Making Clean Steel Competitive in International Trade

A Positive-Sum Agenda for Policy and Diplomacy

A report of the Breakthrough Agenda Policy Network

s-curve economics

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The Breakthrough Agenda Policy Network

The Breakthrough Agenda Policy Network brings together institutes from eight countries and regions to conduct joint research and analysis on opportunities for international cooperation to overcome difficult problems in the low carbon transition. In its first year, the Network has focused on the role of trade in enabling the transition to clean steel. Members of the Network and other experts from Europe, Asia, Africa, and the Americas gathered in Baku in November 2024 and in London in June 2025 to discuss this topic. S-Curve Economics CIC coordinates the Network and acts as its secretariat.

Full references can be found in the main report at: **www.scurveeconomics.org/publications/making-clean-steel-competitive-in-international-trade/**

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Executive Summary

Steel is a foundational industry and the highest emitting industrial sector in the global economy, responsible for 7% of global energy-related CO_2 emissions. It plays a crucial role in the modern economy, underpinning the buildings, industry, transport, power, and defence sectors.

In advanced economies, steel consumption is roughly constant, and the industry remains important at local and national levels. In many emerging and developing countries, demand is either growing rapidly or is expected to grow, and is critical to meeting basic needs. Steel remains vital in the global economy, and the deep decarbonisation of the sector is therefore essential to meet shared climate change goals.

The steel sector's transformation must take place in a context of competitive international trade. At present, trade acts as a barrier to the transition: high trade exposure means that steel producers cannot pass on the additional costs of clean steel production, while global excess capacity depresses prices and profits, further reducing their willingness to risk investment in new technologies. With over half the G20 countries having increased steel tariffs, safeguards or anti-dumping measures since 2024, trade diplomacy remains focused on the issue of excess capacity, while trade and climate policies are developed in isolation. Without a change in this dynamic, investments in clean steel will continue to be delayed.

Primary steelmaking is responsible for around

85–90%

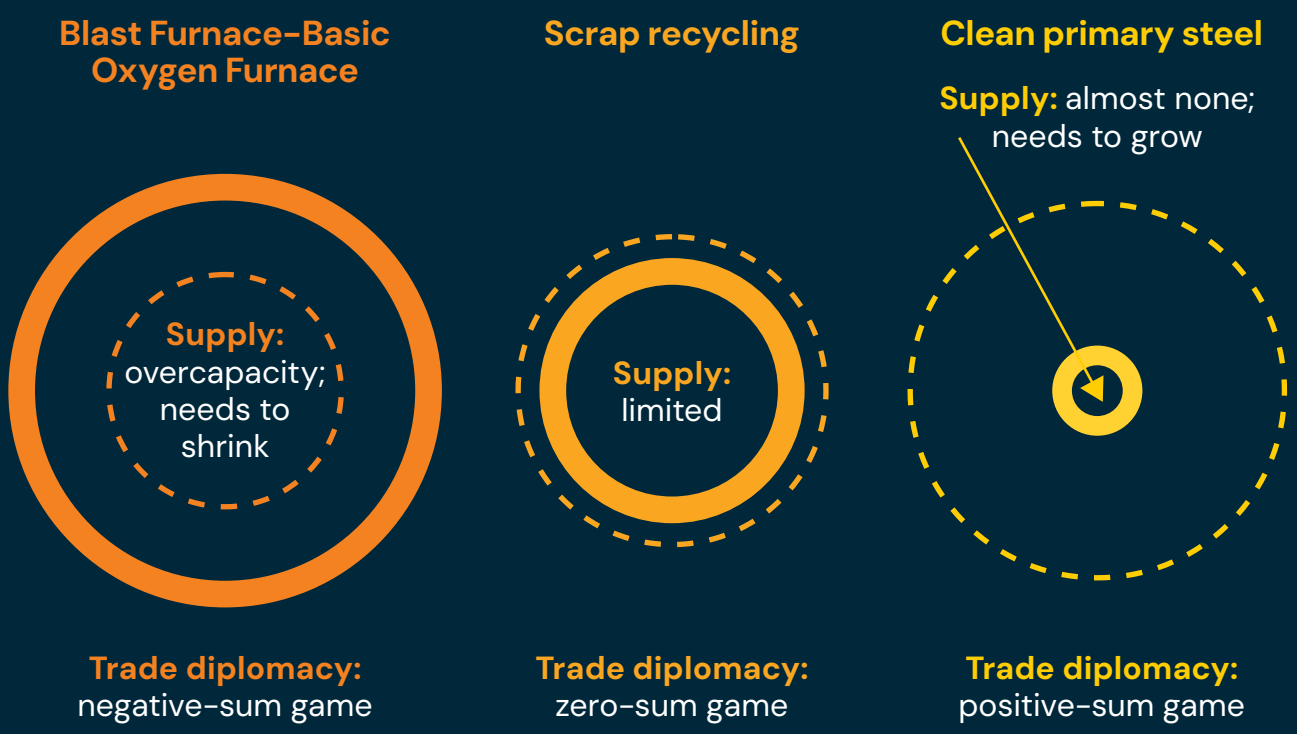
of the sector's emissions.

As we discuss in **Section 1**, this does not need to be the case. With the right rules and incentives, trade could become a driver of the transition: reducing the deployment costs of clean steel technologies, strengthening signals for investment, and reorienting competition towards near-zero emission steel. The right trading arrangements could also improve the prospect that future demand growth for steel in emerging and developing economies is met with clean technologies and drives sustainable economic development, rather than locking in investment into fossil fuel-burning assets. While trade diplomacy in high emission steel is a negative-sum game, for clean steel, positive-sum cooperation is possible.

The most pressing challenge is to deploy clean primary steel production capacity. Primary steelmaking is responsible for around 85–90% of the sector's emissions. More than 100 megatonnes per annum (Mtpa) of near-zero emission primary steel capacity is estimated to be needed by 2030, and less than 1 Mtpa is currently operational. The cost of near-zero emission primary steel production is currently estimated to be 30–75% more than that of conventional steel, meaning that first-mover risks are high. In contrast, steel made from scrap recycling is already competitive or close to competitive in major markets. The supply of scrap is limited – around 80–90% of steel is already recycled, globally – so policies that increase demand for scrap in some countries can decrease its use in others. For these reasons, detailed in **Section 2**, the deployment of primary clean steel should be the top priority for policymakers in this sector.

To make clean primary steel competitive in international trade, action is needed at three complementary levels: unilateral (national) policies, bilateral partnerships, and plurilateral cooperation.

Executive Summary Figure 1:
The dynamics of steel trade diplomacy depend on its focus.

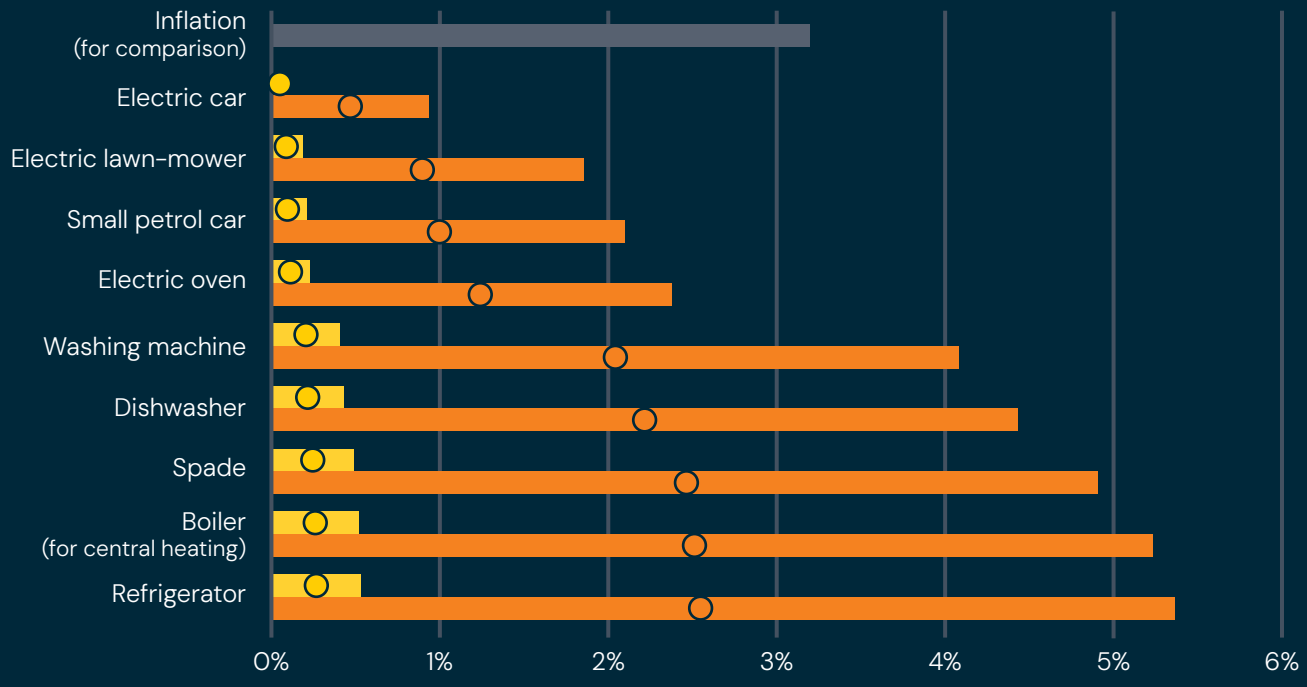


National policies (Section 3)

Multiple lines of evidence – including the current pipeline of clean steel projects, simulation modelling, industry consultations, and past and present experience of technology transitions in other sectors – point to targeted subsidies as likely to be needed for deploying near-zero emission primary steel plants. Almost all near-zero emission primary steel projects announced or under construction are known to have received subsidies. Public procurement or clean steel mandates could play complementary roles, increasing clean steel demand and supply respectively. By contrast, carbon pricing and emissions intensity regulations would be most likely to encourage a shift towards greater scrap recycling or technologies that only partially reduce emissions, and are unlikely, on their own, to enable the near-term deployment of near-zero emission primary steel technologies.

Clean steel subsidies (or payments for avoided carbon emissions) can be made revenue-neutral by 'recharging' their cost to industry, spreading the cost equally across all steel produced domestically or imported, with an exemption for steel exported. With this approach, the additional cost to consumers of deploying near-zero emission steel is lower than with carbon pricing, and can be trivially small during the early stages of the transition – adding only a fraction of one per cent to the cost of a car, dishwasher, or refrigerator. In most countries, annual inflation is considerably higher. Variations of this approach can be designed to suit a country's political economy.

Executive Summary Figure 2:
Clean steel subsidy-and-recharge: revenue neutral for governments, and trivially low cost to consumers.



- Global average annual consumer price inflation over the past ten years
- Increase in cost using a subsidy-and-recharge policy for the first 10% market share of near-zero emission primary steel (high cost-gap assumption)
- Increase in cost using a carbon price at $\$200/tCO_2$ or subsidy-and-recharge at 100% clean steel market share (high-cost gap assumption)
- Increase in cost using a subsidy-and-recharge policy for the first 10% market share of near-zero emission primary steel (low cost-gap assumption)
- Increase in cost using a carbon price at $\$100/tCO_2$ or subsidy-and-recharge at 100% clean steel market share (low-cost gap assumption)

The subsidy-and-recharge approach creates no competitiveness risks to steel producers or downstream industries in either domestic or export markets. In contrast, carbon pricing creates substantial competitiveness risks that can only be partially mitigated with carbon border adjustment mechanisms (CBAMs). For countries that already have emissions trading systems, a hybrid approach is possible, where the balance between carbon pricing and subsidy is managed in response to external conditions, enabling near-term deployment while managing competitiveness risks.

Although a CBAM exerts some influence on the global transition through its leverage of market access, its main effect may be to increase competition for scrap steel. A subsidy-led approach could exert influence internationally by changing expectations: as clean primary steel technologies are successfully deployed, the balance of industry concerns could shift from first-mover risk to late-mover risk.

Bilateral partnerships (Section 4)

Green iron trade partnerships could accelerate the shift to near-zero emission steel by matching exporters with low-cost renewable energy and high-quality iron ore to importers seeking competitive, lower-cost decarbonisation and relief for grid-constrained power systems.

For steelmakers in countries and regions with high energy costs, such as those in Germany, Japan, and South Korea, importing green iron rather than producing it domestically could cut the costs of green iron by around 30%, and of near-zero emission primary steel production by around 15%, improving long-term competitiveness and preserving higher value jobs. Around 70–95% of jobs in the steel sector are downstream of iron production.

For countries with the most abundant iron ore and renewable energy resources, exporting green iron could drive job-creation and growth. Australia's green iron export potential has been estimated to lie in the range of $60–200 billion USD annually. In South Africa, 1 Mt of green iron production per annum could replace the export value of 7 Mt of coal, offsetting the losses from declining demand for fossil fuels.

Future growth in steel demand is expected to come mainly from developing countries, which have low stocks of steel embedded in their economies and consequently more constrained potential for recycling. (Many sub-Saharan African countries have in-use steel stocks of less than 0.5 tonnes of steel per capita, compared with 10–15 tonnes per capita in the USA and many European countries.) Policies that encourage value-added industrialisation through near-zero emission technologies in developing countries will have a stronger chance of ensuring that future demand will be met with low and near-zero emission steel.

Importing green iron could halve the cost gap between high emission steel and near-zero emission steel in a country with high energy costs, but is not likely to eliminate the cost gap in the near term. Subsidies, payments for avoided emissions, carbon prices, or combinations of these measures are likely to be needed to make green iron plants commercially viable. Joint investment and long-term offtake agreements could de-risk first projects.

Parties to these deals will need to agree how costs are to be shared, and how 'green iron' will be defined. Standards that are overly stringent could hold back investment. Governments in importer countries giving policy support for this approach will need to communicate clearly how it benefits jobs and competitiveness. Clean steel subsidy policies that give industry flexibility to manufacture or import iron could help to manage both political and commercial risks.

The subsidy-and-recharge approach creates no competitiveness risks to steel producers or downstream industries.

Plurilateral cooperation (Section 5)

Plurilateral cooperation among a small group of large steel producing countries could change global market conditions in the steel sector, influencing investment decisions worldwide and accelerating the transition.

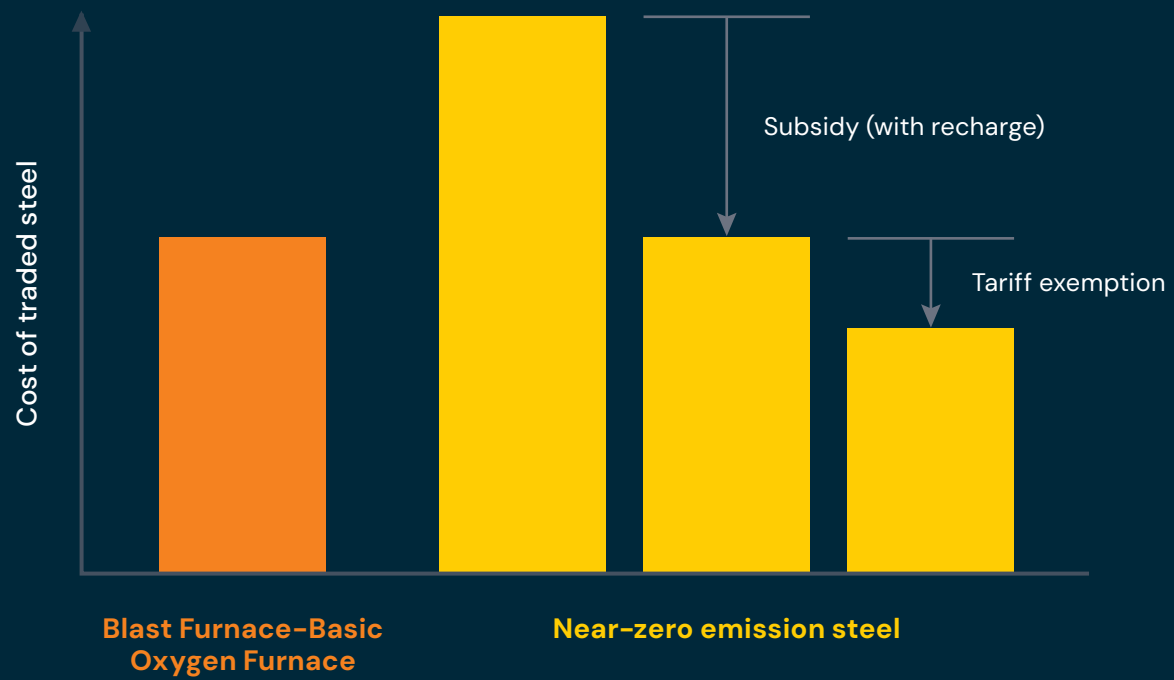
The most widely discussed approach of coordination on carbon pricing (with or without CBAMs) is likely to be particularly difficult to agree among major steel producers because of its immediate, uneven effect across countries. National average emission intensities of steelmaking using the dominant blast furnace-basic oxygen furnace production route vary widely, due to differences in fuels, feedstocks, efficiency, and other factors. A common carbon price of $\$200/tCO_2$ would lead to differing cost increases across countries, from 100% in Canada and 110% in the EU to 140% in China and 150% in India. These differences would immediately affect countries' competitiveness in international trade.

Emissions intensity regulations applied to steel production face even greater practical and distributional competitiveness challenges, making them even less likely to be viable as a basis for plurilateral cooperation at this stage of the transition.

A more effective path would be to focus on positive-sum market creation for clean primary steel. A tariff exemption for near-zero emission steel would have no immediate effect on the cost of steel production or trade balance of any country, making it more feasible to agree. Instead it would reduce the risk for investments in clean steel production, both in absolute terms and relative to conventional steel production. Combined with domestic policies such as subsidy-and-recharge that closed the cost gap to conventional production, the tariff exemption would give clean steel an advantage in international trade. This could provide a powerful additional incentive for investment.

Countries that might see a plurilateral clean steel tariff exemption as being in their interests are those that have either natural resource advantages (iron ore and low-cost renewable energy), leading clean steel technological capabilities, or strong political commitments to near-term decarbonisation. Adoption of the measure by countries with large

Executive Summary Figure 3:
Together with domestic deployment policies, a tariff exemption could give clean steel an advantage in international trade.



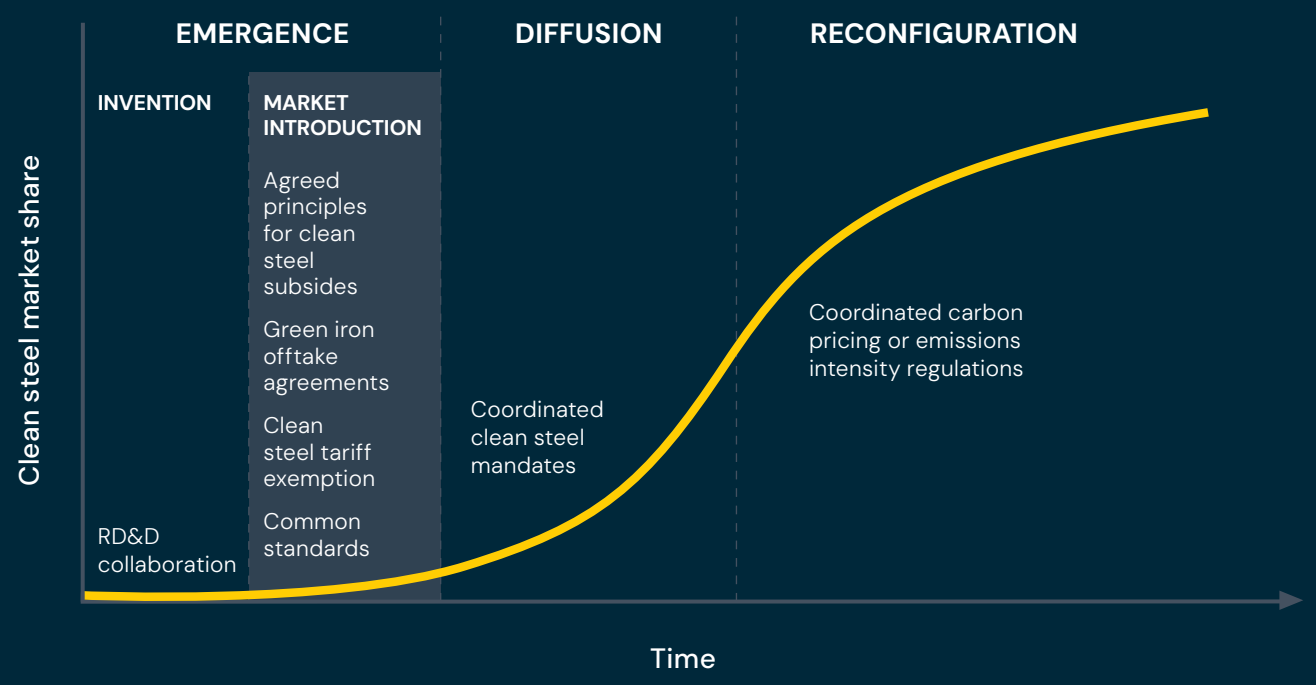
steel imports and significant existing tariff levels would have the most effect. The EU, China, Brazil and Mexico all have relatively strong interests aligned with the transition and substantial existing steel tariffs or safeguards, and together accounted for over a quarter of global steel imports in 2024. Competitiveness risks could be managed by making the tariff exemption time-limited or quota-limited.

To be effective in encouraging investment in clean primary steel production, the tariff exemption would need to be based on standards that discriminate between primary and secondary steel, either using a 'sliding scale' as proposed by the International Energy Agency and ResponsibleSteel, or with a more binary distinction. To be compatible with World Trade Organization rules, the exemption would need to apply to steel from all countries, not only from those that agreed to implement the measure. Consultation and negotiation, flexibility in design, and transparency in implementation would all be important to minimising the risk of successful legal challenge.

An agreement on principles for clean steel subsidies could be an additional helpful measure. The governments of Germany, the USA, the UK, and Japan have already provided subsidies for clean steel or its inputs, and the EU appears to have similar plans. While careful policy design can minimise legal risks, any uncertainty around the legal status of such policies or expectation of future disputes and countermeasures could disincentivise investment. An agreement on principles could at least partially mitigate these risks, allowing industry to invest in clean steel production with more confidence. This could also be important to enable joint action on a clean steel tariff exemption.

As the transition progresses, coordination around other measures may become possible. Clean steel mandates are an alternative option for introducing clean primary steel technologies to the market and could be used to drive their further diffusion. Coordination on carbon pricing or emissions intensity regulations may become more feasible in the late stages of the transition, when the high emission technologies represent a small share of the market and have decreasing economic importance.

Executive Summary Figure 4:
Priorities for trade diplomacy change over the course of the transition.



A new strategic dialogue is needed, to explore the opportunities for cooperation on principles for clean steel subsidies, bilateral or plurilateral green iron offtake agreements, a clean steel tariff exemption, and the definitions and standards to underpin any of these measures.

Next steps for steel diplomacy

Diplomacy on the steel transition already encompasses research and innovation, standard-setting, public procurement, and financial and technical assistance, but diplomacy on the trade aspects of the transition is underdeveloped.

Since multilateral discussions are limited by the trade-off between breadth of participation and depth of potential cooperation, plurilateral diplomacy is needed. It will be most effective if it involves the world's largest steel producers, such as China, India, and the EU, and the countries that could become the largest green iron exporters, most notably Australia, Brazil, and South Africa.

As we outline in **Section 6,** no existing plurilateral forum has a focus on steel trade and the transition, and the participation of these countries. Only two of these six are members of the Climate Club. A new strategic dialogue is needed, to explore the opportunities for cooperation on principles for clean steel subsidies, bilateral or plurilateral green iron offtake agreements, a clean steel tariff exemption, and the definitions and standards to underpin any of these measures. Efforts should be focused on the core challenge of enabling deployment of near-zero emissions primary steel, while also ensuring that actions do not create barriers to expanding secondary steel production.

Recommendations

We recommend that governments should focus on the following priorities:

1.

Implement national deployment policies to close the cost gap for near-zero emission primary steel. Targeted subsidies are likely to be needed for this purpose, and, if funded by a recharge, can be revenue-neutral for government while avoiding competitiveness risks to industry. Public procurement and mandates can also be used to create demand for clean steel. Carbon pricing can be used in parallel, to incentivise a shift from high emission primary production to increased steel recycling.

2.

Develop green iron trade partnerships where these could be beneficial for long-term industrial competitiveness. In countries with high renewable energy costs, policies can blend support for domestic near-zero emission steel production with the option to import green iron from countries with resource advantages. Countries rich in iron ore and renewable energy can pursue this as an opportunity to move up the value chain. These partnerships can build on existing arrangements for cooperation on industrial decarbonisation.

3.

Initiate plurilateral diplomacy focused on creating trade conditions that enable deployment of near-zero emission primary steel production capacity. This should involve the most influential countries in the sector whose interests are not opposed to the transition. Talks could usefully focus on seeking to agree principles for clean steel subsidies, a tariff exemption for clean steel, and the standards and definitions to be used as the basis for these or any other coordinated measures. This approach avoids the immediate, uneven effects on countries' steel production costs and trade that would be inherent in any form of coordinated carbon pricing.

Taken together, these steps could move trade diplomacy in the steel sector out of its defensive position by creating global market conditions where investment, innovation, and competition accelerate the deployment of clean steel technologies.

About us

S-Curve Economics CIC is a non-profit research organisation focused on advancing the understanding of the economics and diplomacy of the energy transition. Our analysis focuses on the power, road transport, and steel sectors, and cross-cutting issues of economics, policy appraisal, and diplomacy.

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