel industry," World Steel Association, May 2021.
8. "Metals & Mining Insights"; Path to hydrogen competitiveness: A cost perspective, Hydrogen Council, January 20, 2020.
9. LEED-certified buildings typically command a higher rent than non-LEED-certified buildings, but this is generally insufficient to offset the additional costs of using green steel. "LEED" stands for Leadership in Energy and Environmental Design.
10. Denmark, France, and the Netherlands have rules regarding embodied carbon, and Finland and Sweden plan to follow suit in 2025 and 2027. US cities such as Santa Monica, California, have similar legislation in place. "Buy Clean Colorado" and "Buy Clean California" are state legislative acts focused on steel. A shift may be supported by legislation such as the US Bipartisan Infrastructure and Jobs Act, CLEAN Future Act, and SUPER Act of 2021.
11. For example, the Partnership for Carbon Accounting Financials (PCAF) has not yet included embodied carbon emissions in required reporting of financed construction emissions due to feasibility constraints.
12. For illustrative purposes only. Regional differences and differences in the construction type of the building (for example, cast-in-place versus hybrid versus structural steel) have a significant impact on both overall emissions and on abatement potential of different levers.
13. Carbon emissions associated with buildings' whole-life materials and construction processes. Nonmaterial emissions include heavy equipment, transport, and small generators.
14. Mostly rebars used in reinforced concrete.
15. The CO2 abatement curve is an illustrative example. Regional differences (for instance, in steel production, technology, or materials availability) can significantly change the levers. The mentioned costs are aggregated for the eventual lever.
16. This assumes no regulatory constraints on the use of cross-laminated timber (CLT) or timber (for example, limited to five-story buildings) and no recent price increase—for example, CLT or timber could be applied in situ for concrete slabs, load bearing walls, or facades.

Construction steel news headlines

construction market and regulations

USA: Biden-Harris Administration Launches Initiative to Modernise Building Codes, Improve Climate Resilience, and Reduce Energy Costs. Modern building codes and standards provide a range of smart design and construction methods that save lives, reduce property damage, and lower utility bills—for example, by ensuring that roofs can withstand hurricane winds, that construction materials are resistant to flood damage, and that insulation keeps heating and cooling costs low. Link

USA: The American Institute of Steel Construction has released the first-ever set of US recommendations for hybrid steel frames with mass timber floors. Design Guide 37: Hybrid Steel Frames with Wood Floors, written by Arup, encourages the use of mass timber floor systems in construction, "an underused yet important material to reduce the amount of carbon-intensive concrete in a structure". Link

Asia: China's investment in real estate development declined in April while property developers' contract sales fell significantly as the country's property markets were seriously affected by virus outbreaks and city lockdowns – investment in property development dropped 10.1% in April from a year ago. To encourage homebuyers to enter the markets, the People's Bank of China announced a reduction in mortgage loan interest rates for first-time homebuyers. Link

Latin America: The Brazilian infrastructure construction segment recorded strong growth in 2021 of 10.2% but growth will slow to 3.8% in 2022 due to rising prices of materials and their lack of availability, as well as elevated interest rates. Growth is expected to decline even further in 2023, to just 1.4% as the rising costs and lack of availability of materials causes significant delays and cost hikes. Link

Africa: Egypt has signed a US$4.45 billion deal for a high-speed electric rail line to link its Red Sea and Mediterranean coasts that contractor Siemens dubbed a "Suez Canal on rails". The contract between Egypt's National Authority for Tunnels and a consortium including Siemens Mobility, Orascom Construction and Arab Contractors will cover design, installation and maintenance of the rail link over 15 years. Link

Asia: India's property developers, which are among the biggest employers of both skilled and unskilled labour, are set to benefit from the Centre's move to ensure cheaper supplies of steel and cement - the two biggest commodities used in construction. Link India's economy grew 8.7% in FY22 against the National Statistical Office's earlier estimate of 8.9%. During FY22, manufacturing and construction grew by 11.5% and 9.9%, respectively. While in Q422 manufacturing declined 0.2%, indicating the slight impact of Omicron variant induced lockdowns, construction also showed tepid growth of 2.0%. Link

Global: Construction equipment sales for the world's top 50 OEMs have hit record levels and were up 20.8% reaching US$232.7 billion as most markets in the world saw growth as the industry bounced back from the impact of the pandemic. Link

Building materials & construction technologies

USA: GE Renewable Energy has opened a new research and development facility in New York, US, to conduct further research on how to 3D print the concrete base of towers used in wind turbines. It will continue to work on optimising the 3D printing technology with the first applications in the field anticipated within the next five years. The research conducted at the facility is being supported in part by a US Department of Energy grant and will enable GE to print the bottom portion of the wind turbine towers on-site wind farms. Link

USA: Virginia-based engineering, construction and project management company Bechtel announced its new manufacturing and technology division, which will target sectors such as semiconductors, synthetic materials, data centres and electric vehicle products and facilities. Primary drivers for the creation of the division include digitisation, energy transition and reshoring for economic and security reasons. Link

Asia: Bentley Acceleration Initiatives, the internal incubator for strategic investments of Bentley Systems, the infrastructure engineering software company, announced the launch of ConstructHelix, a digital construction technology solutions group that caters to the unique and specific needs of the Indian construction sector. The focus of ConstructHelix is to digitalise construction project workflows through its offering of SaaS solutions, enabling a connected data environment with seamless information flow across people and technologies. Link

construction sector players

Europe: Swiss cement-maker Holcim is planning to sell its Indian businesses, Ambuja Cement and ACC, to local conglomerate Adani Group for $6.6bn. Link In the meantime, Holcim completed the acquisition of PRB Group, France's biggest independent manufacturer of specialty building solutions which product range includes coatings, insulation, advanced energy-efficiency and renovation solutions. Link

Europe: Swedish construction company Skanska reported that first-quarter profit dropped roughly 21% year over year to $151 million, or about 18 cents a share. Although the global contractor and developer doesn't have projects in Ukraine, the Russian incursion there poses continued uncertainty for what was an already stressed supply chain. Link

Europe/North America: Construction materials producer and distributor Saint-Gobain has agreed a US$928m cash deal to buy a company that makes and distributes exterior building materials in Canada and the US. The purchase of family-owned Kaycan is intended to make the top siding firm in Canada and enlarging its range of vinyl products across the USA with complementary ranges including aluminium and engineered wood. The purchase price represents a multiple of approximately 11.2 times Kaycan's 2021-2022 earnings before interest, taxes, depreciation and amortisation. Link

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