

GREEN STEEL AND GLOBAL TRADE: LEGAL PATHWAYS AND POLICY BARRIERS IN THE LOW-CARBON TRANSITION

by Ganeswar Matcha

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The production and manufacturing of steel dates back to the 1740s, when an English inventor, Benjamin Huntsman, initially invented crucible (or cast) steel, which was more uniform in composition and freer from impurities than any previously produced.¹ Steel is a foundational material in modern industrialization, with global production nearing 1.9 billion tons annually.² Yet, this scale comes with a steep environmental cost: the iron and steel sector contributes nearly 7% of global anthropogenic greenhouse gas (GHG) emissions.³ These emissions are largely due to the sector's reliance on coal-based production methods, particularly traditional blast furnaces. As global climate commitments tighten and industrial decarbonization becomes urgent, green steel, produced using low-carbon alternatives such as green hydrogen and renewable electricity, has emerged as a potential solution.

First introduced as a proof of concept at the 26th Conference of the Parties (COP26) in Glasgow, green steel now represents a crucial pillar of the net-zero transition.⁴ Its promise lies not only in emissions reduction, but in reconfiguring industrial competitiveness, aligning national climate goals with evolving trade regimes. However, this transition is constrained by multiple barriers, particularly

the high cost and limited availability of green hydrogen, the need for reliable renewable energy sources, and the lack of harmonized international regulatory standards. For many developing and least developed countries, these challenges are compounded by insufficient infrastructure and climate finance.

This Comment explores how national and international regulations are shaping the future of green steel, focusing on the interplay between climate policy and trade law. It examines key instruments such as the European Union's (EU's) Carbon Border Adjustment Mechanism (CBAM), the United States' Inflation Reduction Act (IRA) and Buy Clean Initiative, and the United Kingdom's (U.K.'s) emerging carbon adjustment frameworks. Special attention is paid to the legal implications of these policies under the World Trade Organization (WTO) framework, particularly with respect to the principles of nondiscrimination and fair market access.

Ultimately, I argue that green steel cannot succeed as a global climate strategy without international legal cooperation, equitable financing mechanisms, and inclusive regulatory design. Green industrial policy must balance climate ambition with fairness in trade and development, especially as regulatory asymmetries risk excluding emerging economies from decarbonized markets.

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1. McCreath Laboratories Blog, *People of Steel: Benjamin Huntsman*, <https://www.mcreathlabs.com/blog/people-of-steel-benjamin-huntsman/> (last visited May 22, 2025).
2. Rolf Willeke, *World Steel Recycling in Figures: January-December 2023 Update*, BIR, <https://www.bir.org/members-area/world-mirrors/mirrors-ferrous/1000030286-world-steel-recycling-in-figures-january-december-2023-update> (last visited May 22, 2025).
3. Holger Stamm & Nils Naujok, *Why Steel Can Be an Unexpected Leader in Decarbonization*, WORLD ECON. F. (Aug. 29, 2023), <https://www.weforum.org/stories/2023/08/why-steel-can-be-an-unexpected-leader-in-decarbonization>.
4. Andrew Purvis, *Steel in the Glasgow Breakthroughs Programme*, WORLD STEEL ASS'N BLOG (Nov. 16, 2021), <https://worldsteel.org/media/blog/2021/blog-cop26-steel-in-the-glasgow-breakthroughs-programme/>.

I. Technological Innovation in Green Steel Production

Technological innovation in green steel production is essential for a successful transition from traditional coal-based methods to sustainable alternatives. While the introduction of the green steel ingot at COP26 signals a promising future for the industry, achieving full-scale production requires further research and development (R&D), which is currently underway. The current green steel is approximately 40% more expensive than traditional coal-based steel, which is prohibitively expensive for many States across the world. The significant 40% cost difference includes the potential transition to install low-emission equipment, and revamping the production facilities and the supply chain.

As demand for low-emission steel grows and economies of scale begin to take hold, experts predict that the price gap will narrow. Some projections show that low-emis-

sion steel will be cost-competitive with traditional steel by 2035.⁵ The first prominent step toward making this a possibility was taken by Sweden's Hydrogen Breakthrough Ironmaking Technology (HYBRIT) project, which is a joint venture between SSAB, LKAB, and Vattenfall.⁶

The HYBRIT demonstration project aims to revolutionize the European iron and steel industry by replacing fossil-based technologies with climate-neutral alternatives. The project plans to replace the coal-based blast furnace technology with direct reduction based on fossil-free hydrogen.⁷ The project is also funded by the EU and includes the construction of a greenfield, first-of-a-kind, full-scale plant for the direct reduction of iron ore with 100% hydrogen—"greenfield" here referring to a completely new facility built from scratch, rather than an upgrade of an existing plant. Moreover, the project includes fossil-free hydrogen production via a water electrolysis plant⁸ in Gällivare (500 megawatts (MW)), making use of the high shares of wind and hydropower in the electricity production of the region.⁹

A German-based company, Thyssenkrupp Steel, is also racing to fully commercialize green steel production. Recently, it partnered with Volkswagen in order to work together for a renewable and brighter future.¹⁰

While the goal of these projects is to contribute to a green transition and innovation in the steel industry, the sharing of its technology is subject to intellectual property (IP) considerations. The HYBRIT project or the Thyssenkrupp Steel project likely might have IP protections in place, as they involve new technology that could be valuable in the steel and energy sectors for any significant method or breakthrough they might make other than existing technologies. The companies involved may seek to patent specific processes or innovations developed during the project, especially given the project's potential impact on global steel production and emissions.

However, the broader aim of the project is to make the technology available to help accelerate the transition to green steel production globally. It could be shared through collaborations, licensing agreements, or partnerships with

other steel producers or industries looking to adopt similar green technologies.

Green steel production relies heavily on renewable energy sources. Countries must invest significantly in renewable energy infrastructure if they want a smooth transition toward the production of green steel. The current energy sources it relies on involve¹¹:

- **Hydrogen-based direct reduction:** Hydrogen direct reduction (H-DR) technology, which uses 100% green hydrogen rather than conventional natural gas in the process, is currently considered the most promising technology. Thus, in this Comment, the feasibility of H-DR technology is discussed from the perspective of green hydrogen production and process adaptability.

In the short term, the economic feasibility of H-DR depends heavily on access to low-cost green hydrogen or the imposition of high carbon prices. However, challenges such as low process efficiency and the need to ensure a truly carbon-free product remain unresolved. As a result, hydrogen-rich shaft furnace direct reduction technology is considered a key transitional solution toward full hydrogen-based reduction. In the long term, 80%-90% of carbon emissions can be avoided on application of H-DR in the steel industry; therefore, the widespread application of H-DR technology is expected to be a milestone in the transition of the steel industry to cleaner production.¹²

- **Electric arc furnaces (EAFs):** An EAF is a modern piece of equipment used for steel production that utilizes electrical energy to heat-charge material through an electric arc. Unlike traditional blast furnaces that require coal to generate heat, EAFs operate with electricity, making them more adaptable to energy availability and potentially more environmentally friendly.¹³

- **Carbon capture and storage (CCS):** CCS involves the capture of carbon dioxide (CO₂) emissions from industrial processes, such as steel and cement production, or from the burning of fossil fuels in power generation. This CO₂ is then transported from where it was produced, via ship or in a pipeline, and stored deep underground in geological formations.¹⁴

5. Eric Koons, *Green Steel: Powering the Low-Carbon Economy*, ENERGY TRACKER ASIA (Sept. 25, 2024), <https://energytracker.asia/green-steel-powering-the-low-carbon-economy/>.

6. *Green Steel Technology—A \$89 Billion Revolution*, DAI MAGISTER (Sept. 18, 2024), <https://www.daimagister.com/resources/green-steel>.

7. EUROPEAN COMMISSION, INNOVATION FUND: HYBRIT DEMONSTRATION: SWEDISH LARGE-SCALE STEEL VALUE CHAIN DEMONSTRATION OF HYDROGEN BREAKTHROUGH IRON-MAKING TECHNOLOGY (2022), https://climate.ec.europa.eu/system/files/2022-07/lif_pf_2022_hybrit_en.pdf.

8. U.S. Department of Energy, *Hydrogen Production: Electrolysis*, <https://www.energy.gov/eere/fuelcells/hydrogen-production-electrolysis> (last visited May 22, 2025) ("A water electrolysis plant is a facility that uses electricity to split water into hydrogen and oxygen gas. The process is called electrolysis, and it can be used to produce hydrogen fuel.")

9. HYBRIT Development, *HYBRIT Demonstration*, <https://www.hybritdevelopment.se/en/hybrit-demonstration/> (last visited May 22, 2025).

10. Press Release, Thyssenkrupp, Green Steel for Sustainable Mobility: Thyssenkrupp and Volkswagen Group Sign Memorandum of Understanding to Supply CO₂-Reduced Steel (Oct. 22, 2024), <https://www.thyssenkrupp.com/en/newsroom/press-releases/pressdetailpage/green-steel-for-sustainable-mobility-thyssenkrupp-and-volkswagen-group-sign-memorandum-of-understanding-to-supply-co-reduced-steel-287969>.

11. Divyesh Sharma, *Public and Private Funding in Green Steel Production Worldwide*, ACUITY KNOWLEDGE PARTNERS: (RE)IMAGINE (Jan. 20, 2025), <https://www.acuitykp.com/blog/public-private-funding-green-steel-production>.

12. Rongrong R. Wang et al., *Hydrogen Direct Reduction (H-DR) in Steel Industry—An Overview of Challenges and Opportunities*, 329 J. CLEANER PROD. 129797 (2021).

13. Nemag, *How Switching to an Electric Arc Furnace Affects Your Grab Productivity*, <https://www.nemag.com/dry-bulk-blog/how-switching-to-an-electric-arc-furnace-affects-your-grab-productivity> (last visited May 22, 2025).

14. National Grid, *What Is Carbon Capture and Storage?*, <https://www.nationalgrid.com/stories/energy-explained/what-is-ccs-how-does-it-work> (last updated Mar. 26, 2024).

Each of these technologies has its own place in the future of green steel. The hydrogen-based direct reduction (HRI), or H-DR, holds the most potential for being a truly green solution long-term, as for now. EAF is also considered to be a likely alternative depending on the economic scenario. CCS is an option for countries to adopt; however, it does not completely eliminate the emission but rather reduces it—which means, in simple terms, that the initial input of coal or coke still stays the same. Despite the initial input remaining constant, it can be considered an initial step toward reducing the carbon footprint.

II. Key Regulations and Policies on Green Steel

The transition to green steel is driven by evolving regulatory frameworks and sustainability policies aimed at reducing carbon emissions in heavy industries. Governments and international organizations are enforcing stringent measures to align steel production with climate commitments, fostering innovation in low-carbon technologies. Key regulations establish emission-reduction targets, promote the adoption of hydrogen-based and recycled steel, and introduce carbon pricing mechanisms to accelerate the industry's path to net zero.

In addition to overarching policies, many countries have implemented subsidiary measures to support this transition, including R&D incentives and the commercialization of sustainable supply chains. At the global level, international organizations, financial institutions, and developed nations are collaborating with developing and least developed countries to facilitate a just transition, ensuring that sustainability goals are met without triggering financial instability.

A. EU Regulations on Green Steel and the European Green Deal

The EU Green Deal, launched in 2019, is a comprehensive strategy by the EU aiming to transform the bloc into a climate-neutral continent by 2050, achieving net-zero GHG emissions by that date by drastically reducing emissions across all sectors of the economy, including energy, transport, agriculture, and industry, while simultaneously fostering economic growth and social equity through sustainable practices and innovation. This goal is to be achieved through a series of policy initiatives focused on transitioning to renewable energy, improving energy efficiency, protecting biodiversity, and promoting circular economy principles, all while ensuring a “just transition” to minimize the social and economic impacts on affected regions and industries.¹⁵ As an intermediate 2030 target, it set the goals of at least 40% net reduction in GHG emis-

sions, an increase to 32% share for renewable energy, and 32.5% increase in energy efficiency.¹⁶

The introduction of green steel is a great support to the EU Green Deal and can help the EU become a climate-neutral continent by 2050. According to current data, the steel industry in Europe is responsible for approximately 5% of total CO₂ emissions within the EU, making it a significant contributor to the region's carbon footprint.¹⁷ The EU alone adopted a decision on the financing of the Research Programme of the Research Fund for Coal and Steel, with a total budget of 175 million euros (€) for 2025, to support collaborative research in the steel and coal sectors.¹⁸

The EU has also announced and proposed incentives on the materials required to make green steel as well. At present, there are some initiatives promoting green hydrogen:

- **Renewable Energy Directive (RED III):** Legislation setting binding targets for renewable energy use, including green hydrogen among EU countries.¹⁹ Since introduction of the Renewable Energy Directive (2009/28/EC),²⁰ the share of renewable energy sources in EU energy consumption has increased from 12.5% in 2010 to 24.5% in 2023. Sweden had the highest share of renewables in its consumption (66.4%), ahead of Finland (50.8%) and Denmark (44.9%).²¹
- **Important projects of common European interest (IPCEIs):** Framework allowing state aid for significant cross-border projects, including green hydrogen initiatives. The aid is to promote the execution of an IPCEI or to remedy a serious disturbance in the economy of a Member State that may be considered compatible with the internal market. However, as taxpayers' money is spent, all EU Member States are in the driver's seat to form an IPCEI, identify the scope of the projects, and select participating companies and projects.

Member States that wish to initiate an IPCEI should use the dedicated Joint European Forum for

15. European Commission, *2050 Long-Term Strategy*, https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy_en (last visited May 22, 2025).

16. Sanja Filipović et al., *The Green Deal—Just Transition and Sustainable Development Goals Nexus*, 168 RENEWABLE & SUSTAINABLE ENERGY REVS. 112759 (2022), <https://www.sciencedirect.com/science/article/abs/pii/S136403212200644X>.

17. *EU Climate Targets: How to Decarbonise the Steel Industry*, EUR. COMM'N JOINT RSCH. CTR. (June 15, 2022), https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/eu-climate-targets-how-decarbonise-steel-industry-2022-06-15_en.

18. *EU Provides €175 Million to Support Research, Innovation, and Just Transition of Steel and Coal Sectors*, EUR. COMM'N RSCH. & INNOVATION (Jan. 20, 2025), https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/eu-provides-eu175-million-support-research-innovation-and-just-transition-steel-and-coal-sectors-2025-01-20_en.

19. European Commission, *Renewable Energy Directive*, https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en (last visited May 22, 2025).

20. Directive 2009/28/EC, of the European Parliament and of the Council of 23 April 2009 on the Promotion of the Use of Energy From Renewable Sources, 2009 O.J. (L 140) 16.

21. *Renewables Account for 24.5% of EU Energy Use in 2023*, EUROSTAT (Dec. 19, 2024), <https://ec.europa.eu/eurostat/en/web/products-eurostat-news/w/ddn-20241219-3>.

IPCEI to share their ideas with all other Member States. Member States should actively plan their participation in an IPCEI and actively cooperate with all other Member States.²² However, to promote fair competition among the companies in the market, the IPCEI follows Article 107 of the Treaty on the Functioning of the European Union (TFEU) (formerly Article 87 of the Treaty Establishing the European Community).²³ Currently, there is no separate fund for IPCEIs; however, the Innovation Fund can support projects that are IPCEIs.²⁴

- **REPowerEU Plan (2022):** A strategy to reduce dependence on fossil fuels and accelerate the green transition, emphasizing green hydrogen. The European Commission allows more leeway for national governments to subsidize green projects, for instance green hydrogen. While REPowerEU itself is not a direct incentive, it enables and funds various incentive programs to accelerate the energy transition. Many of its initiatives create financial and regulatory incentives for businesses and governments to invest in renewables, hydrogen, and energy efficiency. As one of its key actions, it foresees accelerating the use of renewable hydrogen as a replacement for fossil gas. Research and innovation are key to enable boosting of the domestic production of renewable hydrogen, for example by increasing electrolyzer capacity in the EU by 6 gigawatts (GW) in 2025 and 40 GW by 2030.

The REPowerEU objectives foresee the use of 20 million tons of renewable hydrogen per year in the EU by 2030, with half of this produced domestically and the other half imported.²⁵ With an estimated total budget of €40 billion from 2020 to 2030 from EU Emissions Trading System (ETS)²⁶ revenues, this

fund aims to create financial incentives for companies and public authorities to invest in cutting-edge low-carbon technologies and to support Europe's transition to climate neutrality. The European Hydrogen Bank is an initiative to facilitate the EU's domestic production and imports of renewable hydrogen. It is established under REPowerEU to finance initiatives like green hydrogen. It aims to close the investment gap and connect the future renewable hydrogen supply to consumers.²⁷

- **Contracts for difference (CFD) for hydrogen:** A financial instrument to support green hydrogen production by covering the cost gap between conventional and renewable hydrogen.²⁸ The EU is actively engaging and developing the concept of CFD for promoting the sustainable initiatives, like green hydrogen. However, at the current standpoint, producing green hydrogen can be quite expensive and the burden of paying the difference from the standard price will fall on the government (i.e., the cost gap falls on the government). In the case of EU nations, which are very developed, they have initiatives like the Innovation Fund²⁹ to cover the difference. For instance, if green hydrogen costs €5 per kilogram (/kg) and the market price is only €3/kg, the Innovation Fund pays the €2/kg difference to hydrogen producers.

Following the global movement toward addressing climate change, the EU has brought together a working mechanism that contributes to that goal. The EU has always had its own climate change ambition, and has always believed that as long as other nations continue to have non-stringent laws, there is potential risk of “carbon leakage,” which could in turn disorganize or compromise the EU's climate change ambition.

The EU's CBAM is a landmark tool for the introduction of a fair price on the carbon emitted during the production of carbon-intensive goods that are entering the EU, and to encourage cleaner industrial production in non-EU countries.³⁰ CBAM is designed to be compatible

22. European Commission, *Practical Information for Important Projects of Common European Interest (IPCEI)*, https://competition-policy.ec.europa.eu/state-aid/ipcei/practical-information_en (last visited May 22, 2025).

23. Consolidated Version of the TFEU art. 107, May 9, 2008, 2008 O.J. (C 115) 47:

[L]ays out the rules concerning State aid within the EU's competition framework. It defines when aid granted by Member States to businesses is considered incompatible with the internal market. For instance, General Prohibition of State Aid (Paragraph 1)—Any aid granted by a Member State or through State resources that distorts or threatens to distort competition by favouring certain undertakings (companies) or the production of certain goods is generally incompatible with the internal market if it affects trade between Member States.

24. European Commission, *Innovation Fund*, https://single-market-economy.ec.europa.eu/industry/strategy/hydrogen/funding-guide/eu-programmes-funds/innovation-fund_en (last visited May 22, 2025) (“The Innovation Fund is one of the world's largest funding programmes for demonstration of innovative low-carbon technologies. It is not a research programme, it is about bringing highly innovative technologies to the market (commercial demonstration projects).”).

25. Press Release, European Commission, REPowerEU: A Plan to Rapidly Reduce Dependence on Russian Fossil Fuels and Fast Forward the Green Transition (May 18, 2022), https://ec.europa.eu/commission/presscorner/api/files/document/print/en/ip_22_3131/IP_22_3131_EN.pdf.

26. European Commission, *About the EU ETS*, https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/about-eu-ets_en (last visited May 22, 2025):

The EU ETS is based on a “cap and trade” principle. The cap refers to the limit set on the total amount of GHG that can be emitted by installations and operators covered under the scope of the system. This cap is reduced annually in line with the EU's climate target, ensuring that overall EU emissions decrease over time. By 2023, the EU ETS has helped bring down emissions from European power and industry plants by approximately 47%, compared to 2005 levels.

27. Press Release, European Commission, European Hydrogen Bank's “Auctions-as-a-Service” Scheme, Increasing the Funding for Clean Investments (Nov. 17, 2024), https://ec.europa.eu/commission/presscorner/detail/en/ip_24_5862.

28. *What Is CFD: Full Form, Meaning, and Definition Explained*, PAYTM BLOG (Oct. 16, 2024), <https://paytm.com/blog/glossary/cfd-full-form-meaning-definition>.

29. See European Commission, *supra* note 24.

30. *Carbon Border Adjustment Mechanism*, EUR. COMM'N TAX'N & CUSTOMS UNION (Mar. 28, 2025), https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en.

with WTO rules.³¹ The WTO is the only international organization dealing with the rules of trade between nations. At its heart are the WTO agreements, negotiated and signed by the bulk of the world's trading nations and ratified in their parliaments and legislatures. The fundamental goal of the WTO, as set out in the organization's founding agreement, is to use trade as a means to improve people's living standards, create better jobs, and promote sustainable development.³²

While CBAM is designed to be WTO-compliant, its implementation raises legal and economic concerns, particularly for developing countries. In addition, there are questions concerning the introduction of CBAM, such as whether it would replace the existing EU ETS. The EU decided to gradually introduce CBAM with the phaseout of the allocation of free allowances under the EU ETS to support the decarbonization of EU industry.³³ Launched in 2005, the EU ETS is a "cap and trade" carbon market under which companies are required to buy or trade rights to emit CO₂.³⁴ In order to fulfill the Paris Agreement and reach the EU's emissions-reduction target for 2030, the sectors covered by the ETS must reduce their emissions by 43% compared to 2005 levels.

Thus, CBAM is not considered to replace the EU ETS system outright, in the current scenario, but it is likely to gradually phase out a few parts of the EU ETS system. CBAM focuses only on imported goods or products to the EU, but researchers believe that it does supersede the free EU ETS allowances that were previously assigned to EU producers perceived to be at heightened risk of carbon leakage.³⁵ The EU ETS system applies to overall volume, decided by the EU, of GHGs that can be emitted by all the companies covered by the ETS and is subject to a cap (or limit), which is set at the EU level.³⁶ CBAM complements the phasing out of free ETS allowances for EU producers, thereby creating a level playing field.

Until 2026, CBAM will be in a transitional phase without financial penalties, allowing stakeholders to collect useful information, such as emissions data on covered imports, to refine the methodology for the levy's definitive period, which follows thereafter.³⁷ Perhaps the most transformative regulatory instrument, CBAM will apply to imports of certain goods in the initial phase, such as cement, iron and steel, aluminum, fertilizers, electricity, and hydrogen.³⁸ The gradual phasing in of CBAM is designed to facilitate

a smooth transition for both EU and non-EU companies, as well as public authorities, ensuring compliance with the new protocols. This phased approach also supports developing and least developed countries in adapting to the carbon adjustment framework, allowing them to reduce their carbon footprint without facing financial instability.

The permanent system is scheduled to enter into force on January 1, 2026. At that time, importers will be required to purchase CBAM certificates corresponding to the carbon content of their goods, priced in relation to the EU ETS. Importers will need to declare each year the quantity of goods imported into the EU in the preceding year and their embedded GHGs. They will then surrender the corresponding number of CBAM certificates. The price of the certificates will be calculated depending on the weekly average auction price of EU ETS allowances expressed in euros per ton of CO₂ emitted. An important note is that CBAM certificates cannot be exchanged or traded like carbon credits.³⁹

In sum, the EU's legal and financial framework for green steel, anchored by CBAM and supported by renewable energy laws, R&D funding, and hydrogen incentives, positions the EU at the forefront of industrial climate policy. However, questions remain about the system's fairness, trade law compliance, and accessibility for less-developed countries.

B. The U.K.

The U.K. has also supported the green steel initiative, as it was announced at the end of last year that Tata Steel is intending to make Port Talbot one of Europe's premier centers for green steelmaking. The 1.25 billion pound (£) investment, which includes a U.K. government grant of up to £500 million, is the largest capital expenditure investment in U.K. steel production for decades. Seventy-five percent of the raw materials required will be sourced from the U.K., up from 10% today, helping to maintain the country's self-sufficiency in steel and making steel production more resilient to global events.⁴⁰ In addition, they have set up a fund to promote domestic companies to accelerate the development and deployment of low-carbon hydrogen production projects within the U.K.: the Net Zero Hydrogen Fund (NZHF).⁴¹

On December 18, 2022, the U.K. also announced its interest to move forward with its own policy concerning CBAM.⁴² Following the trendsetting decision by the EU to set up a CBAM, many countries have been actively

31. Laurie Durel, *Border Carbon Adjustment Compliance and the WTO: The Interactional Evolution of Law*, 27 J. INT'L ECON. L. 18, 18-40 (2024).

32. WTO, *What Is the WTO?*, https://www.wto.org/english/thewto_e/whatis_e/whatis_e.htm (last visited May 22, 2025).

33. See *Carbon Border Adjustment Mechanism*, *supra* note 30.

34. See European Commission, *supra* note 26.

35. PlanA, *Carbon Border Adjustment Mechanism (CBAM)*, <https://plana.earth/policy/cbam> (last visited May 22, 2025).

36. Irish Environmental Protection Agency, *EU Emission Trading System*, <https://www.epa.ie/our-services/licensing/climate-change/eu-emissions-trading-system/> (last visited May 22, 2025).

37. Brian Gicheru Kinyua, *EU Carbon Tax Could Have a Significant Impact on Global Trade*, MAR. EXEC. (Oct. 1, 2023), <https://maritime-executive.com/editorials/eu-carbon-tax-could-have-a-significant-impact-on-global-trade>.

38. See European Commission, *supra* note 24.

39. *Carbon Border Adjustment Mechanism*, *supra* note 30.

40. *Tata Steel UK and JCB Have Signed a Memorandum of Understanding for the Supply of Low CO₂ ("Green") Steel*, TATA STEEL UK (Dec. 16, 2024), <https://www.tatasteeluk.com/corporate/news/tata-steel-and-jcb-sign-green-steel-deal>.

41. U.K. Department for Energy Security and Net Zero, *Net Zero Hydrogen Fund Strands 1 and 2*, <https://www.gov.uk/government/publications/net-zero-hydrogen-fund-strand-1-and-strand-2> (last updated Feb. 27, 2024).

42. *UK Government Announces Adoption of Carbon Border Adjustment Mechanism (UK CBAM)*, ERNST & YOUNG (Dec. 22, 2023), <https://taxnews.ey.com/news/2023-2123-uk-government-announces-adoption-of-carbon-border-adjustment-mechanism-uk-cbam>.

either working on setting up reviews or bringing forth a full-scale CBAM policy. This idea can contribute to climate change actions with which the world has decided to move forward and help nations in their own decarbonization policies as well.

The U.K. plans to implement the CBAM policy by 2027, and the carbon price will be levied upon some of the most emissions-intensive industrial goods imported to the U.K. from the aluminum, cement, ceramics, fertilizer, glass, hydrogen, iron, and steel sectors.⁴³ Further consultation took place in 2024, with outcomes expected to shape the final policy design. The U.K. would impose taxes on lists of products mentioned in scope 1 and 2—exempting scope 3, which accounts for indirect emissions like the transportation by air of finished products by subsequent entities—on a timely basis.⁴⁴ Scope 1 emissions cover companies involved in direct emission such as boilers or cars. Scope 2 emissions involve indirect emissions like when the electricity or energy a company buys for heating and cooling buildings is being produced on its behalf.⁴⁵

However, it would be a comprehensive decision for the U.K. to follow the design of EU's CBAM method and potentially release a phase-wise plan that gives its foreign producers and nations a chance to stay competitive in their respective markets. This could help foreign nations to come up with their own strategies in maintaining the mechanism and staying competitive in the market. This also gives adequate time for public authorities to adhere to the new regulations.

The U.K. government's fact sheet highlights a notable distinction: the exclusion of CBAM certificates in the U.K.'s approach.⁴⁶ Under the EU CBAM policy, importers are required to hold CBAM certificates for trade during Phase 1. However, the fact sheet does not specify an alternative mechanism. Instead, the U.K. CBAM is expected to align with the U.K. Emissions Trading Scheme (UK ETS), which typically assigns a cost to GHG emissions from domestic producers.

A phased rollout of the U.K. CBAM is anticipated, mirroring the EU's transitional structure. This approach would give foreign producers and public authorities time to adapt and develop compliance strategies, thus minimizing

market disruption. The U.K. government conducted a policy design consultation for CBAM in 2024, with the final design features confirmed in October 2024. A subsequent technical consultation on the draft legislation is underway in 2025, with CBAM set for implementation in 2027.

Overall, the U.K.'s strategy is characterized by a blend of industrial investment, hydrogen innovation, and cautious regulatory convergence with EU practices. While the details of its CBAM remain under development, the U.K.'s commitment to green steel reflects its broader goal of achieving net-zero emissions by 2050 through coordinated economic and climate policies.

C. *The United States*

The United States has also taken action to support green steel and green hydrogen. The Inflation Reduction Act's dedicated investment is the Advanced Industrial Facilities Deployment Program, which offers more than \$5.8 billion to commercialize technologies that could take carbon emissions out of the industrial sector.⁴⁷ Another initiative was the Federal Sustainability Plan to achieve net-zero emissions procurement by 2050. To help implement this plan, the Federal Buy Clean Initiative was launched, prioritizing the purchase of low-emissions concrete, steel, asphalt, and flat glass.⁴⁸ The U.S. Department of Energy introduced the Loan Programs Office (LPO) to provide loans and loan guarantees available to help deploy innovative clean energy, advanced transportation, and tribal energy projects in the United States. Over the past decade, the LPO closed more than \$30 billion of deals across a variety of energy sectors.⁴⁹

The Clean Competition Act was introduced by Sen. Sheldon Whitehouse (D-R.I.) and Rep. Suzan DelBene (D-Wash.). The legislation has been sponsored by Reps. Don Beyer (D-Va.), Kathy Castor (D-Fla.), and Ami Bera (D-Cal.), and Sens. Brian Schatz (D-Haw.) and Martin Heinrich (D-N.M.).⁵⁰ Compared to the EU, the United States faces greater challenges related to carbon leakage. U.S. manufacturers are significantly less carbon-intensive than many of their international competitors—China's manufacturing sector is nearly three times, and India's nearly four times, as carbon-intensive as that of the United States.⁵¹

Like the U.K. CBAM and EU CBAM, if passed, the Clean Competition Act would impose a carbon border

43. *Factsheet: UK Carbon Border Adjustment Mechanism*, U.K. DEP'T FOR ENERGY SEC. & NET ZERO (Feb. 18, 2025), <https://www.gov.uk/government/consultations/addressing-carbon-leakage-risk-to-support-decarbonisation/outcome/factsheet-uk-carbon-border-adjustment-mechanism>.

44. *Zero in on . . . Scope 1, 2, and 3 Emissions*, DELOITTE (May 12, 2021), <https://www.deloitte.com/uk/en/issues/climate/zero-in-on-scope-1-2-and-3-emissions.html>.

Scope 1 emissions—This one covers the Green House Gas (GHG) emissions that a company makes directly—for example while running its boilers and vehicles. Scope 2 emissions—These are the emissions it makes indirectly—like when the electricity or energy it buys for heating and cooling buildings, is being produced on its behalf. Scope 3 emissions—Now here's where it gets tricky. In this category go all the emissions associated, not with the company itself, but that the organisation is indirectly responsible for, up and down its value chain. For example, from buying products from its suppliers, and from its products when customers use them. Emissions-wise, Scope 3 is nearly always the big one.

45. *See id.*

46. *See Factsheet: UK Carbon Border Adjustment Mechanism*, *supra* note 43.

47. *Inflation Reduction Act Two Years Later: Historic Industry Investment*, FORBES (Aug. 19, 2024), <https://www.forbes.com/sites/energyinnovation/2024/08/19/inflation-reduction-act-two-years-later-historic-industry-investment/>.

48. Ankita Gangotra et al., *What Does "Green" Procurement Mean? Initiatives and Standards for Cement and Steel*, WORLD RES. INST. (Apr. 25, 2023), <https://www.wri.org/insights/green-procurement-initiatives>.

49. U.S. Department of Energy, *Loan Programs Office*, <https://www.energy.gov/lpo/loan-programs-office> (last visited May 22, 2025) ("The Loan Programs Office (LPO) provides loans and loan guarantees available to help deploy innovative clean energy, advanced transportation, and Tribal energy projects in the United States.")

50. Press Release, Office of U.S. Congresswoman Susan DelBene, *DelBene, Whitehouse Introduce Bill to Boost Domestic Manufacturers, Tackle Climate Change* (Dec. 6, 2023), <https://delbene.house.gov/news/documentsingle.aspx?DocumentID=3711>.

51. *See id.*

adjustment on energy and carbon-intensive imports, while incentivizing decarbonization of domestic manufacturing. Starting in 2025, the adjustment would apply to energy-intensive industries, including fossil fuels, refined petroleum products, petrochemicals, fertilizer, hydrogen, adipic acid, cement, iron and steel, aluminum, glass, pulp and paper, and ethanol. In 2027, it would be expanded to include imported finished goods that meet certain weight or value thresholds, such as cars.⁵²

This Act received some support from U.S. domestic producers as well. Kevin Dempsey, president and chief executive officer of the American Iron and Steel Institute, issued the following statement:

The American Iron and Steel Institute (AISI) welcomes Senator Whitehouse's proposed system of carbon intensity-based tariffs on higher emitting foreign imports that are one aspect of the Clean Competition Act. As the American steel industry leads the world in low-carbon steel production, a carbon tariff approach will help level the playing field for American steel producers and ensure that domestic industry investments in cleaner production processes are not undercut by high-carbon-emitting steel made overseas.⁵³

Aside from national policies, countries will have to foster international cooperation in order to achieve their aim in reducing their carbon footprint. One such initiative is the Global Arrangement on Sustainable Steel and Aluminum (GASSA), a joint U.S.-EU initiative designed to align trade policy with climate goals by discouraging high-carbon steel and aluminum imports, particularly from China and other high-emission producers.⁵⁴ This initiative seeks to address both the climate impact of industrial production and the market distortions caused by nonmarket economies that engage in overproduction and price undercutting. By establishing carbon-based trade measures, GASSA aims to impose restrictions on carbon-intensive imports while promoting the trade of low-emission metals. Additionally, it introduces sector-specific carbon intensity standards, encouraging investment in cleaner production technologies such as hydrogen-based steelmaking and carbon capture systems.

Beyond emissions reduction, GASSA also addresses global overcapacity in steel and aluminum markets, particularly the unfair competitive advantage held by countries that subsidize high-emission metal production. By linking climate goals with trade policy, the initiative seeks to ensure that U.S. and EU manufacturers, who are already invest-

ing in decarbonization, are not disadvantaged by cheaper, high-carbon alternatives. Further, the agreement could serve as a model for integrating carbon border adjustments and green subsidies into international trade policies, reinforcing transatlantic cooperation while applying economic pressure on major emitters like China, India, and Russia.

If implemented effectively, GASSA has the potential to transform global industrial trade, ensuring that sustainability and competitiveness go hand-in-hand. However, as of early 2025, the incoming Donald Trump Administration brought significant shifts in U.S. climate and industrial policy, and the negotiations have halted as renewed tariffs and unilateral trade actions have led to a breakdown in negotiations between the United States and EU regarding GASSA.⁵⁵

Several initiatives established under the IRA,⁵⁶ including funding streams for green steel and hydrogen production, are now facing rollbacks or delays due to executive orders and ongoing legislative pushback. The future of the LPO⁵⁷ remains uncertain, with budgetary restrictions and political scrutiny curtailing its ability to finance new clean energy and industrial decarbonization projects.

Moreover, federal support for the Buy Clean Initiative has weakened considerably, with the Administration prioritizing deregulation and conventional energy production.⁵⁸ While some state governments continue to implement low-emissions procurement standards independently, federal momentum has slowed.⁵⁹ The Clean Competition Act has stalled in the U.S. Congress and is unlikely to move forward under the current Administration, despite continued backing from industry groups advocating for carbon-based trade protections.

These developments mark a substantial pivot in U.S. green industrial policy. Although some legacy programs from the previous Administration are still operational, their long-term viability is now in question. Moreover, the new Administration has also signed an Executive Order to leave the Paris Agreement, the only legally binding international climate accord.⁶⁰ As a result, uncertainty looms over the regulatory and financial landscape for green steel in the

52. *See id.*

53. Press Release, AISI, AISI Comments on "Clean Competition Act" Introduced Today (Dec. 6, 2023), <https://www.steel.org/2023/12/aisi-comments-on-clean-competition-act-introduced-today/>.

54. Fact Sheet, The White House, The United States and European Union to Negotiate World's First Carbon-Based Sectoral Arrangement on Steel and Aluminum Trade (Oct. 31, 2021), <https://bidenwhitehouse.archives.gov/briefing-room/statements-releases/2021/10/31/fact-sheet-the-united-states-and-european-union-to-negotiate-worlds-first-carbon-based-sectoral-arrangement-on-steel-and-aluminum-trade/>.

55. Jeff Mason, *Trump to Announce 25% Steel and Aluminum Tariffs in Latest Trade Escalation*, REUTERS (Feb. 10, 2025), <https://www.reuters.com/markets/commodities/trump-says-he-will-announce-25-steel-aluminum-tariffs-monday-2025-02-09/>.

56. Lottie Zayed et al., *Trump Defunds Climate Commitments and Promotes Fossil Expansion Over Green Tech*, CRU GRP. (Mar. 7, 2025), <https://www.crugroup.com/en/communities/thought-leadership/2025/trump-defunds-climate-commitments-and-promotes-fossil-expansion-over-green-tech/>.

57. *See* U.S. Department of Energy, *supra* note 49.

58. Press Release, Sierra Club, Trump Eliminates Buy Clean Executive Order Leaving American Manufacturers Behind (Jan. 21, 2025), <https://www.sierraclub.org/press-releases/2025/01/trump-eliminates-buy-clean-executive-order-leaving-american-manufacturers>.

59. Lori Bird et al., *US Clean Power Development Sees Record Progress, as Well as Stronger Headwinds*, WRI (Feb. 21, 2025), <https://www.wri.org/insights/clean-energy-progress-united-states> ("Maryland's governor signed an executive order requiring the state to develop a framework for a 100% clean energy standard by 2035. Massachusetts passed a climate omnibus bill that is, in part, intended to accelerate clean energy deployment through permitting reform.")

60. Putting America First in International Environmental Agreements, Exec. Order No. 14162, 90 Fed. Reg. 4671 (Jan. 23, 2025).

United States, potentially hindering domestic innovation and slowing the country's contribution to global decarbonization efforts.

D. *The United Nations Framework Convention on Climate Change's Role in Advancing Green Steel and Industrial Decarbonization*

In 1992, countries joined the United Nations Framework Convention on Climate Change (UNFCCC) as a framework for international cooperation to combat climate change by limiting average global temperature increases and the resulting climate change, and coping with impacts that by then were inevitable.⁶¹ By 1995, the Parties launched negotiations to strengthen the global response to climate change, and, two years later, adopted the Kyoto Protocol, which legally bound developed country Parties to emission-reduction targets. There are now 197 Parties to the UNFCCC and 192 Parties to the Kyoto Protocol.⁶² Kyoto laid the groundwork for global climate action but was limited in scope, which led to development of the Paris Agreement as a more inclusive framework.

The Paris Agreement is a legally binding treaty adopted by 196 Parties at the United Nations Climate Change Conference (COP21) in Paris, France, on December 12, 2015. It entered into force on November 4, 2016. Its overarching goal is to hold “the increase in the global average temperature to well below 2°C above pre-industrial levels” and to pursue efforts “to limit the temperature increase to 1.5°C above pre-industrial levels.” However, in recent years, world leaders have stressed the need to limit global warming to 1.5°C by the end of this century.⁶³

The most effective way to achieve this goal at the current stage is by reducing a country's carbon footprint and emissions. Initiatives such as green steel play a crucial role in helping nations meet and maintain their commitments under the Paris Agreement. The Green Climate Fund (GCF) is the world's largest dedicated climate finance mechanism, established under the UNFCCC in 2010.⁶⁴ It aims to help developing countries mitigate and adapt to climate change by providing funding for low-carbon and climate-resilient projects. The GCF has demonstrated its commitment to supporting the decarbonization of the steel industry through targeted funding initiatives. In March 2024, the GCF approved a proposal titled “Enhancing enabling environment to support the decarbonisation of Moroccan steel production through the application of green hydrogen.”⁶⁵

Additionally, financial support mechanisms like the Warsaw International Mechanism for Loss and Damage (WIM) help mitigate financial instability, ensuring a just, smooth transition toward sustainability.⁶⁶ WIM helps with addressing the harms caused by climate change, particularly in vulnerable developing countries. The key connection between the two is that WIM could potentially play a role in supporting developing countries impacted by climate change, including those experiencing economic losses due to transitioning to greener industries like green steel production by facilitating knowledge-sharing, capacity-building, and access to financial resources to manage these impacts.

Ultimately, WIM is not designed to facilitate green steel or clean industrial transitions, but its financial and policy recommendations could support developing nations that experience economic disruptions due to climate-related trade policies or decarbonization mandates. If a country faces industrial decline due to global carbon pricing or trade barriers, WIM discussions could highlight the need for financial and technical support for affected economies.

The Paris Agreement supports the transition to green steel by encouraging nations to decarbonize heavy industries as part of their nationally determined contributions. It promotes policies that reduce emissions from steel production through clean technologies, such as hydrogen-based steelmaking and CCS. Additionally, the Paris Agreement's financial mechanisms, including the GCF and Technology Mechanism, help developing nations access funding and technical expertise to modernize their steel industries. By fostering international cooperation and market-based solutions, such as carbon pricing and emissions trading, the Paris Agreement ensures that green steel production is economically viable while meeting global climate targets.

III. **Green Certifications and Market Demand**

As industries and governments push for decarbonization, green steel certifications have become essential in ensuring transparency, credibility, and market acceptance of low-carbon steel. These certifications provide a standardized way to verify that steel production meets strict environmental and emissions criteria, helping to differentiate truly sustainable steel from conventional or misleading “greenwashed”⁶⁷ products.

One key benefit of green steel certifications is that they build trust in supply chains. As companies and governments set ambitious net-zero targets, they need assurance

61. UNFCCC, *History of the Convention*, <https://unfccc.int/process/the-convention/history-of-the-convention#Climate-Change-in-context> (last visited May 22, 2025).

62. *See id.*

63. UNFCCC, *The Paris Agreement*, <https://unfccc.int/process-and-meetings/the-paris-agreement> (last visited May 22, 2025).

64. GCF, *About GCF—Timeline*, <https://www.greenclimate.fund/about/timeline> (last visited May 22, 2025).

65. GCF, *ENHANCING ENABLING ENVIRONMENT TO SUPPORT DECARBONISATION OF MOROCCAN STEEL PRODUCTION THROUGH THE APPLICATION OF*

GREEN HYDROGEN (2024), <https://www.greenclimate.fund/document/enhancing-enabling-environment-support-decarbonisation-moroccan-steel-production-through>.

66. UNFCCC, *Warsaw International Mechanism for Loss and Damage Associated With Climate Change Impacts*, <https://unfccc.int/topics/adaptation-and-resilience/workstreams/loss-and-damage/warsaw-international-mechanism> (last visited May 22, 2025).

67. Courtney Lindwall, *What Is Greenwashing?*, NAT. RES. DEF. COUNCIL (Feb. 9, 2023), <https://www.nrdc.org/stories/what-greenwashing>.

that the steel they source aligns with their sustainability commitments. Certified green steel guarantees lower emissions, whether through hydrogen-based production, EAFs, or carbon capture technologies. This credibility is crucial for industries like automotive, construction, and renewable energy, where emissions reductions are a major concern.

From a trade and policy perspective, certifications help align industries with regulatory requirements such as the EU's CBAM and similar policies in other regions.⁶⁸ Governments and trade blocs are increasingly favoring low-emission materials in public procurement and trade agreements, giving certified green steel a competitive advantage. This ensures that producers who invest in sustainable technologies are rewarded in global markets rather than being outcompeted by high-emission alternatives.

Green steel certifications contribute to financial incentives and investment flows. Banks, investors, and climate finance institutions often require clear sustainability metrics before funding industrial projects. Certified green steel opens doors to green bonds; environmental, social, and governance (ESG) investments; and climate-focused subsidies, accelerating the transition to cleaner production. In the long run, widespread certification frameworks will play a critical role in making sustainable steel the global standard rather than the exception. There are a few certifications that are currently used in the green steel industry, such as XCarb^{®69} and bluemint[®] Steel.⁷⁰

IV. Challenges in the Regulation of Green Steel

The transition to green steel faces significant technological and economic barriers, primarily due to high production costs and the need for continued innovation. Traditional steelmaking relies on carbon-intensive blast furnaces, while green steel production involves alternative methods like HRI or EAFs powered by renewable energy. These methods are not yet cost-competitive with conventional processes, making large-scale adoption difficult without financial incentives or regulatory support.

A major challenge is the lack of commercial-scale hydrogen infrastructure. Green hydrogen, produced through electrolysis using renewable energy, is essential for sustainable steel production. However, the infrastructure for its generation, storage, and distribution remains underdeveloped. Without sufficient supply chains and investment in hydrogen production facilities, scaling up green steel operations will be slow and costly.

Additionally, sourcing renewable energy at competitive prices, despite the introduction of CFD instruments, remains a key obstacle. The cost gap from CFD instru-

ments, despite being considered a small gap when measured per kg, is a heavy burden on developing and least developed nations when compared to an annual supply. Steel production is energy-intensive, and a stable supply of affordable renewable energy is crucial for maintaining efficiency and profitability.

Many regions still rely heavily on fossil fuels, and integrating large-scale renewable energy solutions requires substantial investment in grid infrastructure and energy storage technologies. Overcoming these barriers will require strong policy support, technological advancements, and collaboration between governments and industries to drive down costs and enable a sustainable transition for the steel sector. Another potential issue is how CBAM will verify and certify green steel imports. If the EU does not accept third-party certifications or if there is a lack of harmonized international standards, exporters of green steel may still face CBAM levies, making it less competitive despite its lower carbon footprint.

Finally, CBAM's compatibility with WTO rules is controversial, particularly regarding the principles of nondiscrimination and fair trade under the General Agreement on Tariffs and Trade (GATT). The two key legal challenges CBAM might face are:

- **Most-favored nation (MFN) treatment (Article I of GATT)⁷¹:** CBAM applies differently to goods depending on their country of origin. If certain countries receive preferential treatment or exemptions, other WTO Members could argue that CBAM violates MFN principles by discriminating against imports from specific regions.
- **National treatment (Article III of GATT)⁷²:** WTO rules require that imported goods be treated no less favorably than domestically produced goods. If EU-produced green steel benefits from subsidies, tax breaks, or regulatory advantages that imported green steel does not receive under CBAM, affected countries could claim unfair treatment.

Major steel-producing nations like China and India argue that CBAM disproportionately affects developing economies that rely on coal-based steel production.⁷³ If the costs associated with CBAM compliance become too burdensome for producers in third countries, they may shift their exports toward regions without similar carbon pricing regulations. Such a shift could create instability in global supply chains and slow the adoption of green steel, particularly in the absence of harmonized carbon pricing policies across different markets. Given that a significant portion of green steel R&D is currently in Europe, disparities in innovation and technology diffusion may emerge.

68. WTO, INFORMATION BRIEF NO. 7, TRADE AND CLIMATE CHANGE (2022), https://www.wto.org/english/tratop_e/envir_e/trade-climate-change_info_brief_no7_e.pdf.

69. ArcelorMittal, *XCarb[®] Steel Certificates*, <https://corporate.arcelormittal.com/climate-action/xcarb/xcarb-green-steel-certificates> (last visited May 22, 2025).

70. DNV, *Green Steel Assurance*, <https://www.dnv.com/services/green-steel-assurance-232895> (last visited May 22, 2025).

71. GATT 1994 art. I, Apr. 15, 1994, 1867 U.N.T.S. 187.

72. *Id.* art. III.

73. *Carbon Border Adjustment Mechanism and Its Impact in India*, AZB & PARTNERS (Aug. 12, 2024), <https://www.azbpartners.com/bank/carbon-border-adjustment-mechanism-and-its-impact-in-india/>.

Additionally, developing nations working to establish their green steel industries could encounter major obstacles in accessing CBAM-compliant technologies. This could deepen the financial divide between developed and developing economies in climate-related investments. Without sufficient international support, these countries may struggle to remain competitive in an evolving, low-carbon trade landscape, ultimately limiting the broader impact of green steel on global decarbonization efforts.

V. Conclusion

The transition to green steel is a critical step toward achieving global climate goals, aligning with international commitments such as the Paris Agreement and the UNFCCC's broader decarbonization framework. With the steel industry contributing approximately 7% of global GHG emissions, regulatory mechanisms like CBAM, alongside climate finance tools such as the GCF and WIM, are playing a pivotal role in driving the shift toward low-carbon steel production.

However, this transformation faces technological and economic barriers, including the high costs of hydrogen-based steelmaking, insufficient commercial-scale hydrogen infrastructure, and challenges in securing competitively priced renewable energy. Additionally, the disparity in climate financing and technology access between developed and developing nations raises concerns about equity in the global steel transition. Without adequate financial and technological support, emerging economies may struggle to compete in CBAM-regulated markets, further widening the climate financing gap.

Countries like the United States, the EU, and the U.K. have introduced policies to accelerate the transition, leveraging financial incentives, carbon pricing, and trade measures. The U.S. IRA and Buy Clean Initiative promoted low-emission steel production through federal investment

and procurement standards. The Clean Competition Act further seeks to impose carbon-based tariffs on high-emission imports, ensuring fair competition for domestic producers committed to sustainability.

However, in light of the new Administration, uncertainty looms over the regulatory and financial landscape for green steel in the United States. Several federal initiatives supporting industrial decarbonization have been rolled back, suspended, or face an uncertain future. Nonetheless, state-level efforts and private-sector momentum in the United States may continue to drive innovation independently.

The EU CBAM sets a precedent for carbon-adjusted trade policies, while the U.K.'s approach to green industrial strategy follows a similar trajectory. Meanwhile, China, India, and other emerging economies are also exploring pathways for decarbonization, though challenges related to cost, infrastructure, and market competitiveness remain significant.

To ensure a just and inclusive transition, multilateral cooperation, trade diplomacy, and climate financing mechanisms must work in tandem. Organizations such as the UNFCCC, WTO, and Group of Seven/Group of 20 (G7/G20) have a role to play in harmonizing policies, ensuring fair treatment of low-carbon steel producers, and promoting technology transfer to developing nations. Strengthening green finance initiatives, global carbon pricing mechanisms, and cross-border partnerships will be essential in making green steel an accessible and economically viable solution worldwide.

As demand for sustainable materials grows, the steel industry has a unique opportunity to become a leader in industrial decarbonization. By addressing regulatory, financial, and technological challenges through coordinated global efforts, nations can ensure that green steel production is both commercially competitive and environmentally responsible, paving the way for a climate-resilient industrial future.