Appendix C: Narrative scenarios for the United States

Scenarios for the global steel transition

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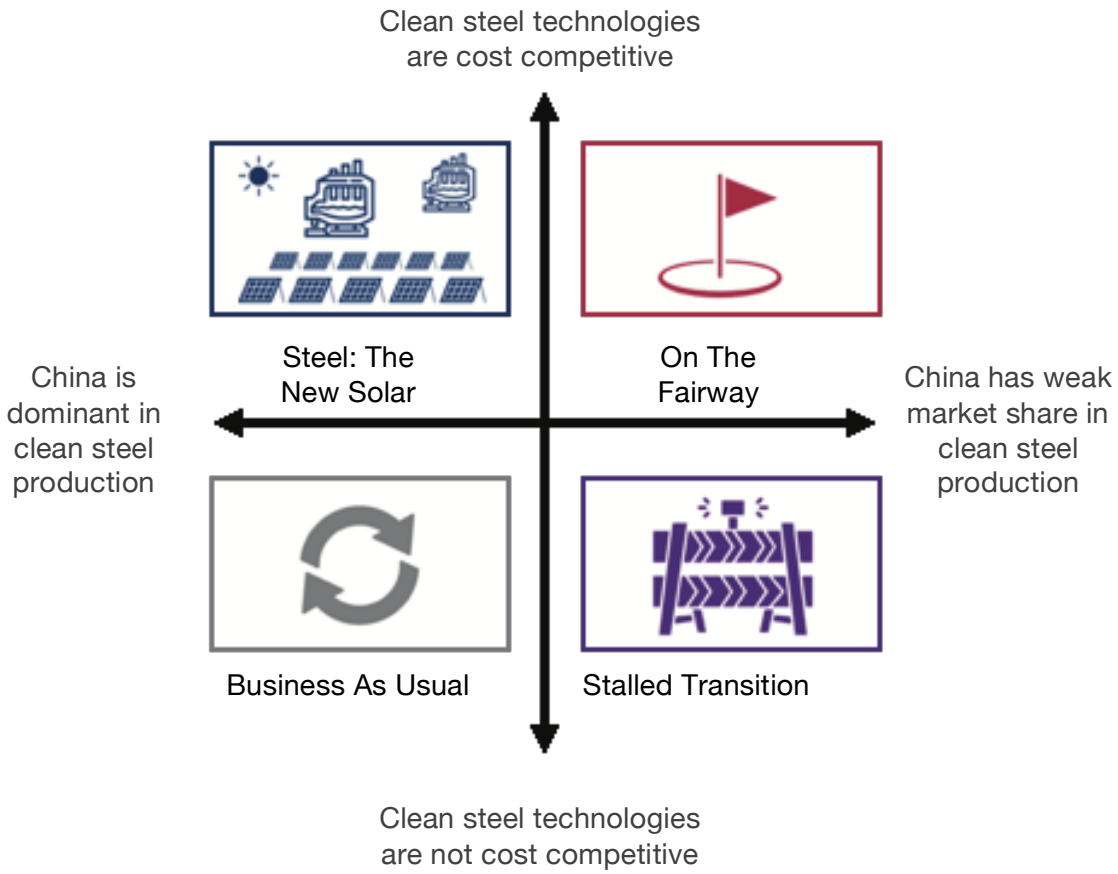

On The Fairway

On The Fairway describes a future where clean steel technologies are cost competitive and China has weak market share in clean steel production. America's desire to be at the forefront of innovation has driven long term investment in low carbon technologies. Washington has forged a coalition with other producers to align standards for low and near-zero emission steel and to impose tariffs on high-emission imports.

China has not invested in clean steel technologies or standards and is locked out of the trade flows shaping the high-value global economy. The US steel industry enjoys first-mover advantage and has no intention of letting its advantage slip.

Teeing up

Back in 2025, the idea that the United States could dominate the clean steel market sounded like wishful thinking. Certainly, the US had vast scrap-EAF production, but hydrogen DRI was

expensive and MOE was unproven. Moreover, the BF-BOF workhorses that had run the industry for a century were still reliable and still consistently producing steel at $550–$600 a tonne – while it was around 65% more expensive to use near-zero emission routes. Most analysts were firmly of the view that the *status quo* would remain for some time to come.

Most analysts, however, underestimated America's desire to be at the forefront of innovation.

Motivated by strategic competition with China, the US doubled down on long-term research and development. Although conventional renewable energy technologies faced political headwinds under changing administrations, cross-party support for innovation in strategic clean technologies held firm. Private investment flowed into developing the technologies underpinning MOE, as well as advanced nuclear and geothermal power. Development funding for blue hydrogen technologies came in close behind. Investors enjoyed early returns.

The US Department of Energy (DOE) and Department of Commerce (DOC) mobilised for scale up, launching multi-billion dollar funding rounds for pilot and first-of-a-kind plants in hydrogen DRI and MOE alongside grants for advanced scrap sorting and processing. These were paired with tax credits and loan guarantees to de-risk private investment.

There remains some debate today about which actors – industry, investors or administration – were the main catalyst of the US transition. There is, however, no debate at all about its impact: America bet on its innovation prowess and, in doing so, rewrote its own industrial story.

Driving forward

The US understood from the start that pouring capital into R&D would not be enough to beat the competition. Seeking to both isolate China for what it saw as unfair market practices and to maximise the rewards from its growing competitive advantage in clean steel, Washington used trade policy to reshape market conditions. Working with the EU, Japan, South Korea and Canada, Washington forged a coalition that aligned carbon accounting rules, agreed new standards for low and near-zero emission steel and imposed tariffs on high-emission imports.

The coalition created a protected premium market for clean steel across advanced economies. China objected strongly but was diplomatically isolated. With its own move to clean steel production held back by complicated domestic politics, China saw an opportunity to double down on conventional steel production and exports. Beijing kept its BF-BOF fleet running and strengthened its exports to meet demand.

Excluding Chinese producers from high-value markets gave the coalition's mills the breathing space they needed to scale up clean technologies without being undercut. Confidence fed investment, investment drove competitiveness, and a virtuous cycle of growth in market share and jobs followed.

Going for the green

2031 was a big year for technological change in the US steel industry. A decade of concentrated development finally delivered a step-change with MOE being proven to work at scale and to be replicable. Furthermore, innovation in nuclear and geothermal electricity combined with advances in electrolyser manufacturing and energy storage meant that the cost of low-emission hydrogen in the US fell below $1.50/kg.

These advances pushed both hydrogen DRI and MOE into cost parity with BF-BOF for high-grade

steel production. At the same time, the National Scrap Quality Strategy (launched in 2029 in response to industry demand) started to deliver. Automated dismantling systems, digital scrap passports, and improved alloy sorting created a reliable flow of high-purity feedstock. The economics shifted almost overnight: US producers could run EAFs on a flexible diet of upgraded scrap and clean DRI, balancing cost, quality and emissions performance.

Venture capital flowed into clean steel start-ups; incumbents raced to acquire them and retrofit plants. By 2031, the first wave of commercial-scale MOE and hydrogen DRI facilities were operational in Ohio, Pennsylvania and Texas. Blast furnaces were shuttered in favour of these routes, fed by both DRI and high-quality scrap.

Course management

Having achieved cost competitiveness, US producers turned outward, using a mix of trade protections, brand reputation and standards diplomacy to win contracts across the markets of countries in the US-led coalition, from automotive steel for German carmakers to plate for Japanese shipyards.

Washington also positioned itself as a technology exporter. Licences for American MOE designs and hydrogen integration systems were sold to producers in Brazil, Morocco, and Australia; countries with abundant iron ore and renewable energy potential but lacking in proprietary technologies. This created new diplomatic leverage, as access to American clean steel technology became a key bargaining chip in trade negotiations.

By the mid-2030s, the concept of paying a premium for clean steel had largely disappeared in advanced markets. In the early stages, data centres, prestige carmakers, and infrastructure projects were somewhat willing to pay extra to meet ESG commitments. But once cost parity was achieved, “clean” became the default — a hygiene factor rather than a luxury attribute.

In consumer-facing industries such as automotive and appliances, the benefits of lighter, stronger steel (enabled by new processes) added value in their own right — improved EV range, lower fuel use, better safety performance — further embedding clean steel in supply chains.

China falls below par

China remains the world’s largest steel producer, but has become a marginal player in clean steel, misaligned with the technologies, standards and trade flows shaping the high-value global economy.

Trade barriers and intellectual property protections have limited its ability to acquire and scale new technology quickly and, although China’s EAF capacity is large, it suffers from a relatively high average emissions intensity in the sector which the standards adopted by the US-led coalition have been designed to punish. Domestic efforts to upgrade scrap recycling trail far behind OECD peers and the industry has successfully lobbied against domestic policies that would have forced a move away from its coal-hungry blast furnaces. It has been supported by provincial governments worried about potential job losses.

This has led to major competition for new markets in now booming regions for steel demand such as Africa and Asia. While the US and OECD allies seek to export clean steel and its component technologies, China has triggered a price war by seeking to offload its higher emission BF-BOF steel at rock bottom prices.

Playing partners

Europe has been a key partner for the US in reshaping the global steel market. Building on the Green Deal Industrial Plan, Brussels backed hydrogen valleys, supported hydrogen DRI plants in Sweden, Germany and Spain and established EU-wide scrap recycling programmes. The CBAM and trade defences protected European producers, while domestic subsidies smoothed the transition until new technologies reached cost-competitiveness, ensuring guaranteed markets for low-carbon steel. Europe's automakers and infrastructure projects became anchor customers, embedding clean steel in global supply chains.

While the US led in breakthrough technologies such as MOE, Europe's strength lay in regulation, demand creation, and circularity. Together, the transatlantic economies set the rules that locked China out.

On the leaderboard

Today, the US steel industry enjoys first-mover advantage, control over its scrap supply chain and a robust export portfolio.

It's a powerful position – but there is no room for complacency. Canada, Australia, and Brazil are scaling up their own clean steel capacity, leveraging vast iron ore reserves and cheap renewable energy. If they achieve lower cost at scale, they could eat into US export markets. And while China lags, its ability to mobilise capital and industrial capacity means it could still catch up fast — as the solar panel industry learned the hard way. The US industry is alert to these threats. It has no intention of letting its advantage slip.

Steel: The New Solar

Steel: The New Solar describes a future where clean steel technologies are cost competitive and China is dominant in clean steel production. Despite being well-positioned to compete in the global race to transition to clean steel, America fails to respond when China's leadership classifies clean steel technology as a strategic national priority. US steelmakers still do well domestically but are under pressure from overseas suppliers. For US policymakers, the choice now is whether to accept this weaker position or to launch a second push.

Opportunity lost

The United States appeared well-positioned to compete effectively in the global transition to clean steel back in 2025. EAF production already dominated the US steel sector. American universities and entrepreneurs had pioneered MOE. The US remained committed to investing in politically acceptable clean energy technologies. Market forces continued to drive investment in clean technology start-ups.

But then America hesitated - and China pulled ahead.

China continues to dominate conventional steel production but is also now the undisputed leader in clean steel production. Its clean steel is now cheaper than traditional BF-BOF steel, eliminating the green premium that once slowed take up. In many markets, it is the only clean primary steel available at scale.

China has secured this position through its own actions, of course, but America's hesitation — a combination of policy drift, fragmented investment and an overreliance on market forces to solve what was always going to be a state-backed, scale-driven race – certainly cleared the path to the front of the race.

A pivotal moment

The late 2020s were a decisive window for that race. China's leadership moved quickly to classify clean steel technology as a strategic national priority on a par with semiconductors, batteries, and electric vehicles. The designation unlocked state financing on a scale Western steel-producing countries could not match.

China's state-owned enterprises began simultaneous deployment of hydrogen DRI plants and large-scale upgrades of electric arc furnaces running on high-quality scrap and clean power.

There were, of course, some concerns that closing blast furnaces could lead to job losses in the future, but these did not have to be faced immediately. The priority - investment in the new technologies needed to drive clean steel production forward – took precedence.

In 2026, China's National Development and Reform Commission mandated that all new public construction use a minimum threshold of near-zero emission steel, creating guaranteed domestic demand. By 2027, long-term renewable power purchase agreements with integrated energy storage gave steelmakers electricity that was reliable, near-zero emission, and lower cost than grid electricity in most other large economies.

Crucially, China cut the two cost drivers of hydrogen steelmaking by developing cheaper electrolysers and achieving ultra-low power costs from massive wind and solar deployment backed by long-duration energy storage. The combination delivered a structural advantage that competitors simply could not replicate.

The US response was piecemeal: fragmented policies to scale up hydrogen hubs and Carbon Capture and Storage (CCS), modest R&D grants, a political focus on tariffs over investment and a reluctance to invest aggressively in new clean power sources. Washington assumed that clean steel was only of interest to governments attempting to address climate change, ignoring the lesson that China's state-driven innovation in clean technologies could transform the economics of the sector as it had for the power and automotive sectors.

Taking the lead

By 2030, China's first generation of industrial hydrogen DRI plants had reached commercial scale. Paired with low-cost green hydrogen and upgraded scrap-EAFs, they delivered near-zero emission steel that undercut BF-BOF on cost in most markets.

China seized control of the value chain. It became the world's largest electrolyser manufacturer, secured iron ore through strategic acquisitions and partnerships, and invested heavily in downstream sectors from shipbuilding to automotive — ensuring Chinese clean steel fed Chinese-controlled industries.

On the diplomatic front, China worked hard to secure agreements with a growing number of countries that cemented new low-emission definitions and standards to enable trade in near-zero emission steel.

Chinese clean steel was increasingly attractive to emerging economies given its high quality and lower cost. Ministries in Southeast Asia, Africa and Latin America signed multi-year contracts that locked in Beijing's market share and integrated supply chains around its grades and specifications. Those countries seeking to build the competitiveness of their own steel industry entered arrangements to import Chinese clean steel technologies. As the cost-competitiveness of those technologies increased, so did countries' willingness to agree standards preventing trade in high-emission steel.

For the US, the strategic competition implications were stark. While those sectors important to national security sourced steel exclusively from domestic producers regardless of cost and emissions, others – such as construction, manufacturing and infrastructure - valued the lowest cost outputs they could source, and increasingly valued lower emissions materials for exports.

Although the US's steel had been highly competitive in the past, its position had weakened dramatically due to technological change and the spread of new standards. Efforts to build a "steel alliance" with Europe, Japan, and Australia, centred around arguments that China's approach was market distorting, met with partial success in high-value segments but had little impact on the mass market.

Still, US steel producers began to follow the leaders in the transition to new technologies, spurred on by the new quality and emissions standards set by the Chinese industry. They adopted Chinese electrolysers, deployed large-scale hydrogen DRI complexes in energy-rich states and blended domestic R&D with imported engineering know-how. Several MOE projects finally reached commercial scale, with US firms leaning on their strengths in process integration, certification, and quality assurance. American mills regained competitiveness in high-trust segments — aerospace, defence, and premium automotive — where domestic supply and quality commanded a premium.

It was a meaningful recovery, but not enough to offset China's overwhelming advantage in cost and scale.

Europe's shrinking foothold

Europe maintained influence over sustainability standards through its leverage as a large consumer and its capacity for designing regulatory frameworks, but its share of global production shrank steadily. High energy costs and fragmented national industrial policies meant European mills could not scale up near-zero emission production at the pace or cost of their Chinese counterparts.

A coalition of northern European producers attempted to maintain a premium green steel brand combining near-zero emission with high standards on labour rights and environmental pollution, targeted at automotive and high-value manufacturing supply chains. This secured niche demand in Germany, Scandinavia and Japan. Yet in construction, shipbuilding, and most mass-market applications, Chinese clean steel was the default choice.

Europe's predicament was paradoxical: it set many of the rules, but lacked the industrial weight to fulfil them globally.

Where to go from here?

China's dominance has become self-reinforcing. Clean steel has become the default commodity and Beijing's technical norms and certification schemes set global standards.

The clean steel race underscores a lesson America has learned before but forgotten - in sectors where technological change faces high initial barriers, waiting for the market to deliver can be a losing strategy. Semiconductors, aerospace, and defence all became global strengths through early, sustained and strategic public investment, before markets took over. The transition to clean steel technologies required the same approach, but Washington treated it as a secondary priority until the race was already lost.

Today, US steelmakers still matter domestically, but are under continued pressure from cheaper Chinese imports, much like in other parts of the clean energy economy. In the global market, the rules, the prices and the supply chains are set elsewhere.

For US policymakers, the choice now is whether to accept this weaker position or to launch a second push — one that recognises that in clean industrial technologies, the competition is not just about invention, but about building fast enough and big enough to set the terms for everyone else.

Business As Usual

Business As Usual describes a future where clean steel technologies are not cost competitive and where China is dominant in clean steel production. US steel producers focus on their strengths in EAF production and BF-BOF. China sees clean steel as a low risk gamble and, mobilising a small number of state-owned mills to develop commercial-scale technologies, comes to dominate the market.

Efforts to build the US clean steel sector fail to gain traction as producers argue that being a “fast follower” makes more sense than risking first-mover disadvantage. As other producers move into clean steel, there are growing concerns that the US industry will fail to keep pace.

Wait and see

In the mid 2020s, American steel producers faced a choice: invest heavily, early and at scale in still-expensive clean primary steel technologies — knowing they are not yet cost-competitive — or keep running and extending the existing BF-BOF and scrap-EAF fleets until the economics improve.

The lack of strong policy signals (carbon pricing, public procurement mandates or subsidies) meant there were simply no incentives to decarbonise. Yes, US steel remained cleaner than that of most countries in that more of it was produced via recycling in EAFs; but the electricity grid remained carbon intensive and plenty of coal was still used in BF-BOFs. And so, rather than bet on expensive, immature technologies, US steel producers overwhelmingly chose the conventional path – to retain their strengths in EAF production for secondary steel and invest to extend the life of BF-BOF plants.

That strategic bet meant the US risked having no cost-competitive clean steel capacity to bring to market by the early 2030s. Neither investors or producers could tell how the bet would play out. All they could do was wait and see.

High hopes…dashed

Europe’s early ambitions to lead the transition meant its industry made early investments in

hydrogen DRI and ultra-low-emission EAF when the US chose not to; but high renewable electricity prices, grid congestion and much higher hydrogen costs than they had envisaged meant they, too, faltered.

While some European producers shifted towards a greater share of EAF production due to inevitable market forces, others stuck with conventional BF-BOF production. There was some investment in efficiency upgrades to reduce the cost of compliance with the EU emissions trading system, but no commitment to large-scale replacement. The EU maintained the CBAM but – in a market where most European producers were focussed on defending domestic share and had successfully lobbied for the continuation of free allowances – the effective ETS carbon price remained low. CBAM's impact was muted.

A throw of the dice

Like others, China saw clean steel as a gamble. Unlike others, however, it had a capacity and scale that meant its gamble was relatively low risk. With state-owned giants able to cross-subsidise clean steel pilots, Beijing could afford to experiment in ways Western firms could not.

So, while Beijing continued to run high-emission BF-BOFs for the bulk of its output – keeping global prices low and defending its dominance in commodity steel – a small number of state-owned mills developed and perfected commercial-scale technologies. Their aim was to export near-zero emission primary steel selectively to Europe and Japan, supplying those niche markets where voluntary private businesses or policy demanded it.

This approach had two immediate impacts. First, China secured what little demand there was for near-zero emission steel; second, it ensured that no rival could build equivalent scale.

Emerging markets, lacking carbon border measures or procurement mandates, continued to produce and buy conventional steel.

Grounded

The US Government and industry's failure to invest in nascent primary clean technology for steel and its lack of ambition on providing cheap clean power had stark consequences.

Start-ups focused on clean steel technologies struggled to raise capital. Many folded or were acquired by Chinese investors, transferring intellectual property overseas. A few projects clung to life, resulting in a single demonstration plant here and there, but without the volumes needed to drive down costs they remained expensive curiosities. Venture capital exited the sector entirely.

By the early 2030s, the US steel innovation ecosystem was hollowed out. Entrepreneurs moved to other industries, specialised equipment suppliers closed or pivoted away and university research programmes in metallurgy and process engineering found it hard to recruit.

Steel demand in the US grew, but only slowly, driven mainly by maintenance of existing infrastructure. The US steel fleet remained a mixture of EAFs and BF-BOFs; with no carbon pricing, no mandatory low-carbon procurement, no willingness to pay a green premium, and no potential beyond its small, policy-driven overseas niche, green steel simply failed to take off. Steel production remained cleaner than that of most other countries but the continuing failure to decarbonise the grid - together with taxes and other barriers to clean power deployment - meant producers were unable to target the small overseas niche markets that did exist for near-zero emission steel.

Think tank reports continued to make the case for decarbonisation, but without strong policy in the form of subsidies or binding mandates, producers still saw little incentive to move. In boardrooms, executives argued that being a “fast follower” made more sense than risking first-mover disadvantage in a high-cost, low-demand segment.

China reaches out

Since the global market for clean steel remained small, trade patterns remained largely unchanged into the 2030s. China continued to dominate conventional steel exports, keeping prices low enough to deter new entrants and to cause difficulties for US, European, and other East Asian producers. Its modest clean steel exports flowed into the few market segments that require near-zero emission materials, including a few small European countries and luxury cars in Japan.

Chinese state-owned enterprises moved into clean steel production quietly and efficiently, but with no desire to push growth further than the market would bear. Domestic demand remained overwhelmingly conventional, preserving low production costs and protecting the profitability of large integrated mills.

Strategic investment in steel mills in emerging markets – either through acquisition or through foreign direct investment – meant that Chinese steel became embedded in local infrastructure, automotive, and manufacturing supply chains.

It was an effective approach and one that means China remains firmly in control today.

National security matters

The erosion of the US steel industry’s competitiveness and capacity for innovation has revived concerns about strategic vulnerability. If clean steel technologies can come down in cost through a combination of cheap renewables, long-duration storage, and low-cost electrolysers, the US looks at risk of falling even further behind. There are fears that the collapse in the US’s steel innovation ecosystem could spread more generally.

Yet, even these fears have not spurred a surge of investment and, without cost-competitive technologies, the private sector remains reluctant to commit. Public investment on the scale required to bridge the gap is simply unrealistic.

Looking ahead

There are no obvious signs that the US’s business-as-usual trajectory will shift. Clean steel remains marginal and, without a cost breakthrough, few producers are willing to gamble on scale. China continues to dominate by keeping its commodity steel from BF-BOFs cheap, by flooding emerging markets and by undercutting any competitor tempted to build primary clean steel capacity. Its selective deployment of near-zero emission steel marketed to Europe and Japan secures the premium niche too, ensuring no rival achieves scale.

Europe has little leverage. The CBAM protects domestic producers while they make incremental emissions reductions but fails to generate global influence. European mills defend local markets, but their share of global trade is declining. Washington has no desire to see the sector decarbonise globally, but the complacency of the past decade is gradually being replaced with concern over its industry’s reduced capacity for innovation. China sets the terms — on price, on scale, and even on who gets access to clean steel.

For as long as steel remains marginal, as innovation continues to stall and as the bulk of global production continues to run on carbon-intensive BF-BOFs, patterns of global production and trade will not look much different from the past. But if clean steel technologies should finally break through into cost-competitiveness, a radical restructuring – one which the US industry is, unfortunately, far from prepared for – could still happen quickly.

Stalled Transition

Stalled Transition describes a future where clean steel technologies are not cost competitive and China has weak market share in clean steel production. The cost gap between clean steel technology and BF-BOF is wide and the transition is effectively stuck. Europe strikes out on its own, pairing subsidies for clean primary steel with a rising carbon price and a fully implemented CBAM. As Europe becomes stronger in clean steel and China doubles down on conventional steel, the US risks losing out in both markets.

However, it remains unclear whether the real race has begun and whether the US can strengthen its position before it does. For now, the technological future of the sector remains uncertain.

The next big thing…

Back in 2024, clean steel was supposed to be the next great industrial race — a test of whether the US could pair climate ambition with manufacturing competitiveness. Hydrogen DRI, MOE and EAF production were all hailed as processes that could make coking coal obsolete.

Ten years later, those technologies are still expensive science projects. The cost gap with BF-BOF remains stubbornly wide and the sector's transition is stuck in neutral. Near-zero emission steel production accounts for only a few percent of global output. The US slice is small.

…fizzles out

The commonly held view ten years ago was that China, the world's largest steel producer, would move into clean steel to maintain export dominance.

It didn't. Instead, Beijing calculated that, with political challenges at home, no significant global demand and abundant infrastructure needs in Africa and ASEAN, it was better off sticking with high-carbon BF-BOF production. By doubling down on volume and price, China flooded emerging markets with cheap steel, locking in buyers and keeping global prices too low for clean alternatives to compete.

This created something of a policy dilemma for Washington. China's move meant that US steelmakers would only be able to compete in export markets with government subsidies - but granting them would undermine Washington's argument that China was supporting its industry unfairly, and climate change remained a polarising topic amongst voters.

As policymakers and the industry grappled with how to maintain their position in a global market dominated by cheap, high-emission steel, the transition to clean steel simply fell off their priority list. Political representatives could not see any public appetite for it. Some steel executives stopped talking about "green steel" completely. Others used the phrase to refer to whatever recycling they already did.

Once it became clear that clean steel wouldn't be a market disrupter anytime soon, US producers dug in. They extended the life of their BF-BOF assets and confined very low-emission production to small volumes for prestige buyers — the Teslas and Apples of the world — who needed the ESG branding.

Technology providers wanted to push ahead, but without large orders, finance fizzled out. Some innovative firms continued to plug away at breakthrough technologies, but without supporting policies to make plants commercially viable, target dates for deployment were repeatedly pushed back.

Europe's Different Play

Europe faced the same cost challenges but chose a different path. Brussels doubled down on the Green Deal Industrial Plan, pairing subsidies for clean primary steel with a rising carbon price and a fully implemented CBAM. That shielded EU producers from underpriced imports and - even though the economics were tight - gave investors the confidence to fund large-scale hydrogen DRI projects in Sweden, Germany and Spain.

By aligning climate policy with trade defence, Europe kept its clean steel build-out moving slowly. Today, the EU's share of the global clean steel market sits at around 20 per cent, but that apparently small share includes most of the high-value, certified near-zero emission steel sold in the global market. EU producers dominate those specialised segments such as aerospace alloys and automotive steels where competitive advantage comes from quality and certification, not only from price.

Europe has, moreover, become a rule-maker. The EU's Clean Materials Club (EUCMC) – set up in the last part of the 2020s to provide a unified framework for measuring and certifying carbon intensity in steel, cement and other heavy industries – has expanded in the last 5 years. Japan and Canada joined early on and were quickly followed by Brazil.

Those who hesitate

Washington chose not to join the Clean Materials Club when it had the chance in 2030, partly because most producers remained unconvinced there were real opportunities and partly because those few producers who *were* trying to build scale didn't want to concede (as they saw it) rule-making power to Europe.

It was the wrong call. EUCMC certification became the gold standard and in 2033 participating countries became suppliers to the multinational automakers and aerospace companies that chose to be first-movers in buying clean steel.

The US was locked out. What few orders it had came under pressure from certified EUCMC members.

Who cares?

If American consumers noticed that the US was slow on steel decarbonisation, they showed little concern. Certified near-zero emission steel carried a premium that most buyers were unwilling to pay. What mattered to them was cost, reliability and availability — and conventional EAF and BF-BOF steel delivered on all three.

That, of course, turned out to be an advantage for the US producers who had delayed investment

in clean technologies. Instead of being penalised for inaction, they benefited from lower capital costs and steady domestic demand. Companies extended the lifespan of existing BF-BOF assets, avoided expensive retrofits and continued to supply competitively priced steel to local markets.

Investors, too, saw little downside. While European firms wrestled with compliance costs and tight margins, US producers delivered stable returns. By the mid-2030s, the industry had settled into a paradoxical position: profitable and resilient at home, but increasingly left out in global trade as China continued to dominate the market for conventional steel and others supplied the niche markets for clean steel.

Beyond the transatlantic divide

Other steelmakers charted varied paths which, taken together, failed to create a critical mass in favour of steel's low-carbon transition in global markets.

India ramped up BF-BOF output to serve its vast infrastructure boom, while experimenting with small-scale hydrogen pilots supported by state subsidies.

Japan and South Korea aligned with the EU's certification standards and approach to carbon pricing, seeking to protect their advanced automotive and electronics supply chains, but did little to support the deployment of clean steel technologies at scale.

Brazil and Australia initially hoped to leverage their iron ore and abundant renewable power resources to position themselves as exporters of green iron, but found little demand for this globally as those jurisdictions that did support primary clean steel also supported their own domestic producers.

The Middle East, meanwhile, pursued green hydrogen megaprojects, but oriented these towards producing fertilisers and shipping fuels, as the markets for clean steel had yet to fully materialise.

The big question

The divide between Washington, Brussels and Beijing has hardened. China holds sway in high-volume commodity markets, but its weak clean steel share leaves it excluded from the premium segments that are beginning to shape advanced supply chains.

Europe has turned weak economics into institutional power: its carbon pricing, CBAM and the Clean Materials Club anchor a protected demand space that others — Japan, Canada, Brazil — have joined. Producers dominate the certified near-zero emission niches that are forming within sectors such as aerospace alloys and automotive steels, where quality and traceability as well as cost are decisive.

The US is stranded between these poles. Domestic producers remain profitable supplying conventional BF-BOF steel at home, but America is irrelevant in both global commodity and premium clean steel trade.

The sector is moving forwards, but cautiously, and one big question hangs in the air at the moment: is any country going to move decisively enough to reshape the global market?

Perhaps the EU and its partners can expand the niche markets they are developing for clean steel into larger sections of the global market. Perhaps US companies, having had more time for the development of breakthrough technologies, will re-enter the race once the firing gun finally goes off. Or China could reorient its enormous industrial capability towards clean steel.

For now, the technological future of the sector is still uncertain.

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