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Autos, Buildings, Renewables

Finding China's Green Steel Buyers

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Executive Summary

This report identifies the industries and companies that can lead the shift to green steel.

China is the world's largest steel producer, accounting for more than half of global output. The country's reliance on conventional, coal-fed steel production makes the industry in China a major source of greenhouse gases, accounting for 17% of its total emissions. This report identifies the industry leaders in auto, property construction, and renewables needed to support solutions.

The price premium is currently a major barrier to adoption.

There are moves at both the corporate and regulatory levels to introduce technologies that produce steel more cleanly. These include using green electricity, increasing scrap use in electric arc furnaces (EAF), and/or hydrogen Direct Reduced Iron (DRI). While costs will inevitably fall as these technologies advance and gain economies of scale, the total capital required to supply green energy and the consequent price premium for “green” over conventional steel are barriers to adoption by domestic buyers.

Automakers have emerged as early movers…

China’s automakers have emerged as early movers in adopting green steel, with a handful of purchase commitments and cooperation agreements already in place. There are also signs of interest from the construction sector—China’s biggest steel user—along with regulatory initiatives to mandate low-carbon steel use in the industry. These commitments offer important demand signals to steelmakers as they evaluate the feasibility of large-scale investments in the development and commercialisation of green steel technologies.

…but adoption will need to accelerate rapidly to meet emissions targets.

Still, China will need to accelerate green steel adoption rapidly to meet its goal of reducing steel industry's emissions and achieving net-zero before 2060. The current predicaments are that China’s supply of low-carbon steel is limited, and cumulative demand is well below even 1% of total consumption.

Green steel demand from industry leaders could be 1.3% of total steel by 2030.

In 2023, China's crude steel production was 1.02 billion tonnes, and consumption was 935 million tonnes. By 2030, demand is forecast by China Metallurgical Industry Planning and Research Institute (MPI) to drop to 890 million tonnes. Our analysis shows that demand for green steel from early movers by that year could range from 1.3 million tonnes to 6.6 million tonnes a year, representing between 0.7% and 1.3% of projected total domestic demand.

An S-curve transition to green steel is the best-case scenario.

It is hoped that, like many major industrial transformations, the transition to green steel will follow an S-curve, gaining traction gradually until volumes are sufficient to create a combination of reduced costs and support from policy mechanisms that spur exponential growth. China is at the very beginning of this curve. To accelerate progress, steelmakers will need more reliable indications of demand, including a much larger volume of purchase commitments, to spur capital investment in the technologies to make green steel at scale.

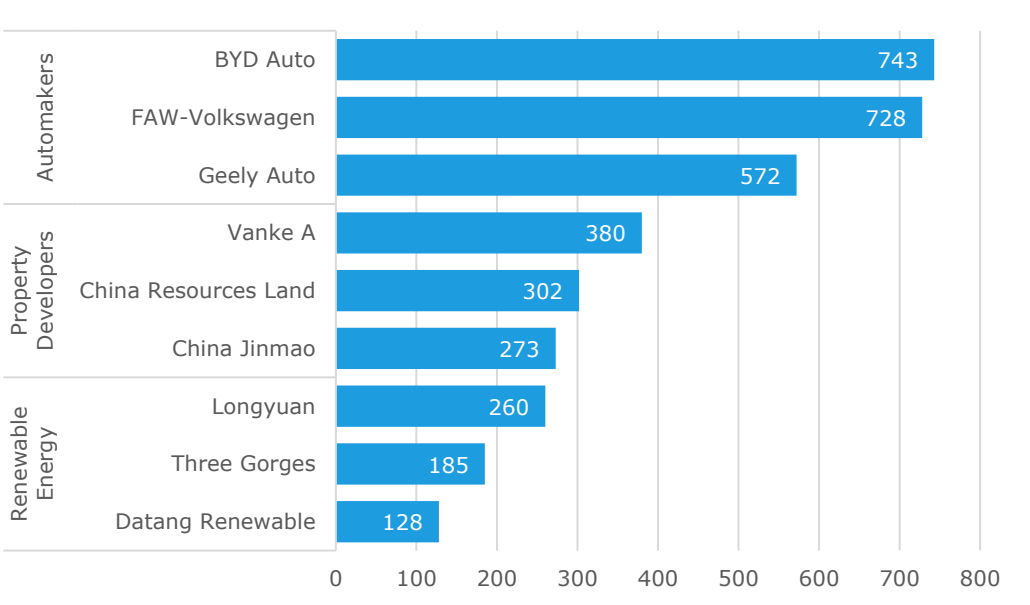
The transition is likely to be led by the auto, property, and renewable energy industries.

This report aims to identify potential early adopters capable of helping the steel industry take these critical early steps. To do that, ARE first identified three industries likely to lead the shift: automotive, property construction, and renewable energy. These three industries could account for a combined 65%[1] of projected total steel demand by 2030.

Having focused on these industries, we then broke down which companies could produce sufficient combined demand to shift at least 1% of total domestic steel consumption to green steel by 2030.

It is these buyers that could provide the firm purchase agreements that stimulate investment in breakthrough technologies and encourage other large consumers to make the transition.

Figure 1: Potential green steel demand by 2030; top three companies, by industry.



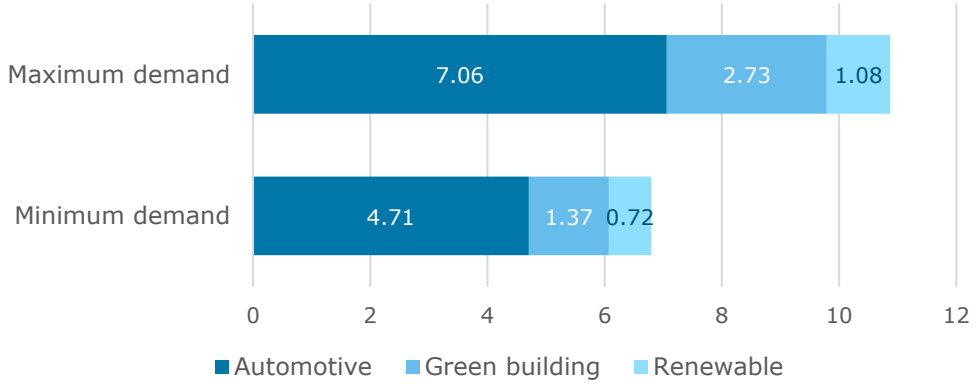
('000s tonnes/year)

Key Findings

- At the time of writing, supplies of high-standard green steel in China are at, or close to, zero. Very few companies have entered into offtake agreements, or publicly stated an intent to switch to green steel. Those that have done so are mainly international joint-venture automakers.

- Combined green steel demand from the largest domestic companies in the three selected industries could reach at least 10 million tonnes a year (equivalent to one large facility) by 2030. This is a necessary step, though falls short of the timeline needed to reach global climate targets.

Figure 2: Total green steel demand from potential early movers in China by 2030 (millions of tonnes).



- Several automakers in China have made agreements to buy green steel. Research shows green steel would add an estimated US$20-180 to the retail cost of a vehicle, but while high-end makers and consumers can readily absorb these costs, nearly all EV manufacturers are already running at a loss and may struggle operationally to make the transition. Demand from identified leaders could reach 4.7 million to 7 million tonnes by 2030.

- Green building certifications are incentivising developers to seek more sustainable, low-carbon construction. The market is already willing to absorb green premiums of up to 10% in major purchase agreements. But few companies have entered into green steel agreements. Demand from identified leaders could reach 1.4 million to 2.7 million tonnes a year by 2030.

- So far, no renewable energy companies have made agreements to use green steel, though the opportunity to boost green credentials is a part of the industry's basic value proposition. Using green steel in wind turbines raises the levelised cost of electricity (LCOE) by only 1% over the lifetime of each facility and can reduce lifetime emissions by up to 50%. Demand from identified leaders could reach 1 million tonnes by 2030.

Figure 3: Factors Driving Adoption of Green Steel, by Industry

Industry	Product Competitiveness	Sensitivity to Green Steel Premium	Market Concentration	Climate Change Impetus
Automotive	Cars labelled 'green' command a premium	Limited	High	• Strong impetus to decarbonise value chain
Property Development	Buildings labelled 'green' command a premium	Limited	Fragmented	• Moderate impetus to decarbonise value chain • Earning 'green' certification will increasingly require reducing embodied carbon
Wind Power	No commercial differentiation	Capex - Moderate LCOE - Limited	High	• Weak impetus to decarbonise value chain • Reducing GHGs is fundamental to basic value proposition • Supply to electric arc furnaces and for green hydrogen create major opportunities

Recommendations

Automotive

- Carmakers can review steel sourcing, including requesting information from suppliers on the carbon intensity of their products.
- Carmakers can provide direct demand signals to steelmakers, with offtake agreements and future procurement commitments to buy specific volumes of low-carbon steel with well-defined “green” labelling standards.
- Carmakers can set and disclose deadlines for substituting a proportion of their total steel purchases with green steel and publish regular progress reports.

Property Development and Construction

- Property developers and construction companies can assess their Scope 3 raw materials/upstream emissions, particularly for steel, and subsequently seek to mitigate these emissions, setting targets and action plans.
- Property developers can lower the embodied carbon emissions from their buildings in premium locations through sourcing green commodities, particularly green/low-carbon steel.
- Because of market fragmentation, property developers that don’t buy steel directly from producers can consider negotiating green steel purchases collectively to leverage buying power. Developers can encourage contractors and suppliers to commit to reducing their own supply-chain emissions and set deadlines for reaching minimum procurement ratios.
- The industry can create a clear and common standard for what qualifies as “green steel” in building construction. These can be linked with “green building” certification systems that include criteria for embodied carbon content and reduction targets.

Renewable Energy

- The renewable energy industry is built on the premise of low-carbon power. Developers and operators can therefore strengthen their reputations by reducing Scope 3 embodied carbon emissions. Green steel procurement is a key lever for achieving this.

- Green steel production requires high energy inputs. As such, it represents a significant opportunity for renewable energy companies. Wind and solar producers can consider reciprocal arrangements with steel companies that combine procurement commitments with provisions to supply renewable energy for producing steel and hydrogen.
- Developers can engage with equipment suppliers to review and request information on carbon intensity for key products, particularly those with a high steel content like turbines and towers. This signal can be strengthened when developers work with manufacturers to set targets for reducing supply chain emissions, and targets for green steel content. Developers can provide incentives in tenders to bidders proposing to use green steel.
- The green steel premium has a smaller impact on the LCOE of offshore wind turbines, so wind energy companies can consider using green steel for offshore turbines as an initial step.

Investors and Creditors

- Investors can engage with company management, encouraging companies to set deadlines for reducing supply-chain emissions as well as for switching to green steel.
- Commercial banks and other financial institutions can support buyers of green steel by offering products that tie financing costs to green steel purchases and the resulting reduction in emissions.

The Future of China's 'Green' Steel

Understanding China's Steel Landscape

China has a potentially game-changing role to play in the steel transition.

As the world's largest producer and consumer of steel, China has a potentially game-changing role to play in reducing the global industry's carbon emissions.

To realise that potential, several formidable obstacles must be overcome.

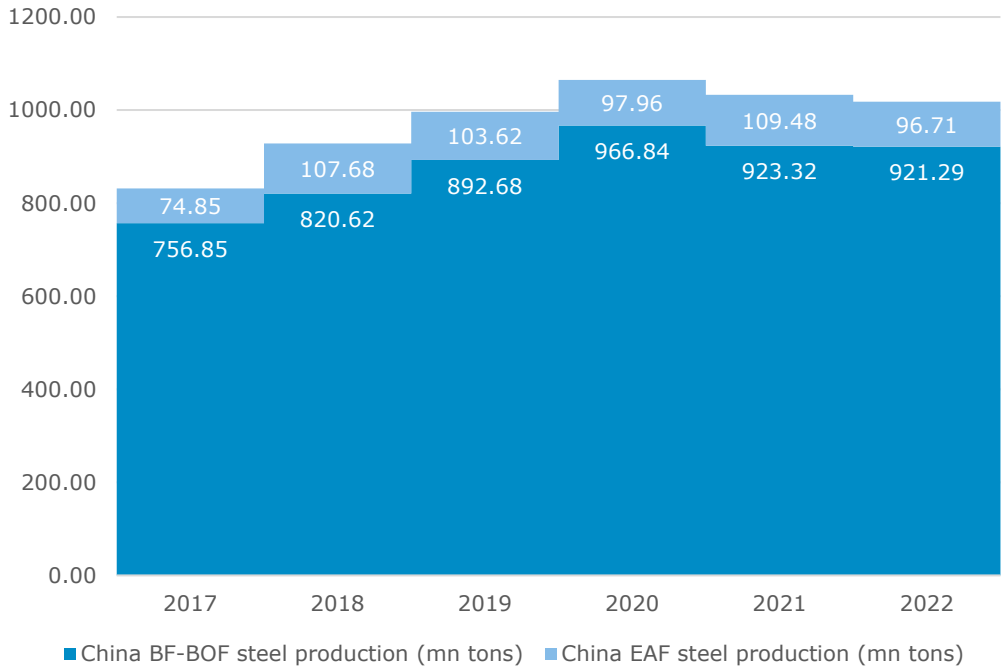
China has a higher - than-average carbon footprint from steelmaking…

The first is that China's steel industry has a higher carbon footprint than its overseas counterparts. Steelmaking accounts for about 17% of the country's total greenhouse gas (GHG) emissions,[2] generating more than 2.3 metric tonnes of CO_2 per tonne of production, compared with the global industry average of 1.4 tonnes of CO_2.[3]

…in part because scrap supplies are lower than the US or Europe…

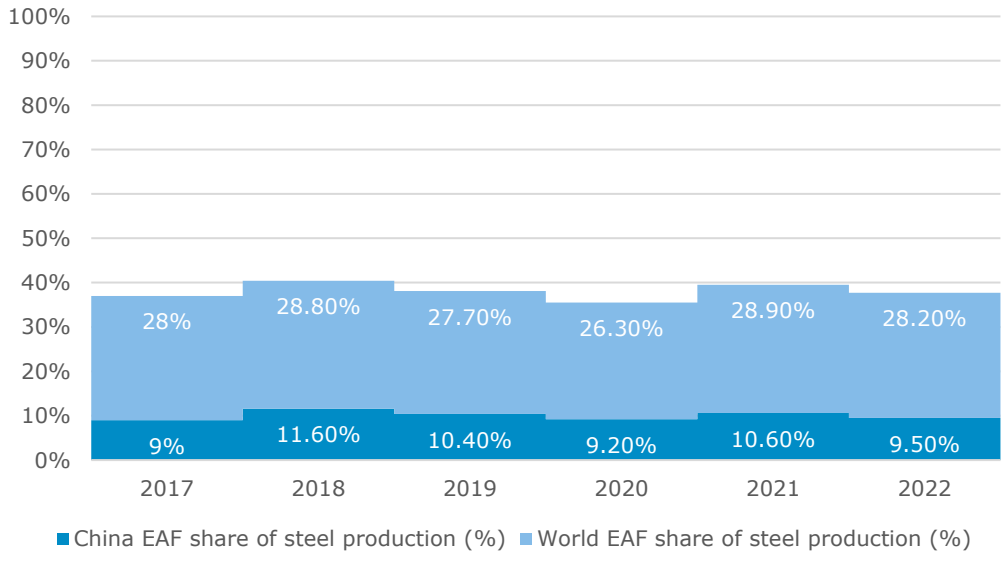
This is largely because steel producers in Europe and the United States have ample supplies of scrap metal they can recycle into new steel, using less-polluting electric-arc furnaces (EAFs). Having industrialised more recently, China has less scrap available as a proportion of total supply. Only around 10% of China's steel is produced in electric-arc furnaces (EAFs) compared with 44.8% in the EU and 69.2% in North America.[4] Instead it relies largely on smelting iron ore in conventional blast furnace-basic oxygen furnaces (BF-BOFs) using coke produced from metallurgical coal.

Figure 4a: China Crude Steel Production by Process



Source: World Steel

Figure 4b: China vs. World Proportion of EAF Production



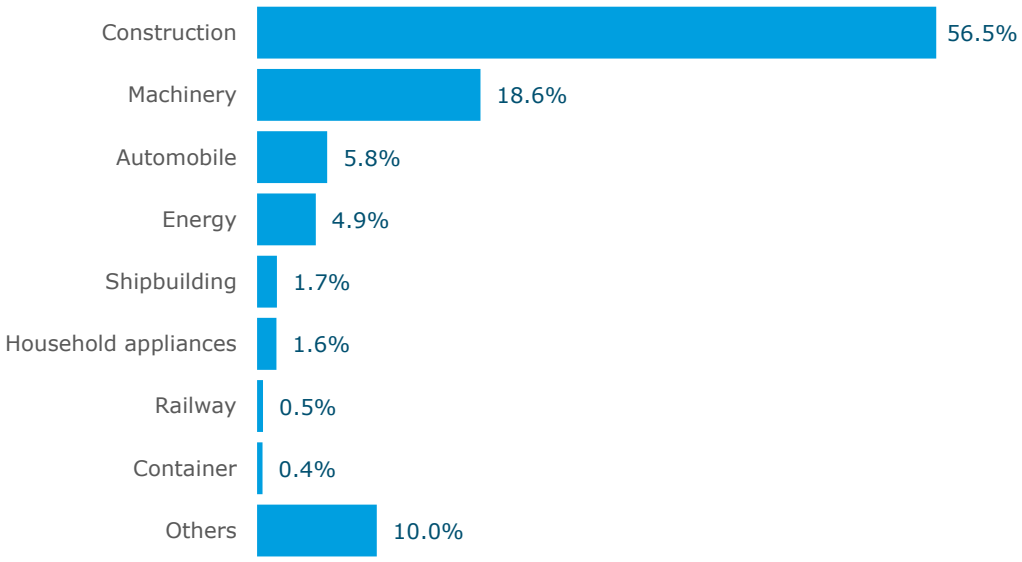
Source: World Steel

...and per capita steel consumption remains far ahead of other major economies.

Further, China's phase of rapid industrialisation and urbanisation has not yet ended. The construction industry, while slowing, still accounts for more than 500 million tonnes (or almost two-thirds) of annual steel demand, and annual per capita consumption in China stands at about 700kg, compared with about 232kg in North America and about 100kg in Asia ex-China.[5]

In 2022, construction represented more than half of production, while automakers accounted for slightly less than 6% of total consumption and the energy sector consumed about 5%.[6]

Figure 5: China's Crude Steel Consumption by Sector, 2022



Source: China Metallurgical Industry Planning and Research Institute

What is 'Green' Steel

One of the challenges in identifying and projecting demand for green steel is that there is still no international commonly accepted definition. In some cases, green steel is defined by the emissions created in producing it; in others, steel is described as green when the technology used to make it emits fewer GHGs than the conventional Blast Furnace-Basic Oxygen Furnace (BF-BOF) process.

Complicating matters further, there are several terms used frequently and interchangeably to describe steel produced with cleaner methods. "Near-zero," "net-zero," "low-carbon," or "low-emission" all suggest green credentials but lack precise definitions.

Without a specific green steel definition, it's difficult for companies to make a business case for accelerating capital investment in the required technologies. Steel producers might invest to improve efficiency or focus on increasing recycling rates at some of their plants running electric arc furnaces. This will lead to important reductions in GHG – and enable products to be labelled green – but it will not support the deeper cuts needed in future decades.

To achieve the deepest cuts, companies must deploy efficient hydrogen blast or Direct Reduced Iron (DRI) furnaces, with green hydrogen, use carbon capture and storage, and ensure renewable electricity is used for electric furnaces.

One way to define green steel is to use a CO_2 emissions threshold. Another is to limit the allowable choice of technologies. The definition could use a high fixed hurdle, or it could use a transition-oriented concept, with the definition of green becoming tighter over time, reflecting alignment with Paris Agreement goals.

We hope that industry can form a consensus and work with regulators to create a standard definition. In its absence, for the purposes of this report we have defined green steel with a carbon emission threshold, selecting the Responsible Steel Decarbonisation Progress Level 2. This threshold ranges from ≤2000 to ≤350 kg CO_{2e} per tonne of crude steel, depending on the 0-100% scrap share of metallic inputs.

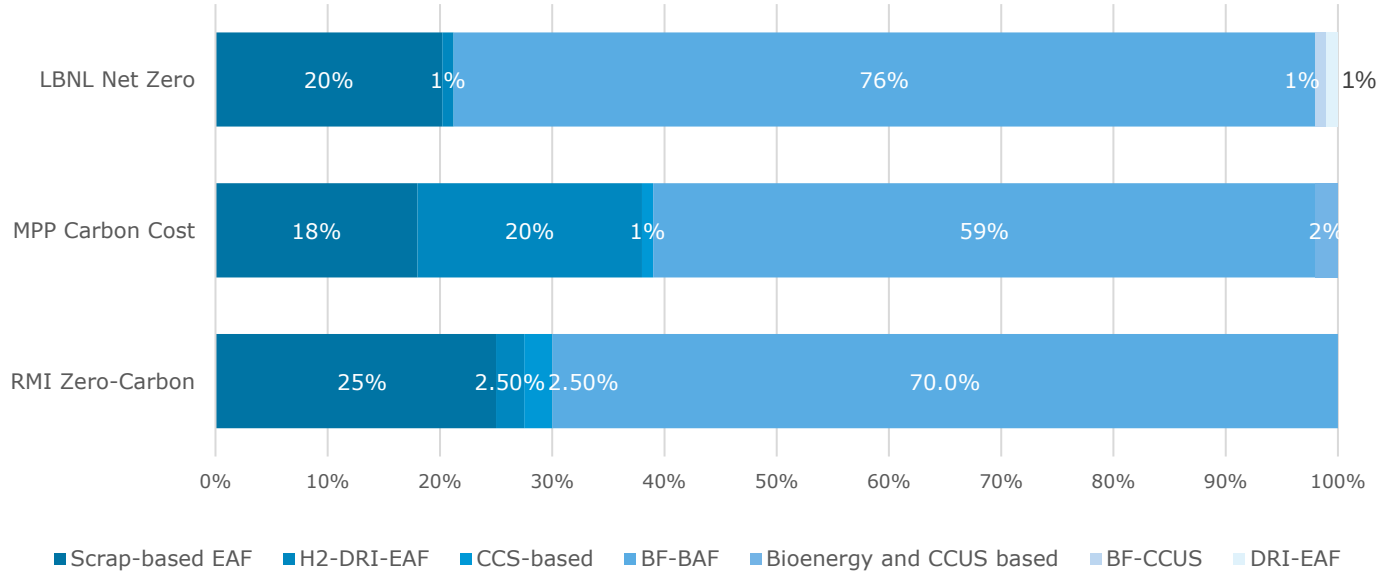
A successful transition requires commercialising newer technologies.

Achieving China's broader targets for reducing steel emissions will eventually require the successful commercialisation and deployment of newer technologies such as carbon capture, utilisation, and storage (CCUS) and green hydrogen. Such technologies could account for about 40% of the reduction in GHG emissions from China's energy sector under the International Energy Agency's Announced Pledges Scenario (APS), which assumes that all government and industrial climate commitments made by the end of August 2023 will be met in full, and on time.[7]

Shifting to EAFs is a rapid way to kick-start change.

Shifting to EAFs offers a fast and feasible way to significantly reduce steel emissions as China develops these technologies while building renewables. China has entered the later stages of industrialisation and urbanisation, so peak domestic demand for steel has passed and supplies of scrap steel for EAFs are starting to grow. Huabao Securities projects that China's newly initiated construction area will likely shrink at a rate of 3.1% a year through 2030. That will likely translate into a decline of about 3% a year in demand for building construction steel.

Figure 6: Projections for China's 2030 Steel Production in a 1.5°C Scenario



Sources: RMI, "Pursuing Zero-Carbon Steel in China;" Mission Possible Partnership (MPP), "Making Net-Zero Steel Possible;" and Lawrence Berkeley National Laboratory, "Net-Zero Roadmap for China's Steel Industry."

Solutions, Costs, Regulations, and Demand

Producers are likely to rely on DRI as feedstock until scrap supplies grow.

Until there is a sufficient volume of scrap supply, most steel producers will likely rely on Direct Reduced Iron (DRI) as a feedstock for their EAFs. And because of the relatively high cost of hydrogen, they are likely to produce that DRI using natural gas, switching to hydrogen once doing so becomes economical.

The U.S.-based non-profit Rocky Mountain Institute (RMI) projects that the price of green hydrogen will drop from CNY40/kg (c. USD6) in 2020 to between CNY7-20/kg (USD1-2.8) by 2030. This would reduce the premium for steel produced using the H_2-DRI-EAF process from 80% to 40%, and from 40% to 30% for the Scrap-EAF process.

Current green/low-carbon steel supply in China is close to zero…

Currently, China's supply of green steel is limited, and hard to quantify in the absence of globally agreed definitions, while cumulative demand for low-carbon steel is negligible.

To date, only one Chinese property company—Hang Lung Property—has committed to using green steel. This is partly due to cost; green steel is still more expensive than its conventional counterpart, with costs ranging from 40% higher to double those of BF-BOF steel.[8]

…and China's steel producers face higher write-offs from a rapid transition.

China's blast furnace fleet is also comparatively young, with an average age of 13 years (less than one-third of a typical furnace lifecycle). If there is a rapid transition to green steel production, operators could face write-offs, or at least enjoy shorter periods of high profitability on depreciated assets than regions with more mature steel industries elsewhere in the world.

There are signs of progress, however.

The government is working on policies to cut industry emissions…

China is already working to reduce industry emissions, largely by switching from BF-BOFs to EAFs. In 2021, the government revised its "Implementation Measures for Capacity Swap in the Steel Industry," prohibiting the addition of new steelmaking capacity and allowing only for the replacement of blast furnaces with electric furnaces.[9]

In 2022, the Ministry of Industry and Information Technology, the National Development and Reform Commission (NDRC), and the Ministry of Ecology and Environment (MEE) issued a joint

"Implementation Plan for Carbon Peaking in the Industrial Sector and Guidance to Promote the High-quality Development of the Steel Industry", which set a target for raising the proportion of steel made in EAFs to 15% by 2025 and 20% by 2030.[10]

...and has suspended approval for new capacity swaps.

In August 2024, the government suspended approvals for new steel capacity swaps in a move to cut pig iron and crude steel capacity and boost EAF production. The last plan specifies that the replacement ratio for blast furnace iron in zones targeted for air pollution prevention and control should be no less than 1.5:1, and 1.25:1 in other areas. For EAF, an equivalent replacement is allowed. Previously, China had released three versions of the steel capacity replacement implementation measures, and a stricter new plan is currently awaited.

More than 100 companies have plans to cut emissions.

More than 100 steel companies in China have developed plans for reducing their carbon emissions.[11] In the past three years, some of the country's largest steelmakers—including Angang Steel, Baowu Steel Group, HBIS Group, and Jianlong—have published plans for cutting carbon emissions and achieving net-zero. Several leading producers have launched pilot projects that use new and experimental technologies such as hydrogen-based DRI-EAFs and CCUS.

Challenges remain to shift at least 1% of consumption to green steel.

Despite these steps forward, the conundrum remains: where can producers find sufficient demand to shift at least 1% of consumption to green steel by the end of the decade, and hence propel the industry the first few steps along the S-curve of accelerating adoption?

According to ARE's analysis, this transition is most likely to be kickstarted by three industries: automobiles, construction, and renewable energy.

The Chemistry of Steel: In with Iron, Out with Carbon

Why is steel so carbon-intensive? And how can it be made more cleanly? Understanding the industry’s efforts to decarbonise steel requires a basic knowledge of how steel is made and how new technologies reduce the amount of carbon needed to make it.

Blast Furnace-Basic Oxygen Furnace (BF-BOF)

- BF-BOFs use coke, a concentrated form of coal, as a reducing agent to remove oxygen (O_2) from iron ore (Fe_2O_3). The GHG carbon dioxide (CO_2) is the main by-product. Carbon from the coke also binds with the iron and must be removed by adding O_2. That produces steel, but also more CO_2.
- Making coke requires purifying coal in ovens heated by burning coal, which also creates CO_2.
- CCS / CCUS promises to capture much of the CO_2 instead of releasing it into the atmosphere.
- Hydrogen (H_2) can be used as a partial replacement for coke, yielding water (H_2O) instead of CO_2 as a by-product.

Electric Arc Furnace

- EAFs use electricity instead of coke. They could be powered from renewable sources instead of coal.
- EAFs can use existing scrap metal instead of relying on mining of new iron ore.
- EAFs can also use direct reduced iron (DRI) instead of scrap. DRI is a way to remove O_2 from iron ore without melting it in a blast furnace, thereby requiring less energy. DRI is often produced using coal or natural gas but can also be produced using H_2 instead. Producing H_2 usually requires fossil fuels but new technology allows it to be produced economically from H_2O using electricity, yielding O_2 as a by-product. That electricity could in turn be produced from renewables, creating “green hydrogen.”

Finding the Early Buyers

Automakers

- Using green steel would have a negligible impact on retail prices for high-end vehicles.
- Some automakers already have initiatives to switch to green steel.
- A key obstacle for domestic players is that most EV producers are not yet profitable.
- Demand from 22 leading companies could reach 4.7 million to 7 million tonnes by 2030, or 5.7-8.5% of projected auto sector steel use.

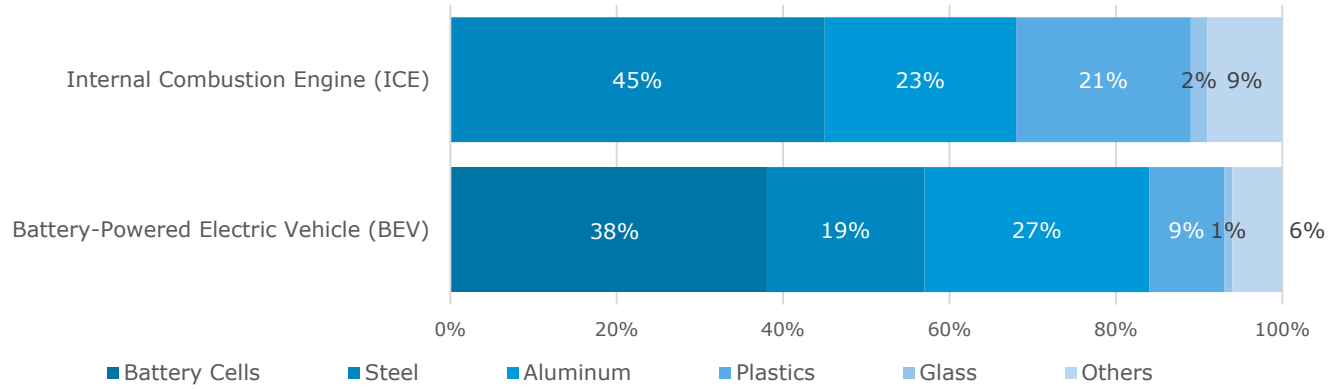
China carmakers have achieved first-mover status.

The Industry Landscape

China's carmakers have emerged as early adopters of green steel, but the industry can still make considerable progress.

While China's automotive manufacturers have made rapid recent progress in greener vehicle production, the focus has primarily been on reducing "tailpipe emissions" (the GHGs cars emit when driven). As more drivers switch to electric vehicles (EVs)—the EV penetration rate may top 50% by 2035,[12] according to some forecasts—the car production process will assume a greater relative importance in the sustainability evaluation of each vehicle over its lifetime.

Figure 7: Average carbon footprint of the production of ICE and BEV



Source: Deloitte, The automotive industry's road to net zero Decarbonization path for Automotive production, 2024

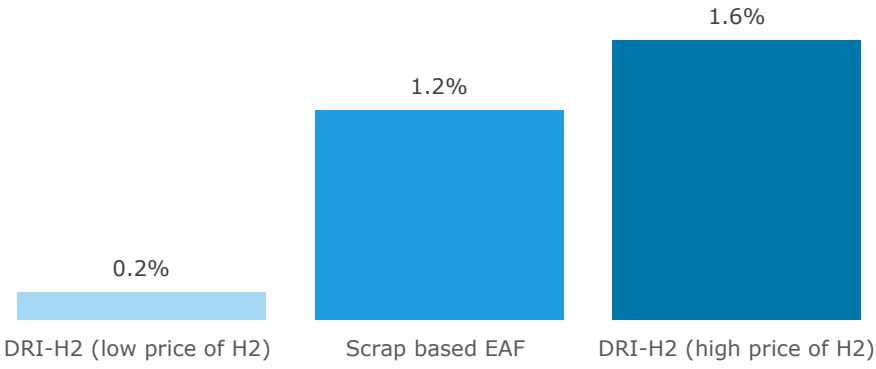
The use of green steel has a minimal impact on the retail cost of a vehicle…

Steel accounts for about 19% of total CO_2 emissions in the production of a BEV, compared with 45% for an internal combustion engine (ICE) equivalent. However, the amount of steel used (and therefore emissions from steel) is about the same, and the total footprint of a BEV is higher than that of an ICE, meaning that the absolute emissions of each type of vehicle is similar.

As BEV technology advances and exhaust emissions decrease, the proportion of materials, especially steel, in the vehicle's total lifecycle carbon footprint becomes increasingly significant. Thus, reducing steel's carbon emissions will be the next critical step toward achieving net-zero.

The cost of the transition to manufacturers and consumers would be relatively small. Using the high-end Mercedes-Benz E300e as an example, steel accounts for 46% of the vehicle's total weight—approximately 980kg. As of October 2024, the steel price in Jinan was USD520 per tonne, which means the cost of steel in each E300e is about USD510. With a 30% premium on scrap-based EAF steel, the absolute premium would be USD168.

Figure 8: Increased Cost of EV Manufacture from Switching to Green Steel

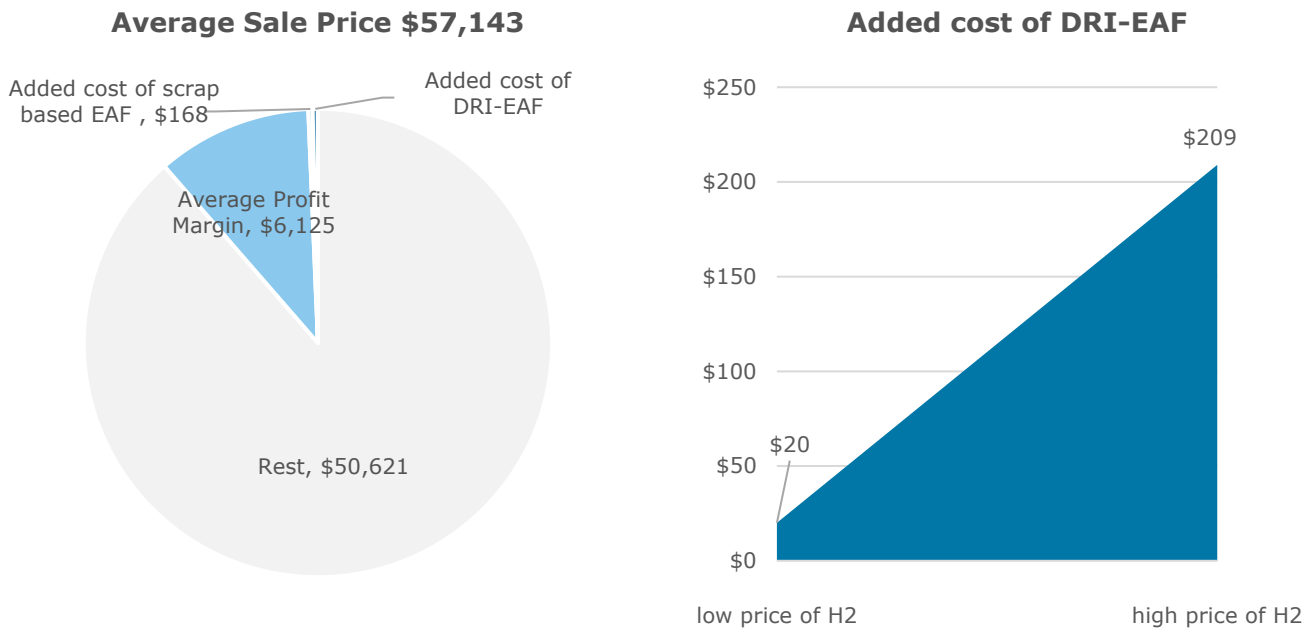


Source: ARE analysis, with inputs from BCG, The High-Stakes Race to Build Affordable B-Segment EVs in Europe, 2023; UBS Evidence Lab Electric Car Teardown–Disruption Ahead?, 2017; RMI
Note: 'high-priced' H_2 = USD2.80/kg; 'low-priced' H_2 = USD1/kg.

...however, most EV makers in China still operate at a loss and may be reluctant to absorb the premium.

The issue remains that while green steel offers the auto industry a way to cut its environmental impact, most EV manufacturers still operate at a loss, and only the largest and most profitable can absorb green steel's higher cost.

Figure 9: Per-Vehicle Green Steel Premium Relative to List Price and Margin (USD)



Note: Based on list price and margin for a Beijing Benz passenger vehicle, made with 100% green steel.

Higher-end carmakers can absorb green steel premium.

High-end conventional carmakers can cope with such modest increases relatively painlessly; healthy profit margins enable them to either absorb or pass on additional costs to customers. Significantly, EVs in China became cheaper than their internal-combustion counterparts for the first time in 2023,[13] thanks in part to government subsidies, so the small additional cost of using green steel should not be a deal-breaker for most consumers, and certainly not for buyers at the premium end of the market.

However, except for BYD, China's dedicated electric carmakers are still unprofitable, so they are unlikely to risk going deeper into the red by rushing to replace conventional steel supplies at this stage.

Several manufacturers have adopted net-zero targets along their value chains.

Nevertheless, many automakers in China have already adopted deadlines for achieving net-zero emissions along their entire value chain. Some have set specific target years, such as Geely, which has pledged to be completely carbon-neutral by 2045.

Adopting green steel will be essential to meeting these targets. That means making binding commitments to buy specific quantities of green steel over defined periods and communicating these purchase agreements to the market along with details about how they move the company closer to its decarbonisation targets.

Purchase agreements will inspire market confidence and guarantee supply.

Doing this will not only provide stakeholders with confidence in the company's net-zero transition, but also send essential demand signals to steel suppliers. Without such signals, there is no guarantee of sufficient green steel supplies to meet their targets.

Potential Demand from Leaders

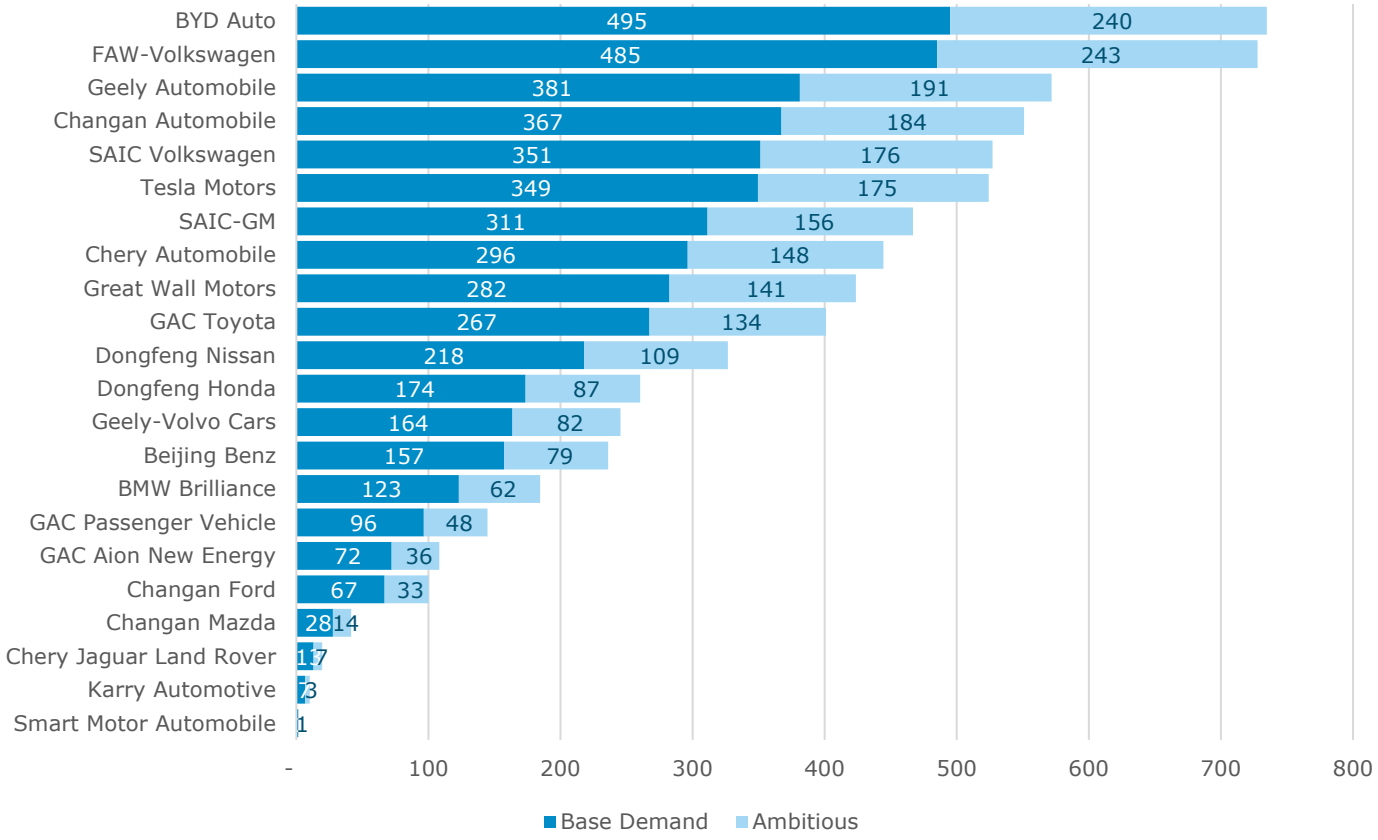
We identified 21 automakers as potential transition leaders.

We evaluated the top 50 automakers by sales in China—both purely domestic and foreign joint ventures—on a range of criteria, including per-vehicle profit margins, climate change commitments, Scope 3 decarbonisation targets, and steel supplier relationships. From this, we identified 21 automakers with the potential to become first movers in adopting green steel. They include six Chinese automotive groups, two multinationals, and eight Sino-foreign joint ventures.

Green steel demand could reach more than 12% of auto industry total by 2030.

Carmakers that have both clear targets for reducing Scope 3 emissions and robust per-vehicle profit margins are in the best position operationally to lead the shift to green steel. By 2030, ARE projects demand for green steel in passenger vehicles will reach to between 4.7 to 7 million tonnes by 2030. That compares with the auto industry's total estimated steel consumption of 56.2 million tonnes by the same year.[14]

Figure 10: Potential 2030 Auto Industry Green Steel Demand by Company ('000s of tonnes)



Source: ARE analysis, with inputs from Automakers' annual and ESG reports, 盖世汽车资讯

Note: The "Base demand" scenario represents calculating green steel demand as 20% of the total steel demand by 2030, while the "Ambitious" scenario adds an additional 10% demand on top of the base demand.

Methodology

Most automakers calculate steel consumption based on total vehicle weight and the assumed proportion of steel in each vehicle (typically 70% of total vehicle weight). Some carmakers disclose total steel consumption by volume or intensity. Since specific sales volumes for different vehicle types (SUVs, hatchbacks, crossovers, convertibles, sedans, etc.) are often difficult to obtain in China, we calculated each automaker's estimated steel consumption by multiplying its total vehicle sales by an average vehicle weight.

Many carmakers have set targets to reduce their Scope 3 emissions by 20%-30% by 2030. We therefore assumed that by 2030, green steel could account for 20%-30% of their total steel consumption. Our calculation of potential green steel demand by 2030 also considered growth in overall steel consumption alongside total growth in automobile sales from a base year of 2022. For that growth rate,

we used the 3% estimated annual growth rate for car sales forecast by Wang Qing, Deputy Director of the Market Economy Research Institute of the State Council Development Research Centre.

The First Movers

Beijing Benz Automotive, Germany’s BMW Group, Chery Automobile, and Great Wall Motors have all announced agreements to either develop or start buying green steel from Chinese steel companies.

General Motors and Ford have joined the First Movers Coalition buyers ’club and committed to purchasing at least 10% of their steel from near-zero sources by 2030, while Baosteel and Beijing Benz have signed an MOU to create a green steel supply chain (see Figure 11).

Volvo Cars, a listed subsidiary of Geely Auto, was the first automaker to join the SteelZero initiative, pledging to procure 100% fossil-free steel by 2050. It has not, however, made any commitments to buy green steel from Chinese manufacturers.

Figure 11: China Automakers' Commitments to Green Steel

Automaker	Steel Company Partner	Type of Agreement	Terms	Technology
Great Wall Motors	HBIS Group	Strategic cooperation	• Will jointly build a green, low-carbon industrial chain.	N/A
Chery Automobile	BaoSteel	MOU	• Will create a green, low-carbon steel supply chain. • In 2024, BaoSteel will provide low-emission steel with 30% reduced emissions (BeyondECO®-30%). • In 2026, BaoSteel will provide green steel with 50% reduced emissions (BeyondECO®-50%). • Subsequently, BaoSteel will provide low-emission steel with 80% reduced emissions (BeyondECO®-80%).	Hydrogen-based vertical furnace
Beijing Benz Automotive	BaoSteel	MOU	• Will create a green steel supply chain. • In 2023, BaoSteel began providing low-carbon steel with significantly reduced emissions. • From 2026, BaoSteel will use H2-DRI-EAFs to provide steel with 50%-80% reduced emissions. • Subsequently, BaoSteel will provide green steel with 95% reduced emissions.	Hydrogen-based DRI-EAF
BMW Group	HBIS Group	MOU	• Will create a green steel supply chain. • From mid-2023, HBIS began providing steel with 10%-30% reduced emissions to BMW's Shenyang factory. • From 2026, HBIS will provide green steel to BMW'S Shenyang factory. • This green steel, based on such processes as green electricity and EAFs, will gradually produce steel with 95% less emissions.	Hydrogen-based DRI-EAF
N/A	Beijing Shougang	MOU	• From 2025, Beijing Shougang will provide steel with a 50% scrap ratio, reducing carbon emissions by over 40% from 2020 levels. • From 2026, Beijing Shougang will provide EAF-produced automotive steel, allowing further carbon reductions From 2030, Beijing Shougang will provide steel with a 80% scrap ratio, reducing carbon emissions by over 70% from 2020 levels.	Scrap based EAF
Volvo Cars	N/A	Future procurement commitments	• Joined SteelZero Initiative • Pledged to buy 100% fossil-free steel by 2050 • Pledged to by 2030 buy 50% of its steel from suppliers with emissions-reduction pathways and science-based targets for reducing emissions • Pledged to buy 50% low-carbon steel by 2030	N/A

Property Developers/Construction Companies

- Green building certification will increasingly incentivise developers to switch to green steel.
- Some buyers are already willing to absorb 'green costs' for premium buildings in major Chinese cities.
- Industry fragmentation means collaboration is required to spur green technology investment by steelmakers.
- Demand could rise to 1.4m-2.7m tonnes by 2030.

The Industry Landscape

Property developers are increasingly committing to 'green' buildings…

Despite the financial challenges in real estate, property developers in China are increasingly constructing "green" and sustainable buildings as part of their commitment to help the country decarbonise, as well as appeal to environmentally or energy/cost conscious buyers and tenants.

…but have largely overlooked Scope 3 emissions so far.

To date, they have primarily been buildings that use more efficient construction equipment and consume less energy. The Scope 3 emissions involved in producing raw materials such as steel have been largely overlooked, even though this embodied carbon is one of the largest sources of emissions in a building's lifecycle.[15] But as developers become more eager to attach green-building certifications to their projects, that will need to change.

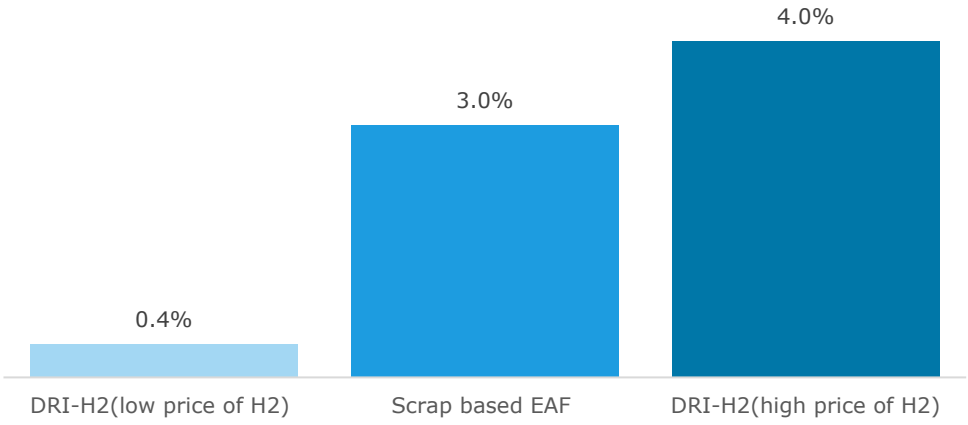
This may start to change as developers chase international certifications.

All the main international certifications—the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED), the U.K. Building Research Establishment's Building Research Establishment Environmental Assessment Method (BREEAM), the International Finance Corp.'s EDGE, and the U.S.-based International Living Future Institute's Zero Carbon Certification—include embodied carbon as a criterion, and using green steel is an effective means of reducing that carbon.

China's big-city markets are already willing to absorb green premiums…

Green steel may cost more, but steel is only a small percentage of a building's construction costs, and the China market has proven willing to absorb the premium. "Green" grade-A office space already commands a premium in China's major cities, ranging as high as 7% in Beijing, 8% in Guangzhou, and 10% in Shanghai.[16]

Figure 12: Projected Increase in Construction Costs Using Green Steel (2030)



Source: ARE analysis, with inputs from 国盛证券. 原材料价格上涨对建筑行业影响几何

…and regulators are starting to get onboard.

Regulators may soon accelerate the trend, making green steel a mandatory part of green building classification. The Ministry of Housing and Urban-Rural Development conducted a public consultation in 2023 on broadening its green-building standards to calculate a building's carbon intensity over its entire lifecycle rather than by floor area.[17] The ministry also held a public consultation on a new "Technical Standard for Zero-Carbon Buildings" that would place a cap on a building's embodied carbon.[18]

Industry's carbon intensity makes transition essential…

This would be an important step. Carbon emissions from China's construction industry accounted for about half of the country's total in 2020.[19] Even though demand for steel from China's developers is declining amid a property market downturn, transitioning to green steel can play a significant role in helping the industry and the country meet its emissions targets.

…but market fragmentation means collaboration is needed.

To reach that point, some degree of industry collaboration is likely to be necessary. The property sector is much more fragmented than the automotive industry, with the top 10 companies by sales in 2022 accounting for only 16% of the market. This makes it more difficult for industry leaders to generate the kind of clear demand signals steelmakers need to justify a shift into green production.[20]

A buyers' club or industry alliance may be needed to aggregate demand.

Developers typically don't buy their steel directly from manufacturers, making purchases instead through contractors that sell to multiple construction companies. An industry alliance or buyers' club, like the initiatives already set up in the auto industry, may therefore be

needed to aggregate demand and send a signal to steelmakers. This in turn could lead to more binding offtake agreements with steelmakers, especially those that are currently weighing the feasibility of investing in green steel facilities. Steel companies may also use company pledges as an indicator of future demand.

These types of alliances can help identify potential early green steel buyers and provide them with a useful platform for pursuing common concerns about sustainability. By adding procurement commitments as a condition of membership, such alliances could provide steelmakers with a vital demand signal in advance of individual members signing binding purchase agreements.

International agreements could act as a model for Chinese companies.

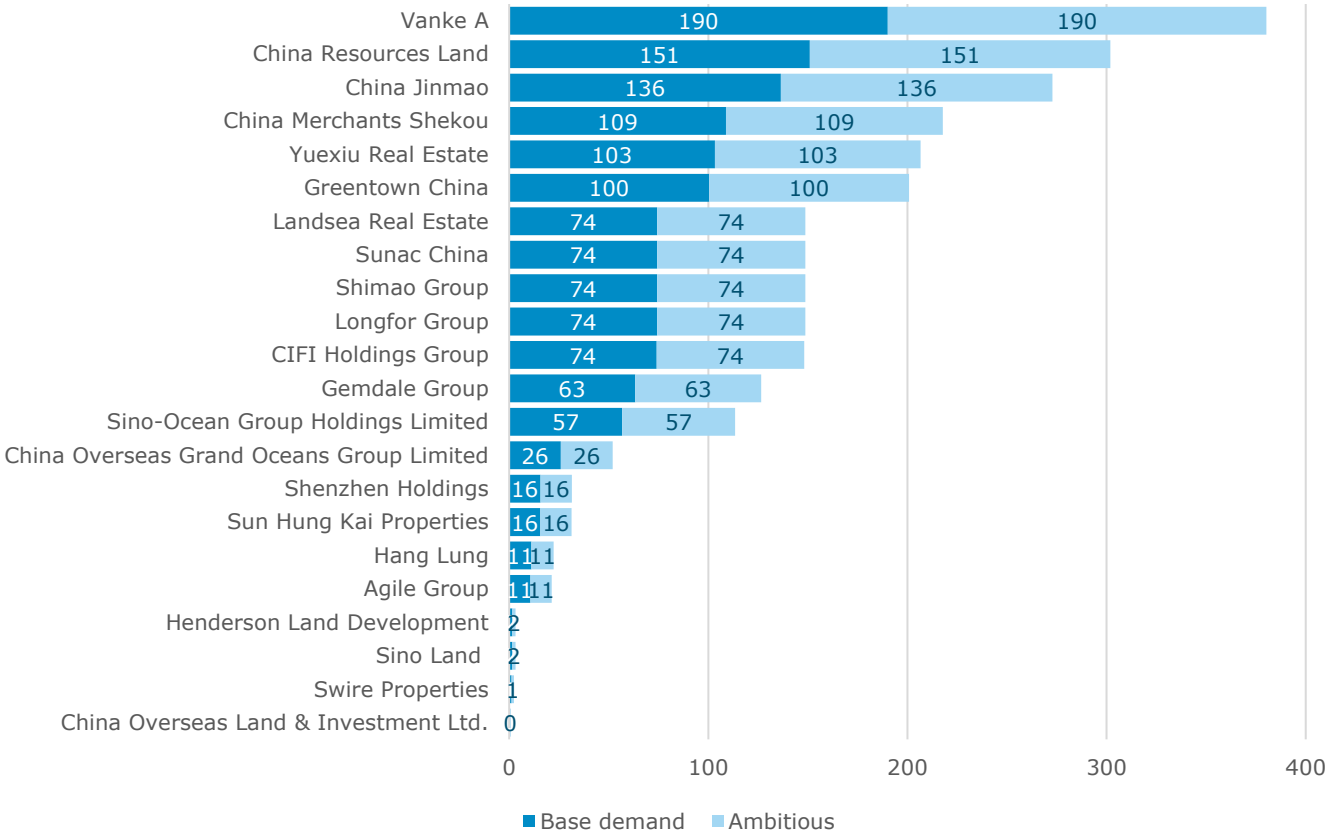
This is already happening in some countries. Late in 2023, a group of steel-consuming companies including Microsoft, Volvo, solar service provider Nextracker, and property company Trammell Crow joined RMI's new Sustainable Steel Buyers Platform, which aims to place a combined order for up to 2 million tonnes of "near-zero emissions" steel.[21] To date, there have been no equivalent moves in China.

Potential Demand from Leaders

Our report identifies 16 likely first movers.

We evaluated China's 43 listed real estate developers, both for residential and commercial buildings, and found 16 likely early green-steel buyers. By 2030, we calculate that combined annual green steel demand from these developers could rise to between 1.4 million tonnes and 3 million tonnes. (Data on current demand is unavailable.)

Figure 13: Potential Demand for Green Steel in 2030 (by developer, thousands of tonnes)*



Source: ARE analysis, with inputs from Real Estate companies' annual and ESG reports
Note: The "Base demand" scenario represents calculating green steel demand as 10% of the total steel demand by 2030, while the "Ambitious" scenario adds an additional 10% demand on top of the base demand.

Methodology

Property developers estimate steel usage by multiplying newly initiated construction area with an average value for consumption of steel rebar of 85kg/m^2.[22]

We assume that the average proportion of green steel consumption in 2030 will rise to between 10% and 20% of total steel usage. Only 14 of the 22 construction companies analysed for this report disclosed new construction area for 2022. So, we have used the average new construction area of these 14 companies, applied the projected -3.1% year-on-year growth rate for newly initiated real estate construction from 2023 to 2030 and, from that, calculated potential demand for green steel.

The First Movers

Hang Lung Property is the only committed green steel buyer to date...

Only one property company had made a green steel commitment at the time of writing. Hong Kong-headquartered Hang Lung Property joined non-profit Climate Group's SteelZero initiative in 2023, the only Asian company to do so. As part of its membership, Hang Lung pledged to use low-emission steel for half its needs by 2030 and has set a target to use only net-zero steel by 2050.[23] Hang Lung provides a breakdown of its embodied carbon emissions that shows steel is the largest contributor.

...though other developers have set Scope 3 emissions targets...

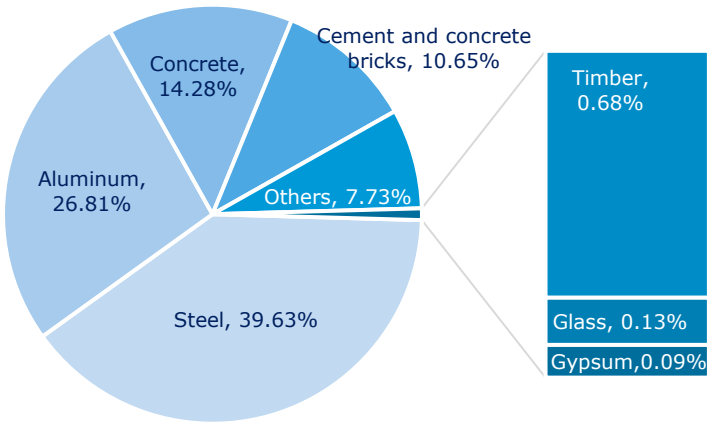
Some Chinese property developers have also adopted targets for reducing Scope 3 emissions. Landsea Green Management, for instance, has pledged to achieve Scope 3 carbon neutrality by 2030.

These companies are likely to be the first to start procuring green steel. Those large enough to set conditions for suppliers can go further by publishing deadlines for using a minimum proportion of green steel. Alternatively, they can offer incentives in tenders to contractors that prioritise low-emission materials in their bids.

...and more than 100 firms have joined a green supply chain action group.

Alliances to promote sustainable procurement do already exist in China. For example, more than 100 property companies and their suppliers have joined the "Green Supply Chain Action in the Real Estate Industry."[24] This initiative is primarily focused on evaluating green practices at suppliers of aluminium, cement, steel, and other products associated with environmental pollution, though it does not set clear criteria for "green" materials or make any specific commitments to buy them.

Figure 14: Hang Lung Properties Building Material's Embodied Carbon Emissions in 2023



Source: Hang Lung Properties Sustainability Report 2023

Renewable Energy Producers

- Green steel production offers a significant potential market for renewable energy companies.
- No clean energy companies currently exploring green steel agreements.
- Higher cost of green steel has a minimal impact on LCOE over lifetime of wind turbines.
- Green steel demand can reach 1m tonnes by 2030.

Industry Landscape

There is a hidden environmental cost to China's renewable energy leadership…

Though China leads the world in renewable energy production, there is a hidden environmental cost. Building two-thirds of the planet's total wind and solar projects and generating an estimated 1,200 gigawatts[25] (GW) of renewable power requires a lot of steel.

Steel constitutes 60% of a wind turbine's weight, and accounts for half of the embodied carbon in a wind-generated power plant.[26]

…even though there is minimal long-term economic cost to using green steel.

For a 15 megawatts (MW) offshore wind turbine, switching to green steel could raise costs by more than $500,000 (using DRI-$H_2$ technology with high-priced, low-carbon hydrogen). While the premium may seem significant, the impact on the LCOE over the expected 20 to 25-year[27] lifetime of a turbine is minimal, at about 1%.

Renewable power companies in China are missing an opportunity to reduce impact…

For renewable energy producers, the higher cost of using green steel can be justified, as it aligns with their role as subsidised producers of clean power and bastions of the low-carbon economy. That mission is largely accomplished by reducing the Scope 1 and Scope 2 emissions from the thermal power they replace. Going a step further to reduce Scope 3 emissions using green steel would be consistent with their purpose and increase their impact.

…and supply clean power to the steel industry.

Decarbonising steel also requires a lot of green electricity. The renewables companies have a major new opportunity to supply clean power to the steel industry.

The main challenge is that, compared with automotive OEMs and real estate developers, it is more difficult for renewable energy producers to pass the green steel premium further downstream.

But clean power companies have minimal scope to pass costs onto consumers…

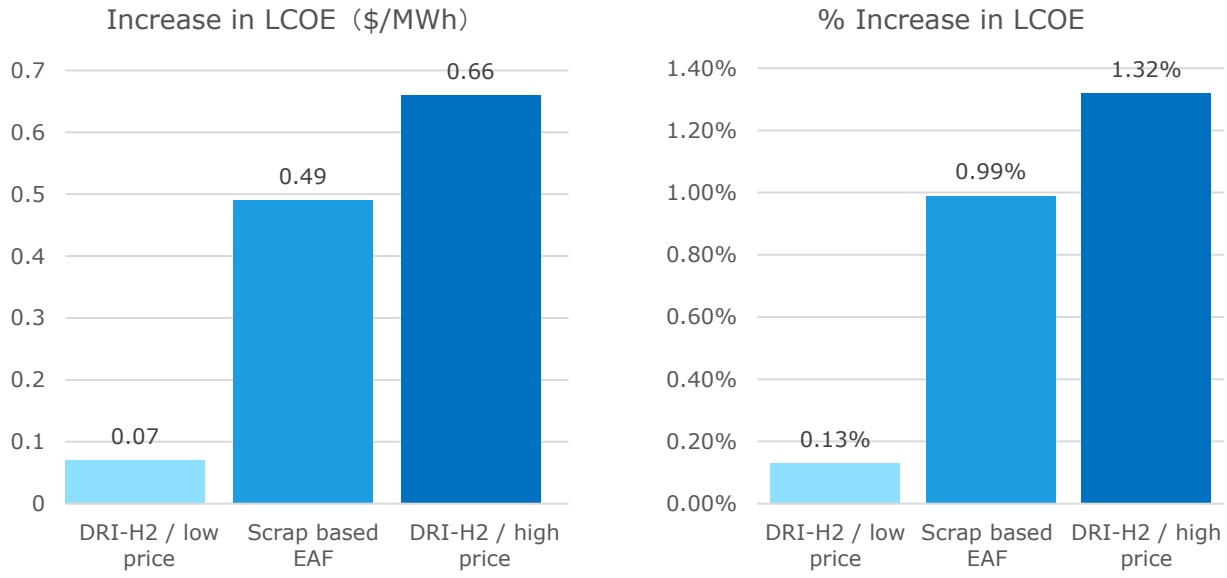
In China, renewable energy electricity generation is divided into two channels: guaranteed procurement and market-based consumption. Under the guaranteed procurement mechanism, the government purchases renewable energy at a price benchmarked to the cost of coal-fired power, which prevents any higher costs being passed on to downstream users.

For medium- to long-term agreements, the electricity price cannot exceed the benchmark price (which is the coal benchmark price multiplied by different time coefficients), while spot market prices are based on marginal costs. Therefore, any increase in capital expenditure from using green steel is unlikely to lead to higher end-user electricity prices.

…and so far show little interest in tackling supply-chain emissions.

In addition, renewable energy companies in China seem relatively unconcerned about tackling emissions in their value chain, despite the key role they play in the low-carbon economy. They also face little pressure to do so, compared with other industries.

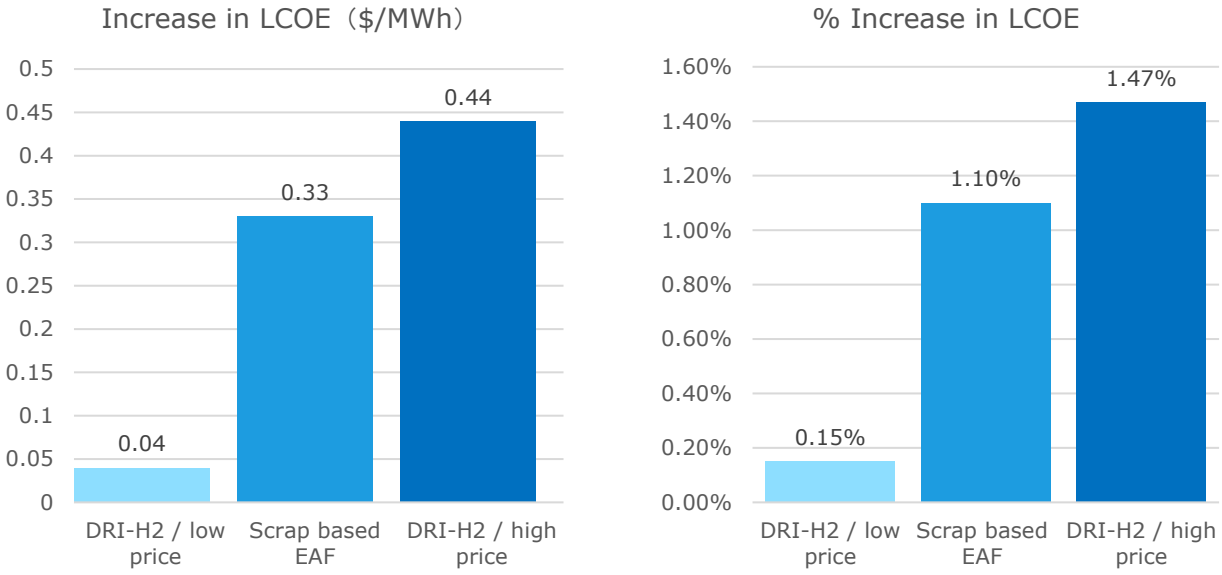
Figure 15: Projected Increase in Offshore Wind Power LCOE Using Green Steel (2030)



Source: ARE analysis, with inputs from U.S. National Renewable Energy Laboratory 2021 Cost of Wind Energy Review; 华创证券. 风电设备行业深度研究报告：风电产业链全面分析;国海证券,御"风"而行，风电发展下的大宗商品

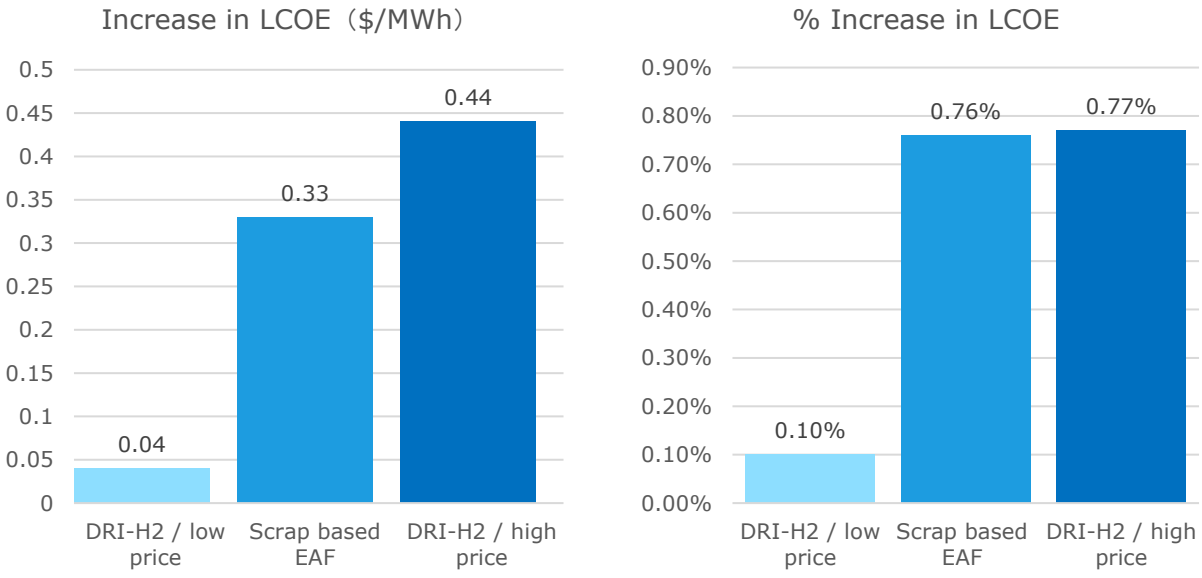
Note: The calculation assumes that average size of offshore wind turbines being installed by 2030 will be 15 MW, and the turbine that uses 2,850 tonnes of steel, has a lifetime electricity generation of 937,500MWh. The percentage increase assumes that the LCOE for an offshore wind turbine is $50/MWh.

Figure 16: Projected Increase in Land-Based Wind Power LCOE Using Green Steel (2030)



Note: The calculation assumes that average size of onshore wind turbines being installed by 2030 will be 10 MW, and the turbine that uses 1,200 tonnes of steel, has a lifetime electricity generation of 625,000 MWh. The percentage increase assumes that the LCOE for an offshore wind turbine is $30/MWh.

Figure 17: Projected Increase in Solar Power LCOE Using Green Steel (2030)



Source: CPIA; 北极星太阳能光伏网

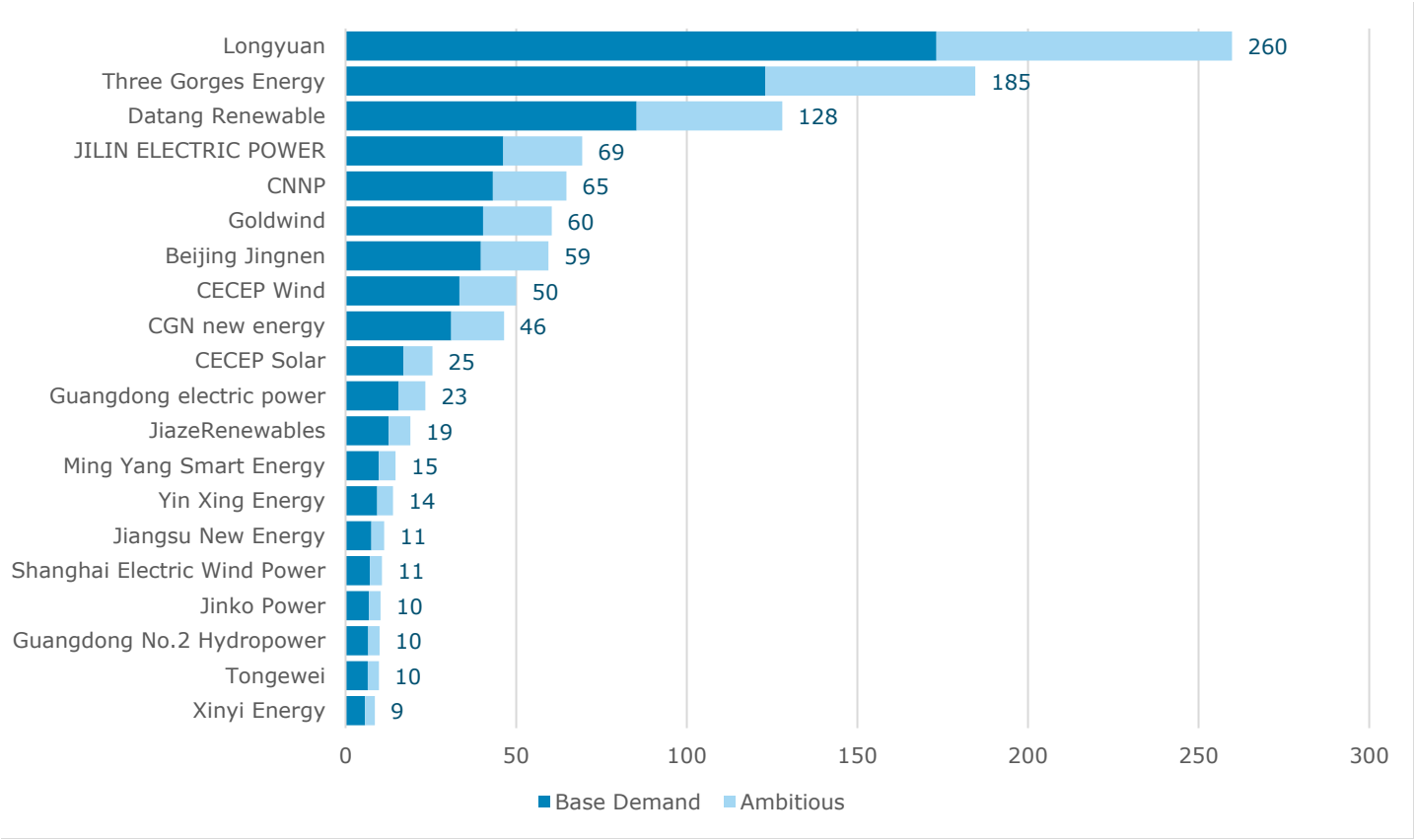
Note: The calculation assumes that a solar power project consumes 38 tonnes of steel per MW, has 1,500 full-load hours per year, a lifetime of 25 years, and an LCOE of $30/MWh.

Demand from China’s renewable energy sector could reach 1 million tonnes by 2030.

Potential Demand from Leaders

At the time of writing, no renewable energy producers in China have made agreements to use green steel. We reviewed 21 of China’s largest dedicated renewable energy developers. If they adopt green steel sourcing for 20% to 30% of supply, then green steel demand from these companies could rise from zero currently to between 720,000 tonnes to 1 million tonnes by 2030.

Figure 18: Potential 2030 Green Steel Demand from Renewable Energy Developers (’000s of tonnes)



Source: ARE analysis, with inputs from dedicated renewable energy developers’ annual and ESG reports
Note: The demand for green steel here is primarily for the green steel required for self-operated renewable energy farms.
Note: The "Base demand" scenario represents calculating green steel demand as 20% of the total steel demand by 2030, while the "Ambitious" scenario adds an additional 10% demand on top of the base demand.

Methodology

Steel consumption for wind and solar power is measured by the intensity of steel usage, which is expressed as a ratio of the weight of steel used to build 1MW of generating capacity.

Figure 19: Steel Consumption Intensity in Renewable Energy

Energy Source	Steel consumption (tonnes/MW)
Onshore wind	124
Offshore wind	190
Solar	38

Source: ASI, 华泰期货研究院, Per F. Peterson, Haihua Zhao, etc.

COP28 committed to tripling the installed capacity of renewable energy by 2030. Using 2022 as a base, reaching that target will require a 15% annual increase in total installed capacity. We therefore assumed that each wind and solar company would increase its installed capacity at this rate. Such a rapid build-out will require a substantial increase in demand for steel.

No renewable energy companies have adopted targets for reducing Scope 3 emissions, so unlike the automotive and construction industries there is no domestic benchmark. Instead, we used as the lower bound the First Movers Coalition's 10% minimum requirement for members' 2030 purchases of near-zero steel, and 30% for the upper bound.

The First Movers

Incentives and targets are needed to send clear demand signal to steel producers.

Like property developers, renewable energy companies typically don't purchase their steel directly from producers. Lowering their Scope 3 emissions and sending a clear demand signal to the steel sector will require that they make their preference for green steel clear to suppliers. They could do this by setting carbon reduction targets for their value chains, providing incentives for green steel producers in procurement tenders, and by setting targets for green steel usage in individual projects.

They could also form partnerships with suppliers that commit to purchasing and using a minimum percentage of green steel in joint projects. For instance, Danish wind farm operator Ørsted and wind

turbine maker Vestas have agreed to incorporate at least 25% low-carbon steel into the towers of future joint offshore wind projects.

International partnerships could act as a model for China.

Renewable energy developers could collaborate with steel producers. For instance, they can establish long-term reciprocal arrangements in which they buy green steel produced using their own electricity and electrolytic hydrogen. They could similarly work with suppliers to increase the green steel share of components made with steel.

There are international precedents that may inspire domestic Chinese initiatives. In Europe, turbine manufacturer Vestas and steelmaker Arcelor Mittal have agreed a partnership to use low-emission steel made with 100% scrap in onshore and offshore wind turbines, resulting in emissions reduction of 25-50% over each turbine's lifecycle.[28]

Several other projects in Europe – for example Hybrit[29] and Stegra[30] (formerly H2 Green Steel) – are aiming to replace fossil fuels with green hydrogen in the steel production process, using only electricity from renewable sources. The first commercial plants from these projects are expected to come online in 2030.[31]

Vital Next Steps

Transforming Potential into Firm Demand Signals

Non-conventional steel needs to reach 25% of total China steel production by 2030.

While leading steelmakers are putting transition plans in place, green steel adoption will need to accelerate if China is to achieve its goal of reducing emissions significantly and reaching net-zero emissions before 2060. According to three separate independent projections that align with a 1.5-degree pathway, non-coal or coke based BF-BOF steel needs to make up between 25% and 40% of China's total steel production by 2030 (See Figure 7).[32] Over the next five years, converting potential early-mover demand into actual demand, such as through offtake agreements—even if these early movers represent only about 1% of total demand—could be critical to driving broader adoption.

Demand is most likely to come from large, profitable companies.

According to our analysis, initial demand for green steel will most likely come from large, profitable steel-consuming companies with a clear commitment to decarbonisation. Whether there will be supply to meet that demand depends on buyers communicating clear signals of intent to steelmakers that will give them the confidence to invest in developing and commercialising large-scale green steel production.

For companies in industries with a multitude of stakeholders, such as property development, forming an alliance to negotiate collective procurement agreements for green steel could be the best way to signal demand at scale.

Financing models could secure supply deals.

Buyers could also secure green steel supplies—and reduce the overall cost to the entire industry—by offering financing to steel suppliers. In 2021, for example, Mercedes-Benz bought an equity stake in Swedish start-up H_2 Green Steel to secure production and delivery of carbon-free steel.[33] In 2023, the two companies signed an agreement for H_2 to supply the carmaker with 50,000 tonnes a year of almost CO_2-free steel.[34]

Investing in green steel production in this way could secure resources, accelerate companies' carbon reduction plans, and lock in a supply of low-carbon products specific to their needs.

Financial Institution Support for Green Steel Procurement

Banks could also support green steel with sustainability linked loans.

Investors and lenders can engage continuously with potential green-steel buyers to stimulate support for the shift. They can encourage buyers to transform early and hasten the conversion of indirect demand signals into binding offtake agreements and future purchase commitments.

When investors engage with company management, it is essential that they communicate their expectation that the company reduce Scope 3 emissions and use green steel. Banks and other creditors should support green steel purchases with sustainability-linked loans and bonds that provide lower interest rates and other financial incentives and solutions.

Hebei province leads by issuing guidelines for preferential financing of low-carbon steel.

China's Hebei province, which produces 11% of the world's steel[35], is already putting in place measures to encourage financial institutions to do just that. Earlier this year, the People's Bank of China's Hebei Branch, in collaboration with seven other provincial government departments,[36] issued "Financial Guidelines for the Transformation of the Hebei Steel Industry."[37] The guidelines support green steel purchases with a three-step process:

1. Enterprises submit purchase orders for low-carbon emission steel products to financial institutions.
2. Financial institutions provide working-capital loans financing the purchase, at preferential interest rates.
3. Enterprises disclose the intended use of the low-carbon emission steel products to the financial institutions.

Figure 20: Private and Financial Sector Roles in China's Green Steel Transition S-curve

Phase	1. Solution Search	2. Proof of Concept	3. Early Adoption	4. System Integration	5.Market Expansion
Participants	Visionaries	Innovators	Early Adopters	Early & Late Majority	Laggards
Private sector progress	Chinese steel companies have plans for low-carbon steel production and investments in R&D.	• Chinese steel companies have launched pilot projects on blending hydrogen in blast furnaces, H_2-based DRI, and hydrogen plasma smelting reduction. • Some steel companies have inked agreements to collaborate with customers in creating green supply chains, e.g., Great Wall Motors and HBIS Group.	• Niche markets have been established and offtake agreements have been reached. But volumes remain only a small percentage of overall steel consumption and demand signals remain uncertain. • The green premium remains relatively high, but early adopters are willing to pay.	Not yet reached this phase	Not yet reached this phase
Financial sector progress	Bank of China and China Construction Bank have established a transition finance framework, which includes standards for supporting green steel.	• There are no financial products supporting green steel production or purchasing of green steel. • Venture capital and private equity to emerging steel companies remains scarce.	Not yet reached this phase	Not yet reached this phase	Not yet reached this phase

Source: Deloitte, RMI, Systems Change for a Sustainable Future Rethinking corporate climate action in an era of rapid disruption

Conclusion

To identify the most likely early adopters, we focused on three industries that have a clear rationale for lowering supply-chain emissions and whose steel usage accounts for a significant proportion of their Scope 3 emissions.

Top-tier carmakers lead demand for green steel; developers are likely to follow.

Automotive sector leaders are already providing steelmakers with a clear demand signal for green steel thanks to several prominent offtake agreements, strategic cooperation agreements, and commitments for future procurement. The earliest green steel demand is most likely to come from top-tier carmakers able to absorb the higher cost.

To meet emissions reduction targets, automakers will need to purchase significant amounts of green steel on a scale that can stimulate investment in low-carbon steel technologies and hasten the steel industry's transition.

Property sector can also be an important source of green steel demand.

We also believe the property sector can be a key source of demand for green steel, as developers seek ways to reduce embodied carbon in their projects and offer green buildings that command a market premium.

For renewable power companies, the global goal to triple capacity also means accelerating steel consumption. These firms, particularly wind power companies that use a lot of steel, need to address their own footprints. While the cost premium for green steel is not that significant over the full life of a wind power development, the market structure does not allow companies to recoup higher costs. However, renewable power companies will have a huge opportunity to provide clean energy to the steel industry and we believe they should work to develop this market and to clean their supply chain.

Appendix

Figure 21: China Potential Green Steel Demand 2030, by company (ranked by '000s of tonnes in potential demand by 2030)

Company (中文)	Company (EN)	Industry	Total Steel Demand, 2022	Total Steel Demand, 2030	Green Steel Demand, 2030 (min.)	Green Steel Demand, 2030 (max.)
比亚迪	BYD Auto	Auto	1,954	2,475	495	743
一汽大众	FAW-Volkswagen	Auto	1,915	2,426	485	728
吉利	Geely Automobile	Auto	1,505	1,906	381	572
长安	Changan Automobile	Auto	1,450	1,836	367	551
上汽大众	SAIC Volkswagen	Auto	1,387	1,757	351	527
特斯拉	Tesla Motors	Auto	1,379	1,747	349	524
上汽通用	SAIC-GM	Auto	1,229	1,556	311	467
奇瑞	Chery Automobile	Auto	1,170	1,482	296	444
长城	Great Wall Motors	Auto	1,115	1,412	282	424
广汽丰田	GAC Toyota	Auto	1,055	1,337	267	401
万科 **A**	Vanke A	Real Estate	2,426	1,901	190	380
东风日产	Dongfeng Nissan	Auto	860	1,089	218	327
华润置地	China Resources Land	Real Estate	1,926	1,509	151	302
中国金茂	China Jinmao	Real Estate	1,740	1,364	136	273
东风本田	Dongfeng Honda	Auto	685	868	174	260
龙源电力	Longyuan	Renewable	345	866	173	260
吉利沃尔沃	Geely-Volvo Cars	Auto	646	818	164	245
北京奔驰	Beijing Benz	Auto	621	787	157	236
招商蛇口	China Merchants Shekou	Real Estate	1,389	1,089	109	218
越秀地产	Yuexiu Real Estate	Real Estate	1,318	1,033	103	207
绿城中国	Greentown China	Real Estate	1,281	1,004	100	201
华晨宝马	BMW Brilliance	Auto	486	615	123	185
三峡能源	Three Gorges Energy	Renewable	286	615	123	185
龙湖集团	Longfor Group	Real Estate	949	743	74	149
世茂集团	Shimao Group	Real Estate	949	743	74	149
融创中国	Sunac China	Real Estate	949	743	74	149
朗诗地产	Landsea Real Estate	Real Estate	949	743	74	149
旭辉控股集团	CIFI Holding Group	Real Estate	945	741	74	148
广汽乘用车	GAC Passenger Vehicle	Auto	381	482	96	145
大唐新能源	Datang Renewable	Renewable	106	427	85	128
金地集团	Gemdale Group	Real Estate	808	633	63	127
远洋集团	Sino-Ocean Group Holdings Limited	Real Estate	724	567	57	113

广汽埃安新能源	GAC Aion New Energy	Auto	285	361	72	108
长安福特	Changan Ford	Auto	264	334	67	100
吉林电力	JILIN ELECTRIC POWER	Renewable	144	231	46	69
中国核电	CNNP	Renewable	284	216	43	65
金风科技	Goldwind	Renewable	17	201	40	60
京能清洁能源	Beijing Jingnen	Renewable	136	198	40	59
中海宏洋	China Overseas Grand Oceans Group Limited	Real Estate	331	260	26	52
中节能风电	CECEP Wind	Renewable	-	167	33	50
中广核新能源	CGN new energy	Renewable	76	155	31	46
长安马自达	Changan Mazda	Auto	109	138	28	41
深圳控股	Shenzhen Holdings	Real Estate	201	157	16	31
新鸿基地产	Sun Hung Kai Properties	Real Estate	200	157	16	31
中节能太阳能	CECEP Solar	Renewable	108	85	17	25
广东电力	Guangdong electric power	Renewable	55	78	16	23
恒隆地产	Hung lung	Real Estate	142	112	11	22
雅居乐集团	Agile Group	Real Estate	136	107	11	21
奇瑞捷豹路虎	Chery Jaguar Land Rover	Auto	51	65	13	20
嘉泽新能	JiazeRenewables	Renewable	39	63	13	19
明阳智能	Ming Yang Smart Energy	Renewable	40	49	10	15
银星能源	Yin Xing Energy	Renewable	-	46	9	14
江苏新能	Jiangsu New Energy	Renewable	-	38	8	11
上海电气风电	Shanghai Electric Wind Power	Renewable	1	36	7	11
晶科科技	Jinko Power	Renewable	28	34	7	10
开瑞汽车	Karry Automotive	Auto	27	34	7	10
粤水电	Guangdong No.2 Hydropower	Renewable	22	33	7	10
通威	Tongewei	Renewable	28	33	7	10
信义能源	Xinyi Energy	Renewable	20	29	6	9
恒基兆业	Henderson Land Development	Real Estate	21	16	2	3
信和置业	Sino Land	Real Estate	20	16	2	3
太古地产	Swire Properties	Real Estate	15	12	1	2
智马达汽车	Smart Motor Automobile	Auto	5	6	1	2
中海	China Overseas Land & Investment Ltd.	Real Estate	5	4	0	1

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