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COUNTRY PROFILES[1]

2023 STEEL POLICY SCORECARD

KATINKA WAAGSAETHER, ALEKSANDRA WALISZEWSKA & JOHANNA LEHNE

E3G's 2023 Steel Policy Scorecard shows that there is a long way to go to achieve decarbonisation of the global steel industry. But individual countries are in very different positions, in terms of both their steel industry and political economy. This document paints a picture for each country analysed of where they are now, and what next steps will take them furthest along the road to green steel.

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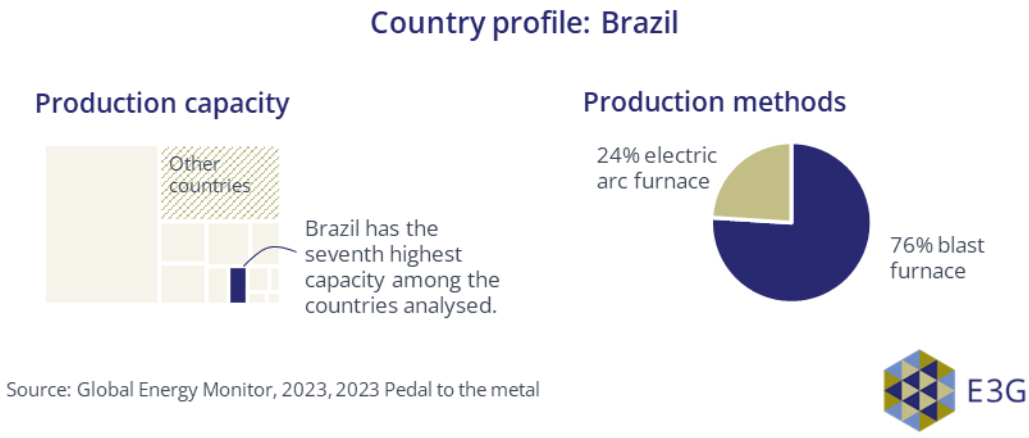
[1] This document supplements the main **2023 Steel Policy Scorecard report: Raising ambition on steel decarbonisation**.

Brazil – a possible future green steel powerhouse

Brazil was left without clear direction for many years, but the Lula administration's wave of policies, plans and aspirations are now starting to steer a new course for Brazil. If the government embeds steel decarbonisation in its push to be a green powerhouse, then Brazil, with its abundant renewable energy and iron ore resources, could become a green steel powerhouse.

Brazil needs to do more policy work and develop climate policy leadership to get to that position. The current clear shift in direction is an excellent start, with many policies and processes underway that could substantially change Brazil's position going forward.



Priority recommendations for Brazilian steel decarbonisation policy

Brazil has great potential to be an important green iron and steel exporter. The following policies can help realise this potential:

> Secure the value-add of a green steel sector to the Brazilian economy, by providing investment security for industrial actors; facilitating the creation of international purchasing clubs and assisting the establishment of international commercial and bilateral agreements; enhancing this agenda during its G20 2024 Presidency.

- Embed climate ambition in the new drive for green reindustrialisation with a dedicated roadmap setting ambitious steel sector emissions reduction targets for 2030 and 2050. This would accompany current spending programmes such as the Growth Acceleration Plan and the Ecological Transformation Plan, and go hand in hand with a plan to green domestic and international steel demand.
- Accelerate the development of an emissions trading scheme (ETS), coupled with government support to steel plants in transition. Plans to safeguard the domestic market against oversupply of high-carbon steel in international markets should also be put in place.

A large producer with an unusual energy profile

Brazil is currently the ninth largest steel producer globally, with 51 million tonnes per annum (Mtpa) steelmaking capacity.[2] Brazil's ample renewables potential and iron ore resources are great prerequisites for producing green iron through hydrogen-based DRI technology (H_2-DRI). However, there are no H_2-DRI plants in the project pipeline and 76% of steel in the country is produced in blast furnaces.[3] Usually such furnaces use coal, but in Brazil 11% of primary steel production uses biochar instead.[4]

Brazil is the only place in the world that uses charcoal in small furnaces. The approximately 1.2 million hectares of planted forests dedicated to the steel industry represent 13% of Brazil's total planted forest area.[5] Areas for biochar production can be obtained through the expansion of planted forests by restoring degraded areas. Charcoal certified according to clear environmental and social sustainability requirements has a role to play in achieving near-zero emission steelmaking. Guaranteeing the protection of conservation areas, adopting modern coking technologies to reduce methane emissions and promoting good rural employment practices are crucial. Additionally, mapping degraded areas and their proximity to steel plants is essential for technical and economic viability.

[2] Instituto Aco Brasil, 2022, **Consolidated industry data for 2022**, accessed November 2023

[3] Global Energy Monitor (GEM), 2023, **Pedal to the Metal 2023**

[4] Biochar is a form of charcoal derived from burning organic material from agricultural and forestry wastes.

[5] Ministry of Agriculture, Forestry and Fisheries of Japan, 2019, **Country Report Brazil**

The Brazilian steel company Aço Verde Brasil has built what is deemed to be the first carbon-neutral integrated steel plant in the world, using biochar derived from planted forests.[6]

Positive signals from the public and private sector – but little concrete action

Brazilian companies are starting to position themselves as producers of green iron, both locally and internationally. Vale is a Brazilian multinational and the world's largest iron ore miner. It is setting up mega-hubs in Saudi Arabia, the United Arab Emirates and Oman to feed DRI furnaces.[7] It also recently signed an agreement with Swedish H2 Green Steel to investigate the feasibility of developing green industrial hubs in Brazil – with an eye to producing hot briquetted iron with green hydrogen. If extended to include the next step – green steelmaking, the value-add to the Brazilian economy could be even greater.[8]

Green iron and steel production fit well with the Lula government's focus on developing Brazil as a green powerhouse. Recent national policies, such as the Growth Acceleration Plan, the Ecological Transformation Plan and the Multi-year Plan (Plano Plurianual 2024–2027), are sending signals in this direction. There is also a growing Brazilian narrative around green neo-industrialisation.

What is also required now are: clear regulatory signals for industry and steel decarbonisation, including emissions reduction targets; and dedicated government funding for steel decarbonisation in form of direct grants or tax incentives. Already, public banks offer some support. More might be needed, especially if the price premium on green steel increases. This could happen with the potential introduction of a mandatory carbon market domestically and due to other mechanisms worldwide, such as the EU CBAM.

Huge clean energy potential to take advantage of once tangible targets and policies are in place

Brazil generated nearly 93% of its electricity from clean sources in the first nine months of 2023.[9] With huge remaining renewable energy potential, it is well positioned to swiftly achieve a net zero power system and fuel its green reindustrialisation aspirations. This would give the country a significant

[6] Global Energy Monitor, AVB Açailândia **steel plant** (accessed January 2024)

[7] Vale, November 2022, **Vale signs agreements to develop Mega Hubs in the Middle East and provide decarbonization solutions for steelmaking.**

[8] E+ Energy Transition Institute, 2022, **Scoping Paper on the Brazilian Steel Industry Decarbonization**

[9] Reuters, October 2023, **Brazil set to widen lead as cleanest major power sector**

competitive edge in a decarbonising world. Private sector action is already starting to power growing steel capacity with new clean energy, thanks to solar and wind being the cheapest sources of energy in Brazil.[10] A recently announced ArcelorMittal joint venture partnership is set to meet 38% of the company's power needs in Brazil until 2030 through dedicated wind power installations.[11]

The country's national energy plan refers to integrating hydrogen in the steel sector.[12] The next step will be to set tangible targets and policies to achieve this goal; a hydrogen strategy (PNH2) is under development. Brazil's ten-year energy plan, published in 2022, included an assessment of the hydrogen technical production potential from various energy sources, including fossil fuels, biomass and renewables, up to 2050. It did not include any production, capacity, consumption or end-use targets, but a certification scheme based on hydrogen emissions intensity is planned.

Brazil also has unexplored potential for biomethane, from agriculture and urban residues. This is mainly in the southeastern region, where the country's main steel mills are located. The ecological transformation plan highlights the possible introduction of general programmes to encourage circular economy practices in the industrial sector. It also includes specific ones for managing urban residues and using them as a source of energy.

The Brazilian government can help build green steel markets

Key players in the Brazilian steel industry are unlikely to make bolder moves without greater certainty about demand for green steel products. Brazil joining the IDDI in July 2023 sends a clear signal on the government's intention to scale up its ambition on public procurement, an important policy lever. This should be followed by clear green steel procurement targets or requirements. In addition, the Brazilian government could pursue bilateral offtake agreements with key countries, such as China, Germany, Mexico, South Korea and the USA. Ideally, it would do so in parallel with a process to identify internationally aligned green steel definitions and standards.

[10] Instituto de Energia e Meio Ambiente (iema), October 2022, **Solar and wind farms are contracted for the best price in the last energy auction**

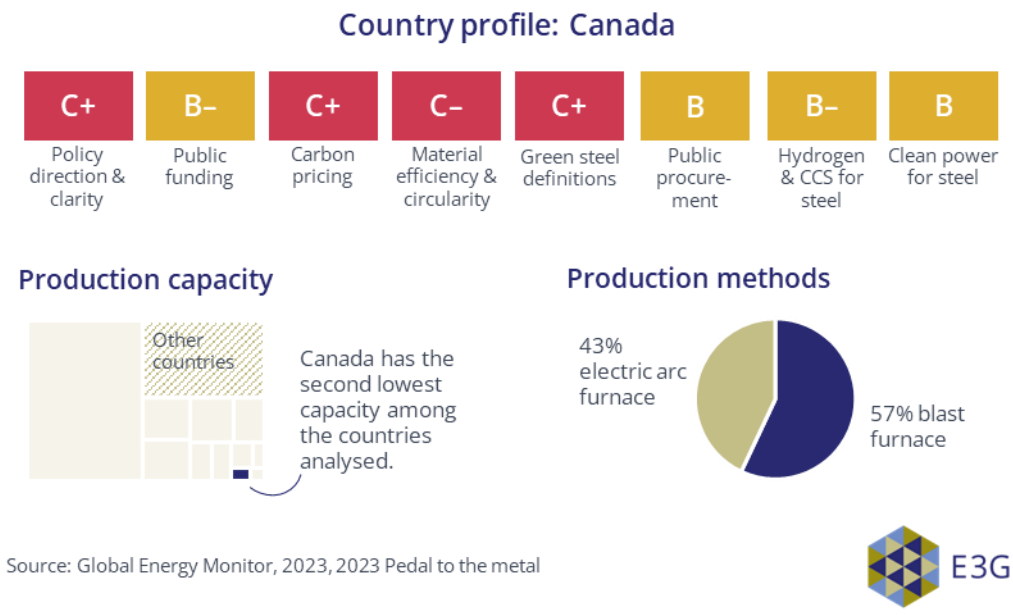
[11] ArcelorMittal, April 2023, **Arcelor Mittal establishes renewable energy JV with Casa dos Ventos in Brazil**

[12] Federal Government Ministry of Mines & Energy, 2021, **Baseline to support the Brazilian Hydorgen Strategy**

Canada – a smaller player with untapped potential

With huge renewables potential, iron ore resources and good access to key markets, Canada could move quickly to become the first all-green iron and steel producer in the world. However, Canada lags behind other G7 countries on public funding for demonstrating near-zero emissions technologies. It could also benefit from setting a clearer overarching clean industrial strategy.

Canada has made progress on setting public procurement requirements and planning infrastructure for hydrogen and clean electricity. It is an active participant in international initiatives on industry decarbonisation. The steel sector is, however, missing an overarching clean industrial strategy and a sector-specific roadmap for reaching net zero. Initiating a roadmap for steel would provide certainty and confidence about the pace and direction of travel.



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Priority recommendations for Canadian steel decarbonisation policy

> Set out a net zero roadmap for the steel sector with an ambitious decarbonisation target and clear timelines for phasing out coal-based steelmaking, building on Canada's existing cement and concrete roadmap.

> Scale up investments in demonstrating and deploying near-zero emission steel technology.

> Apply stringent life-cycle emissions criteria to hydrogen production and consumption, and clarify plans for the application of low-emission hydrogen or CCS to DRI sites in dedicated strategies.

An opportunity for government to lead the way to phase out coal and phase in green energy

Canada is a minor steel producer, with a total of 15 Mtpa production capacity – 0.7% of global production. Almost two-thirds, 57%, of this is currently coal-based; the remaining 43% comes from scrap-EAF.[13] However, Canada has many of the preconditions needed to become a green steel leader: a relatively low-carbon electricity grid, strong renewable energy potential, access to iron ore, a highly educated workforce, a stable regulatory environment and a manufacturing base close to key markets.[14] Being a net steel scrap exporter, Canada also has ample steel scrap resources.[15] Currently, an additional 3 Mtpa green primary steel capacity is in the works,[16] and Swedish H2 Green Steel is in talks with the Canadian government to build a further factory in northern Quebec.[17]

At a federal level, Canada's message to its steel sector could be clearer. Industry features in Canada's Emissions Reduction Plan,[18] and an emissions reduction **pathway** for iron and steel is presented, indicating around 35% reduction by 2030 from 2005 levels. Targets would be a useful addition, for industrial sectors more broadly and for the steel sector specifically.

Provincial level policies play an important role in Canada, as provinces hold key competencies such as energy. Canadian steelmaking is concentrated in two

[13] Calculated from Appendix C in Global Energy Monitor, 2023, **Pedal to the Metal 2023**

[14] Clean Energy Canada, 2023, **Decarbonising industry in Canada and the G7**

[15] BIR, 2023, **World steel recycling in figures 2018–2022**

[16] Global Energy Monitor, 2023, **Pedal to the Metal 2023**

[17] Steel Times International, 2023, **H2 Green Steel considers Canada for green steel plant**

[18] Government of Canada, 2022, **2030 Emission Reductions Plan**

provinces – Québec and Ontario – with coal-based production mainly sited in Ontario. Provincial Ontario policies are therefore key for steel decarbonisation in Canada.

Building demand for green steel through public procurement

While there is no apparent movement on definitions for near-zero emissions steel, Canada is a front-runner in terms of public procurement. It is the only IDDI member that has publicly committed to pledges (1 and 3). In parallel, it is setting out to reduce the embodied carbon of structural materials used in major public construction projects by 30% – starting in 2025.[19] As a smaller steel producer, Canada needs to ensure alignment and strong partnerships with other countries on building "lead markets" if it is going to ensure market access for future green iron and steel exports.[20]

More efforts are needed to bridge the cost premium between green and fossil-based steel production

Canada's federal-level carbon pricing system (OBPS) has only limited impact on trade-exposed industries such as steel. The overwhelming majority of steel production does not face any carbon costs as the carbon price only applies to emissions above a performance standard based on the national average emissions intensity. Still, this federal system comes into play if a provincial scheme does not show similar ambition. Having scrapped its provincial ETS (emissions trading system) in 2018, Ontario is currently subject to the federal system, while Québec has its own system linked with California.

When it comes to public funding, Canadian industrial R&D spending is generally very low compared to other G7 countries. This results in little funding being available for developing low-carbon steel technologies.[21] Most of the coal-based facilities in Ontario receive direct grants to support their transition, from both federal and state governments. The Canadian Growth Fund highlights CCfDs (Carbon Contracts for Difference) as a potential area of future policy action[22] and a possible avenue for operational funding support.

[19] Treasury Board of Canada Secretariat, n.d., **Greening Government Strategy: A Government of Canada Directive**

[20] Clean Energy Canada, 2023, **Decarbonising industry in Canada and the G7**

[21] Clean Energy Canada, 2023, **Decarbonising industry in Canada and the G7**

[22] McMillian, 2023, **Canada's budget 2023: Compromise and competition - climate, carbon and CCfDs**

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Ambitious hydrogen targets but a mixed bag of end-use applications

Canada's hydrogen strategy focuses on both blue and green hydrogen. It clearly emphasises its geographical advantage of producing fossil-based hydrogen with CCS, as well as biomass-based (red) hydrogen. It has a 2030 hydrogen production target sufficient to cover multiple end-uses, but steel is not prioritised over less important end-uses, such as residential heating.[23] The strategy mentions the use of CCS in the production of hydrogen for use in the steel sector, but Canada's recently adopted carbon management strategy does not provide clear enough overarching direction and ambition.[24] One of the first "H_2-ready" DRI projects in the world is being developed at the Hamilton site in Ontario. This will initially be powered by fossil gas, with no clear plans for CCS. There are provisional talks about building a H_2-DRI unit in Quebec. Several provinces have also released their own hydrogen strategies.

Strong focus on clean electricity provision in provinces

Canada's federal 2030 Emissions Reduction Plan stresses that the necessary increase in electricity supply must be net zero. The Canadian grid is already largely decarbonised, though overall progress on greening it fully is slower than expected. Clean electricity regulations[25] are also being developed, recognising the need to electrify industries and setting a 2035 power system neutrality target. Energy is however a provincial competence, and hence provincial policy plays a key role. Ontario is already generating 92% of its electricity from renewable energy sources.[26] The province's government also has specific plans to enable electrification of its steel plants, for instance through building a power transmission line to the Hamilton plant.

[23] IRENA, 2022, **Geopolitics of the Energy Transition. The Hydrogen Factor**

[24] Government of Canada, last updated 2023, **Canada`s Carbon Management Strategy**

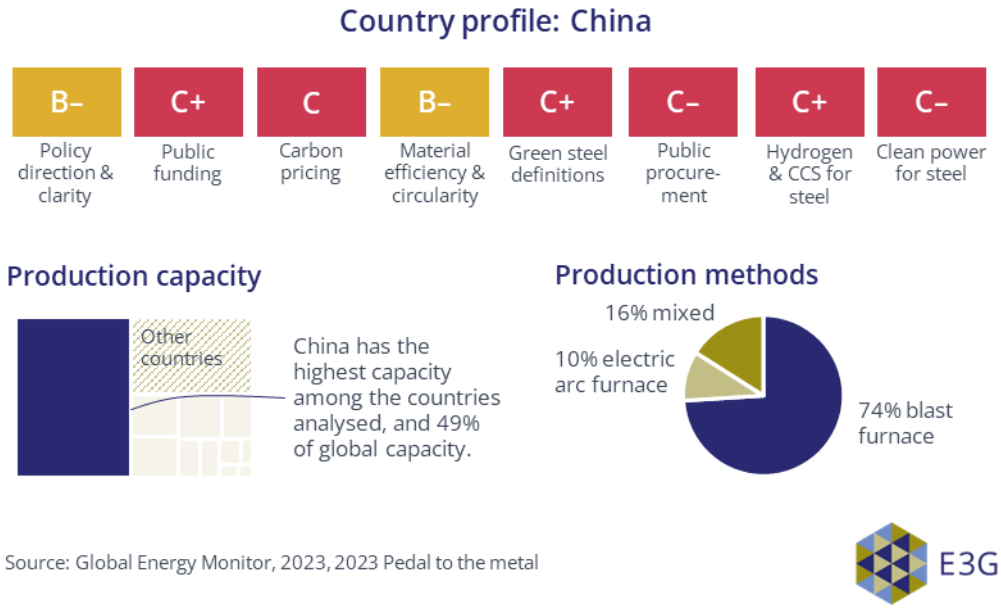
[25] Government of Canada, last updated 2023, **Clean Electricity Regulations**

[26] Government of Canada**, Canada`s Renewable Power – Ontario** (last accessed: 2023)

China – where domestic policy moves make a big global difference

China is central to the decarbonisation trajectory of the steel sector globally. It has nearly half of global steel production, and 59% of that is coal-based.[27] Challenging international diplomatic and trade relations tend to blur the picture, and issues of overcapacity and continued investment in coal-based production overshadow progress on other policy levers.

There are signs of small, yet important policy moves across a variety of levers in China. They include establishing an infrastructure for emissions reporting and setting clear targets for increasing the proportion of secondary, scrap-based steel production. However, these efforts are not yet reflected in China's steel facility pipeline, still dominated by coal-based production capacity, and will require increased ambition. What is more, while China's renewables capacity is expected to overshoot its 2030 target five years ahead of time, this progress remains strategically disconnected from industrial electrification plans.



[27] Global Energy Monitor, **Global Steel Plant Tracker**

Priority recommendations for Chinese steel decarbonisation policy

> Set an ambitious 2030 emission reductions target for the steel sector.

> Take green building materials procurement policy to another level by setting embodied carbon thresholds for key materials, including steel.

> Scale up scrap sorting and recycling and maximise material efficiency potential in the steel sector, building on China's existing track record on circular economy.

Key actor on the global steel market still relying on a coal-based production pipeline

China currently produces 49% of global steel, with a capacity of 1,112 Mtpa.[28] Given this scale, its production landscape and domestic markets have direct implications for international markets. Steel exports have recently seen a 30% uptick as a result of the Chinese real estate crisis and related fall in domestic steel demand, coupled with ongoing challenges of overcapacity. This is raising concerns among trade partners about dumping and the impact on international prices.[29] How China handles these challenges will play an important role in shaping the steel transition globally, and the extent to which it will be characterised by protectionist measures versus trade openness.

China's climate policies also play an important role in the global transition. At present 74% of Chinese steel production is coal-based primary production capacity, with only 10% secondary, scrap-based EAF.[30] China has the second largest coal-based steel production pipeline globally, with another 147 Mtpa of capacity under development.[31] The steel sector is responsible for more than 30% of total coal use in China; it has been the main source of growth in demand for coal.[32] While some DRI facilities with plans for hydrogen or CCS use have been announced, these are minor in scale in the Chinese context. Turning this picture around is central to curbing emissions from global steel production.

[28] Global Energy Monitor, 2023, **Pedal to the Metal 2023**

[29] GMK Center, 2023, **China`s overcapacity problem returns**

[30] Calculated from Appendix C in Global Energy Monitor, 2023, **Pedal to the Metal 2023** (noting that the discrepancy between coal-based and scrap-based production is explained by mixed production process capacity).

[31] Global Energy Monitor, 2023, **Pedal to the Metal 2023**

[32] E3G, PNNL, Oct. 2021, **1.5C Steel: Decarbonizing the Steel Sector in Paris-Compatible Pathways**

Hopes for increased Chinese ambition on emission reduction targets

Current official policy is to peak emissions from the Chinese steel industry before 2030.[33] However, there are indications that increased ambition – **reducing** emissions by 2030 – could be in the works. This was already indicated by the China Iron and Steel Association (CISA) back in 2021.[34]

Provincial strategies as source of hope for raising ambition

With provincial populations ranging from 5 to over 120 million, a city pilot project or policy may have a larger budget or involve more industrial actors than it would in a medium-sized country. As such, provincial projects and policies can have a major bearing on the steel sector.

China's national hydrogen strategy prioritises it use in the commercial vehicles sector; industrial decarbonisation is treated as a future issue. The annual production target of renewable hydrogen planned at national level is 100,000–200,000 tonnes per year;[35] this is insufficient to play a meaningful role in decarbonising China's steelmaking capacity. The strategy aims to also use other types of hydrogen, without indicating any CCS application to hydrogen derived from fossil fuels. Notably, regional strategies are already moving beyond national ambition, with Inner Mongolia aiming to produce 480,000 tonnes of renewable hydrogen a year by 2025.[36]

The lead role provinces can play is also reflected in carbon pricing where some regional pilot carbon market schemes cover the steel sector. The national carbon pricing scheme does not yet include it, and benchmarks for the power sector are non-stretching. There are however plans to include steel in the national system, with emissions reporting set to start in 2023.[37]

Together with state-owned enterprises, the government can provide financial support to the green steel transition

There may be little to no public sector support for R&D on low-carbon steelmaking technology or subsidies for capital or operational expenditure directly from the Chinese government. But the major role of state-owned

[33] National Development and Reform Commission (NDRC), 2021, **Action plan for carbon dioxide peaking before 2030**

[34] National Business Daily article, 31 March 2021, **Exclusive interview with Li Xinchuang, vice president of the China Iron and Steel Association**

[35] Energy Iceberg, 2022, **China`s National Hydrogren Development Plan**

[36] Center on Global Energy Policy, 2023, **China`s Hydrogen Strategy: National vs. Regional Plans**

[37] Climate Cooperation China, 2022, **Status of China's national ETS and regional emission trading pilots**

enterprises (SOEs) in China blurs the line between government policy and company action. Some public sector action indeed takes place **through** the SOEs. The production giant Baowu, 100% government owned, is an important example for steel. For instance, together with the government, Baowu has set up the $6.9bn Carbon Neutral Equity Fund and vowed to dedicate part of its annual revenues to it.

Reporting and comparing emissions from steel products

An important government initiative is the Chinese Environmental Products Declaration (EPD) platform for the steel sector, with its method for calculating, reporting and comparing emissions from products.[38] Here China is building the data to make it easier to establish green steel definitions and standards. While, unofficially, the Chinese EPD team is also said to be exploring green steel definitions and standards, there is no public information on a process or intention in that direction. If confirmed, this would represent a major step forward.

There is no evidence of China looking to set a green-steel public procurement target or requirement. However, the recent green building materials procurement policy includes emission calculations and analysis requirements, an encouraging move. This policy is expected to cover all public procurement projects in the 48 pilot cities by 2025.[39]

First moves on circularity (scrap) and a mixed bag on clean power

China is one of very few countries explicitly connecting steel with its circular economy initiatives. It has set steel scrap use targets as part of its fourteenth Five-Year Plan for the Development of the Circular Economy.[40] The government is implementing policies to increase the proportion of secondary, scrap-based EAF production – from 10% in 2020 to 15% in 2025 and 20% in 2030.[41] These represent important starting points and can lead to a broader focus on material efficiency and demand reduction.

[38] State Owned Enterprises News, 2022, **China's EPD programme makes debut**

[39] State Council, 2022, **Procurement to Support Green Building Materials to Promote the Improvement of Building Quality**

[40] China Briefing, 2021, **China's Circular Economy: Understanding the New Five Year Plan**

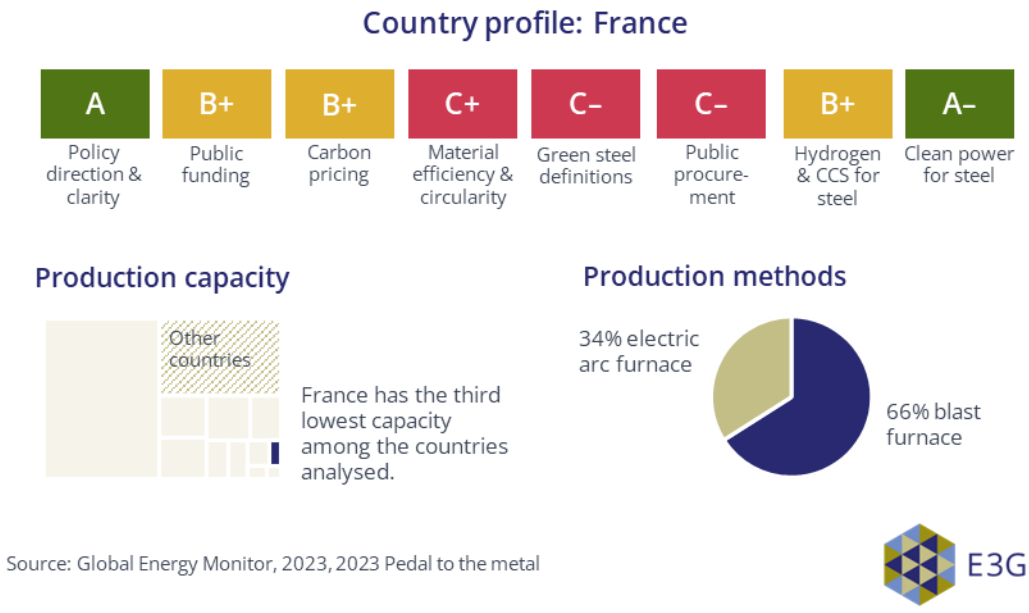
[41] Ministry of Industry and Information Technology & National Development and Reform Commission (NDRC), 2022, **Implementation Plan for Carbon Peaking in the Industrial Sector** / CREA, 2023, **China's steel sector invests USD 100 billion in coal-based steel plants, despite low profitability, overcapacity and carbon commitments**

Finally, China is projected to achieve its target of 1.2 TW RES by 2030 as early as 2025, although its official power system decarbonisation ambition remains low. These developments are overshadowed by widespread curtailment due to insufficient grid capacity and disconnected from industrial electrification plans.

France – picking up the pace on steel decarbonisation

French coal-based steel production is concentrated in two sites, at Fos-sur-Mer and Dunkerque. This means that the new government policy of site-based decarbonisation roadmaps could make for a swift move away from coal-based steelmaking in France.

France is making a number of positive policy moves, applying both policy sticks and carrots. What it does next will be key, from the ambition levels of site-based emissions reduction targets and green product requirements, to the conditionalities of public funding. Transparency on how companies intend to decarbonise and spend the public funding invested will be key to ensure accountability and progress.



Priority recommendations for French steel policy

> Ensure transparency of the site-specific steel decarbonisation roadmaps. Incorporate the roll-out of clean electricity and hydrogen infrastructure.

> Make public transition funding conditional on ambitious decarbonisation targets to which companies are held accountable through regular controls.

> Develop a simple, clear and ambitious Triple E standard that has an explicit focus on steel and includes a progressive emission intensity threshold, in parallel with the development of ambitious green steel public procurement targets or requirements.

Transparent site-based roadmaps as keys to the French transition

Around two-thirds (66%) of France's steelmaking capacity is coal-based primary production; the remainder is secondary, scrap-based EAF production.[42] No new coal-based facilities are in the making, but there is lack of clarity on planned lifetime extensions (relining) of existing facilities.

French industrial decarbonisation policy moving away from sectoral emissions reduction targets and roadmaps to site-based ones. Fifty high-emission industrial sites have been identified, responsible for 10% of total national emissions.[43] Two coal-based ArcelorMittal sites dominate France's steel-making capacity; together they are responsible for 25% of French industry's greenhouse gas emissions.

The French government has vowed to financially support the transformation of both sites. The expectation is that the new site-based roadmaps, not yet public, will increase the ambition of the wider steel industry's roadmap;[44] the latter currently calls for a 31% emissions reduction target for 2030 (relative to 2015). Some H_2-DRI capacity is planned for one of the two sites, though with an initial phase of natural gas-DRI. In parallel, the French government has earmarked a significant amount of R&D funding towards further development of net zero steel production technologies.

Planning for clean energy infrastructure for green steel

The French hydrogen strategy sets a good example on targeting priority sectors:[45] 76% of its budget is dedicated to decarbonising heavy industry, including the steel sector.[46] The government is also considering introducing a hydrogen production support scheme in form of a CfD. Due to its large share of clean baseload power (hydro and nuclear), France is also in a great position to integrate more renewables into its grid. But at the EU level, it has a relatively low

[42] Calculated from Appendix C in Global Energy Monitor, 2023, **Pedal to the Metal 2023**

[43] Climate Action Network France, 2023, **France's top 50 Carbon-intensive Industrial sites**

[44] French Government & the National Industry Council, 2022, **Towards a competitive, innovative, carbon-free and attractive French steel industry**

[45] IRENA, 2022, **Geopolitics of the Energy Transformation: The Hydrogen Factor**

[46] RIFS, 2023, **France`s Hydrogen Strategy**

power system decarbonisation target (for 2035).[47] Despite this, the electricity infrastructure necessary for low-carbon steel is one of the pillars of the national decarbonisation strategy for this sector.

Opportunities for more ambitious green steel standards and using public procurement

Adopting aligned green steel standards and definitions seems to be an underleveraged policy lever in France. The lack of membership of international initiatives like the IDDI also suggests a lack of ambition towards setting targets for green steel public procurement. Green public procurement, beyond what is required by EU directives, is currently voluntary and not steel specific; however, sustainable development criteria are set to become mandatory in public procurement by August 2026 (as set out in the 2021 Climate and Resilience Law).

At the same time, France is working on a new, Triple E, environmental standard, aimed at rewarding the facilities that produce the greenest products. It is expected that Triple E-certified companies will have better access to public contracts, though the ambition of the standard – and whether it will encourage decarbonisation – is still to be seen.

European Union membership providing direction

The EU member states assessed in our G7 Steel Policy Scorecard (France, Germany and Italy) benefit from an ambitious climate policy framework set at the EU level. While some of the new policy measures under the European Green Deal are yet to be transposed into national legal systems, they already help to boost scores for those three countries.

The European Green Deal set a high bar for emissions reduction among EU member states; it targets a 55% reduction by 2030 and climate neutrality by 2050. The Fit for 55 package, introduced to meet these targets, includes a number of policy files relevant to the steel transition.[48] The reform of the EU ETS sets out a gradual full phase-out of free allocations for industry from 2026 to 2034.[49] The EU Circular Economy (CE) Action Plan was released in

[47] Ember, 2023, **EU Power Sector 2030 Targets Tracker;** SP Global, 2023, **G7 Nations agree to decarbonise power sectors by 2035**

[48] Council of the European Union, last reviewed 2023, **Fit for 55**

[49] European Parliament, December 2022, **Press release - Climate Change: Deal on a more ambitious Emission Trading System**

March 2020;[50] it includes a recent revision of the Ecodesign for Sustainable Products Regulation (ESPR), which foresees ecodesign product requiremnets for steel to be introduced in 2024.

EU-level funding options for steel decarbonisation are available for R&D (recently increased resources for steel under the dedicated Research Fund for Coal and Steel, private–public Horizon Europe Clean Steel Partnership, demonstration project support under Innovation Fund) and capital expenditure (Recovery and Resilience Fund – consisting of grants and loans), and more operational support is potentially in the pipeline as the European Commission is considering a CCfD scheme under the Innovation Fund. Any direct state aid to companies from national governments is also subject to Commission scrutiny.

The EU does not have the mandate to intervene in how member states decide to organise their energy mixes. However, its recent reform of electricity market design made system flexibility and certainty of long-term markets for renewables its core pillars.[51] The reform entails harmonisation of public renewables support schemes (CfD). The revenues can then be used for electricity price support for industrial consumers. Member states are also meant to work to remove barriers hampering the development of a long-term PPA market.

In terms of European hydrogen production, the REPowerEU plan sets a target of 10 Mt of green hydrogen to be supplied domestically.[52] The EU is also working towards a "low-carbon hydrogen" definition, having already adopted one for green hydrogen). Another revised directive on renewable energy (RED II)[53] brought with it a target for 42.5% green hydrogen use in

[50] EU, 2020, **Circular Economy Action Plan**

[51] Council of the EU, 2023, **Reform of electricity market design – Council reaches agreement**

[52] European Commission, 2022, **Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: REPowerEU Plan**

[53] European Parliament, 2023, **European Parliament legislative resolution of 12 September 2023 on the proposal for a directive of the European Parliament and of the Council amending Directive (EU) 2018/2001 of the European Parliament and of the Council, Regulation (EU) 2018/1999 of the European Parliament and of the Council and Directive 98/70/EC of the European Parliament and of the Council as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652 (COM(2021)0557 – C9-0329/2021 – 2021/0218(COD))**

industry by 2030,[54] rising to 60% by 2035. RED II also doubled the EU's overall renewable energy target to 42.5% by 2030. These developments aim to green industrial energy use, but there is no indication of end-users such as steel being prioritised, if we take a newly launched support scheme for the production of green hydrogen – the European Hydrogen Bank – as a guide.[55]

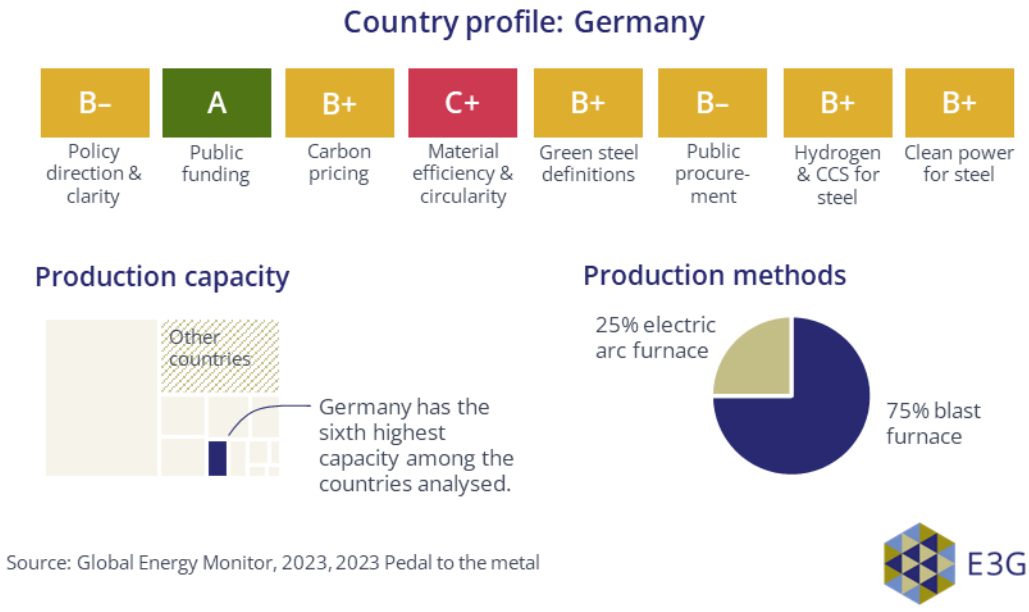
[54] European Parliament, 2023, **European Parliament legislative resolution of 12 September 2023 on the proposal for a directive of the European Parliament and of the Council amending Directive (EU) 2018/2001 of the European Parliament and of the Council, Regulation (EU) 2018/1999 of the European Parliament and of the Council and Directive 98/70/EC of the European Parliament and of the Council as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652 (COM(2021)0557 – C9-0329/2021 – 2021/0218(COD))**

[55] European Commission, 2022, **Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the European Hydrogen Bank**

Germany – looking for its place in a green steel future

The large machinery of the German economy is slowly greening its cogwheels. The domestic transition is being tackled from a wide range of policy angles but will depend on securing large energy imports, if current steel capacity levels are to be maintained. This will require Germany to make bold choices on the future direction of its economic model and create meaningful partnerships in Europe and internationally.

Germany has shown progress across many policy levers in the Steel Scorecard. The government is implementing a good mix of demand-pull and technology-push policy levers, while also leveraging EU-wide instruments such as the EU ETS. Germany is a key potential agenda-setter for the global steel market, with many multinational steel producers headquartered there, and a long track record of ambitious climate policy and fiscal headroom to accelerate the transition.



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Priority recommendations for German steel policy

> Keep emissions reduction targets for industry in place, and ramp up ambition for 2030, along with developing steel specific targets.

> Accelerate the introduction of ambitious minimum requirements for embodied emissions in building materials and encourage the decarbonisation of both primary and secondary steel production along a 1.5 °C-aligned pathway

> Ensure that any public funding offered to steel companies is conditional upon clear net zero transition plans.

German has historically been an important steel producer

Germany dominated global steel markets in the nineteenth century. It was still a leading global producer in the 1960s – a close second to the largest producer at that time, the US. Steel played a key role in shaping both Germany's economic development and its cultural identity.

Today Germany is the largest EU steel producer and holds the biggest coal-based production capacity on the continent. Secondary, scrap-based EAF production makes up 25% of total production.[56] It is nonetheless a global leader in terms of the green primary steel project pipeline, with plans for new DRI capacity amounting to 10 Mtpa.[57] However, recent decisions in 2021 and 2019 to reline blast furnaces will extend the lifetime of these assets by possibly as many as 20 years. This suggests that coal-based production is not yet a thing of the past.

Fighting to green domestic production capacity and leveraging its fiscal power

Germany is making use of large federal and individual state-level budgetary resources to co-finance most coal-based steel sites in the country on their path to net zero. It also subsidises all stages of project development, from R&D to capital expenditure (plant transition) and operational expenditure such as higher energy costs.

Germany is one of the first countries to introduce carbon contracts for difference to support its heavy industry sectors to transition. This is reinforced by tens of billions in tax breaks and additional electricity price support for industrial consumers. However, this strategy may prove difficult to sustain in the long term

[56] Calculated from Appendix C in Global Energy Monitor, 2023, **Pedal to the Metal 2023**

[57] Global Energy Monitor, 2023, **Pedal to the Metal 2023**

as operational costs of H_2-DRI plants in Germany are projected to be particularly high, even beyond 2030, due to regionally/globally uncompetitive energy prices.

Germany is aiming to retain all its current steel production capacity – including the lower value-added and highly energy-intensive ironmaking – while facing an energy cost disadvantage. German policymakers seem convinced they can afford to do so by leveraging ample budgetary resources. Commentators have questioned whether this is a good and sustainable use of public funding as it risks locking in long-term subsidies with a growing risk of stranded assets.[58] A shift in strategy towards importing green iron (over importing costly green hydrogen and producing iron domestically) might help: it could lower the costs of the steel sector transition, enhance the competitiveness of downstream sectors and make more green power available, and cheaper, for other users.[59]

Risk of backsliding on sectoral targets but progress on definitions and procurement requirements

Germany's heavy industry-specific emissions reduction target – a 37% reduction relative to 2020[60] – was made legally binding through the 2019 Climate Protection Act. It clearly signalled its ambition to decarbonise industry. However, a reform tabled in 2023 proposed to remove sectoral targets. If it goes through, it will be a retrograde step for Germany's policy clarity and direction.

A stakeholder consultation process on green steel definitions and measurement standards is under way, which is expected to result in a voluntary green steel labelling system. Germany could be the first country to establish national green steel benchmarks and standards linked to procurement and market building policies.

Germany also committed to announce the adoption of IDDI green steel public procurement pledges at COP28 in November 2023.[61] In parallel it is due to set minimum requirements for embodied emissions in building materials used in

[58] Bruegel, 2023, **Adjusting to the energy shock: the right policies for European industry**

[59] Bähr et al. 2023, **Die Zukunft energieintensiver Industrien in Deutschland. Eine Studie von IW Consult und Frontier Economics im Auftrag des Dezernat Zukunft**

[60] Bundesministerium der Justiz, 2019, **The national climate protection act (Klimaschutzgesetz)** (Annex 2 Industry emission levels: 186 Mt (2020), 157 Mt (2025) and 118 Mt (2030) – which is a 37% reduction from 2020 to 2030)

[61] IDDI, 2023, Status update: **The Industrial Deep Decarbonisation Initiative's Green Public Procurement Pledge**

constructing and operating federal properties. These were set to be instituted by the first half of 2023, as per the federal Sustainability Action Programme.[62]

Powering ahead on hydrogen and clean electricity

Germany is showing relatively high ambition on greening its grid solely through renewable energy sources. The share of renewables in the power mix is set to increase by roughly 25% from 2022 to 2030. Combined with the great challenge posed by the recent complete phase-out of its nuclear fleet, this might not be enough, given Germany's currently majority fossil-based power system.[63] At the same time, it is home to possibly the most developed renewable PPA market globally.[64]

The Steel Action Concept is a strategy document published jointly by the preceding government and the steel sector.[65] It mentions the need to develop modelling on added RES capacity needs, as well as the potential necessity to have to import power. Grid constraints remain a big bottleneck in a country where industry is concentrated in the north, and renewable energy generation in the south. The strategy also foresees meeting parts of Germany's energy demand by using (additional) fossil gas capacity and assumes up to 70% hydrogen imports. A hydrogen import strategy is still in the works; there seems to be an implicit focus on mainly clean imports through developments like an import auction scheme for green hydrogen (H2Global).

Germany's national hydrogen strategy places a high emphasis on steel as an end-use sector and aims to stimulate the development of a market for both blue and green hydrogen.[66] The specific target for electrolyser capacity has been doubled since the strategy´s previous version; this indicates a greater emphasis on green hydrogen. A CCUS strategy is also under way. Multiple H2-DRI installations are being developed by ArcelorMittal, Salzgitter and Thyssenkrupp. All aim to reach full green hydrogen usage, though only some sites are setting specific timelines.

[62] Bundesministerium für Umwelt, Naturschutz, nukleare Sicherheit und Verbraucherschutz, February 2022, **Maßnahmenprogramm "Nachhaltigkeit" der Bundesregierung**

[63] Ember, last updated 2023, **Germany: Coal is holding back Germany`s transition to clean energy**

[64] EY, 2023, **PPA Index**

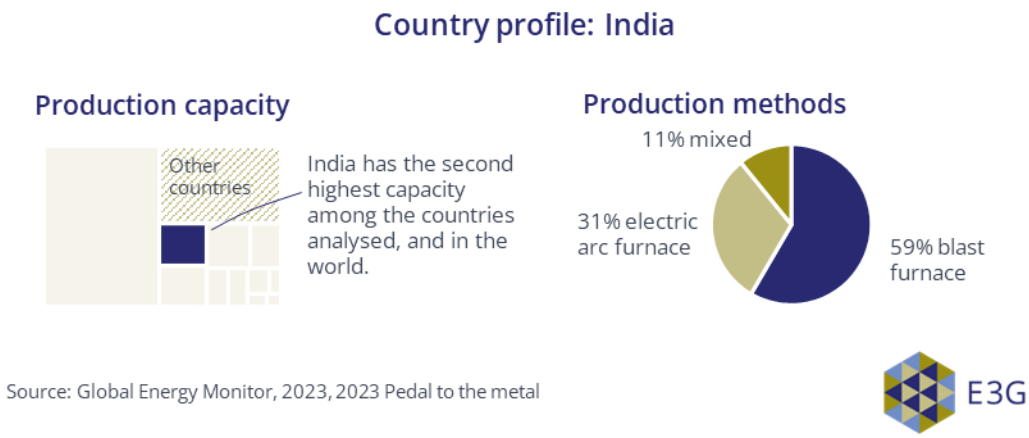
[65] Federal Government, 2020, **Steel Action Concept: For a strong steel industry in Germany and Europe**

[66] Bundesministerium für Wirtschaft und Klimaschutz, **The National Hydrogen Strategy**, accessed January 2024

India – the major growth market for both green and dirty steel capacity

A major current producer, with growing domestic demand, India is central to turning the dial on global steel emissions. This is a challenging task in an economy with restricted fiscal space and a complex steel production landscape. India is sending some positive signals, from potential targets for reducing steel emissions to a green steel definition task force and a growing green steel production pipeline; yet lots remains to be done to see a faster transition of India's steel sector.

India's steel decarbonisation challenge is massive. Not only does its diverse domestic production landscape make local policy responses difficult; financial capacity is also lacking. While India is making moves in important policy spaces, from steel scrap policy to great ambition on green hydrogen, this must go hand in hand with active international support – from transition finance to facilitating a domestic buyers club with global companies.



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Priority recommendations for Indian steel policy

> Keep up the momentum and leadership created through the Indian G20 Presidency in 2023 in the space of circular economy and steel, by building on and increasing the ambition of existing relevant policies such as the Steel Scrap Policy.

> Make strong calls for international climate finance and technology cooperation to develop small-scale green primary steel production technology (under 1,000 tons per annum capacity).[67]

> Ensure regulators and federal- and state-level governments work together to create a predictable policy environment to maximise India's potential for PPA market growth, while addressing local energy distributors' concerns.

Shifting growing, coal-dominated production with limited financial resources

India is currently the world's second largest steel producer. With rapid urbanisation and infrastructure needs, steel consumption is set to increase from 94 Mt in 2020 to 489 Mt in 2050.[68] The government has explicitly set the target to increase steel production to 300 Mt by 2030, more than twice its current production capacity.[69] The current production landscape relies heavily on coal-based primary production, which accounts for 59% of total production, and 31% secondary scrap-based EAF production.[70]

India recently surpassed China as the top developer of coal-based steelmaking capacity; it has plans to build out an additional 153 Mtpa of BF-BOF capacity by 2030, 40% of global BF-BOF capacity under development.[71] This buildout could result in quadrupling India's steel sector emissions by 2050.[72] The key challenge for India will be to reconcile the sector's expansion with long-term emissions reduction targets.

[67] DIW Berlin & TERI, 2023, **Financing Decarbonization of the Secondary Steel Sector in India: Towards an Enabling Environment**

[68] BloombergNEF, 2021, **New Energy Outlook 2021**

[69] PWC, 2015, **Steel in 2025: quo vadis?**

[70] Calculated from Appendix C in Global Energy Monitor, 2023, **Pedal to the Metal 2023** (noting that the discrepancy between coal-based and scrap-based production is the mixed production process capacity)

[71] Global Energy Monitor, 2023, **Pedal to the Metal 2023**

[72] Climate Group SteelZero, 2023, **India Net Zero Steel Demand Outlook Report**

India's fragmented steel production landscape, presents a challenge for steel decarbonisation.[73] It is made up of large-scale production facilities, as well as a large number of small and medium-sized mills.[74] With both large, global players like Tata Steel, and many small, solely India-based, companies, there is differential in-country capacity to transition and to respond to higher carbon-intensity standards set under the EU-CBAM. This makes for an uneven in-country playing field and makes domestic policy responses more challenging.

The many smaller mills, with below 1,000 tons per annum capacity, will require near-zero emissions technology to be developed that is specifically suited to small-scale primary production facilities. Moreover, numerous smaller sites could complicate the roll-out and distribution of clean energy supply, such as green hydrogen. The small and medium-sized facilities employ a large number of informal workers; this suggests that careful consideration needs to be taken of the implications of changes for workers and jobs.

India's GDP per capita is 1/20th of that of Germany and 1/14th of South Korea's.[75] Its capacity to financially support the transition and reskill a formal and informal workforce is in a very different league to that of the G7 nations we assess in the Steel Scorecard. It presents a substantial transition barrier.

Indian steel decarbonisation is thus complex, even more so when seen in the context of its cumulative (historical) emissions and current per capita steel consumption – both relatively low.[76] Countries with high steel consumption, larger fiscal space and a greater share of historical emissions, must play a role in supporting the Indian transition. They can do so through offering transition finance and partnerships for technology and skills transfer. However, it is also essential that India shows clear ambition to rapidly decarbonise, putting in place the right policy signals and enablers. This could be a catalyst for increasingly carbon-conscious foreign direct investment, increasing the global competitiveness of Indian steel production. It could also put pressure on historical high emitters to step up their own efforts.

[73] Mallet and Pal, 2022, **Green Transformation in the Iron and Steel Industry in India**

[74] Global Energy Monitor, **Global Steel Plant Tracker,** accessed December 2023

[75] The World Bank, **GDP per capita (current US$); World Bank National Accounts data,** accessed November 2023

[76] Per person steel consumption in India is 76 kg, compared to 666 kg in China and 426 kg in Germany (World Steel Association, 2022, **World Steel in Figures 2022**) and India is only responsible for 3% of total global CO_2 emissions (Our World in Data, October 2019, **Who has contributed most to global CO_2 emissions?**)

E3G

On the cusp of clearer and more ambitious steel policy

The Indian government has not yet set a specific target for reducing emissions from the steel sector. However, there is hope that the Vision 2047 document, prepared by the Ministry of Steel but not yet publicly available, will signal increased ambition and a clear policy direction. The Minister of Civil Aviation and Steel recently called for the sector to reduce emissions by 30–40% by 2030. This is very encouraging and will hopefully be enshrined in the Vision 2047.[77]

Another promising move is the establishment in April 2023 of 13 different steel task forces, working across four key mission components – including the development of a green steel definition. The intention is there, and this now needs to be translated into clear and ambitious standards and definitions.

Can early signs of leadership and ambition on circularity live up to their promise?

India's 2023 G20 Presidency saw progress on circular economy, through the launch of the Resource Efficiency Circular Economy Industry Coalition; it also saw the release of the technical paper "Knowledge Exchange on Circular Economy in Steel Industry".[78] The Scrap Metal Committee and Steel Scrap Recycling Policy aim to create a framework to facilitate and promote establishment of metal scrapping centers across India.[79] All these indicate Indian ambition and leadership on steel circularity and material efficiency.

India also showed early signs of leadership in public procurement, taking on the co-lead of the IDDI when established in 2021. However, there has been no visible movement on adopting IDDI's public procurement pledges. Nor have we seen any other progress towards setting green steel targets or requirements in public procurement.

Room to bridge the green steel premium with (international) public policy

India's Perform, Achieve, Trade (PAT) scheme functions much like an emissions trading system. And with the 2022 amendments to the Energy Conservation Act there is now scope to also introduce compulsory carbon trading[80] The calculus for

[77] Ministry of Steel, 23 August 2022, **Union Minister of Steel and Union Minister of Mines inaugurate two-day conference on "Indian minerals & metals industry: Transition towards 2030 & vision 2047"**

[78] G20, July 2023, **Knowledge Exchange on Circular Economy in Steel Industry**

[79] Indian Ministry of Steel, 16 March 2022, **Steel scrap recycling policy**

[80] Indian Ministry of Power, 2022, **Energy Conservation (Amendment) Act 2022**

introducing carbon pricing has recently changed in its favour due to the EU's introduction of CBAM.[81]

India is short on funding for capital and operational expenditure for decarbonised steelmaking. However, substantial funding is going into R&D for hydrogen-based steelmaking, through the National Green Hydrogen Mission.[82]

Great ambition on green hydrogen

India's ambitious green hydrogen target, and clear mentions of green hydrogen for steel, are further promising signs. Two pilot plants exploring the use of green hydrogen in the DRI process are currently under construction, while not yet up and running. India also has a relatively high ambition when it comes to adding renewable capacity (from about 177 GW by mid-2023 to about 596 GW by March 2032[83]), but still has a long way to go to achieve the G20 2040 power system carbon neutrality goal; the overall share of electricity produced from clean energy sources is still oscillating around 20%.[84]

Both its steel and hydrogen strategies mention a build-out of clean electricity infrastructure to meet the steel sector's growing needs. Indeed, building out adequate grid infrastructure is the next key step in India's clean power transition. Current transmission capacity still limits the ability to transport renewable electricity from where it is generated to meet industrial demand in other regions. Renewable capacity procured through corporate PPAs is rapidly growing due to green open access rules introduced in 2022;[85] but there is opposition from companies distributing electricity (discoms), which is a state-level competence.[86]

[81] Reuters, 2 November 2023, **India weighs local tax options to avoid EU carbon levy – minister**

[82] Ministry of New and Renewable Energy, 2023, **National Green Hydrogen Mission**

[83] Ministry of Power, Central Electricity Authority, March 2023, **National Electricity Plan**

[84] Ember, last updated 2023, **G20: Members include both leaders and laggards in clean power**

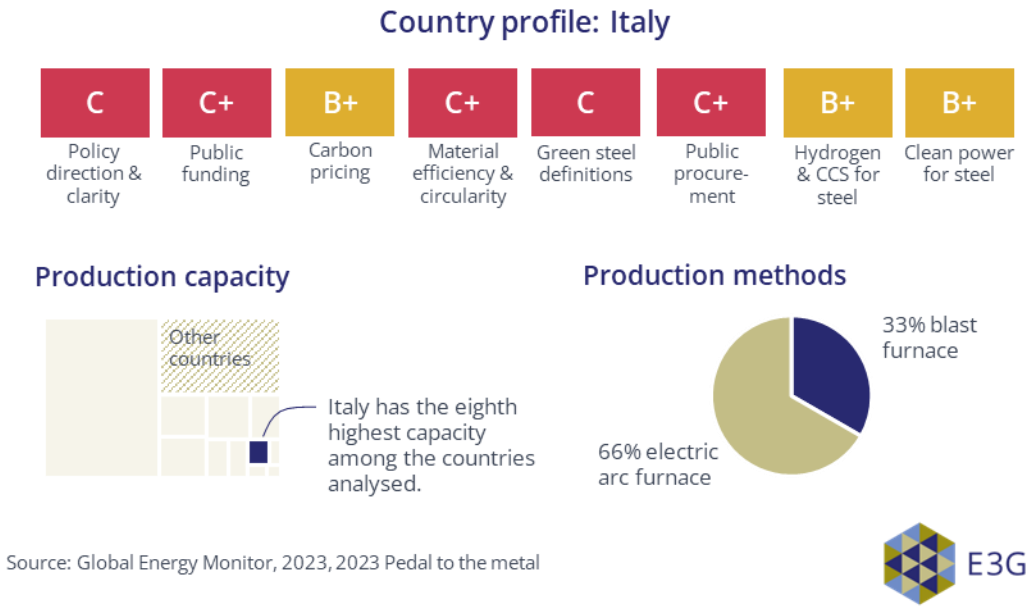
[85] Indian Ministry of Power, 2022, **Indian Ministry of Power notifies `Green Open Access` Rules to accelerate ambitious renewable energy programmes**

[86] Institute for Energy Economics and Financial Analysis, 2023, **State-level issues prevent India`s green open access market from reaching its full potential**

Italy – a European leader in scrap-based production, held back by one major dirty site

Italy is the eleventh largest global producer, with strong renewables potential and a high share of electrified secondary steel production. It is a green steel player to be reckoned with. However, the country's direction on industrial and steel decarbonisation is confusing. It ticks some domestic policy boxes, including on hydrogen and clean electricity, and it benefits from EU-wide policies; yet Italy has recently pulled the plug on money budgeted to support the transition of its major remaining coal-based facility.

Italy shows promising signs of progress across policy levers, and is benefitting from EU-wide policies; but it shows no evidence of cohesive action or of setting a clear policy signal towards domestic steel decarbonisation. With a solid secondary scrap-based production share, and only one remaining coal-based facility left in the country, Taranto, Italy could become a green steel leader. Its 2024 G7 Presidency is the perfect opportunity for Italy to up its game and become a global leader on steel decarbonisation.



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Priority recommendations for Italian steel policy

> Expand focus on and ambition for green steel public procurement, moving towards a threshold for embodied carbon.

> Join international discussions on green public procurement by participating in the IDDI.

> Prioritise decarbonisation of the Taranto site in the national budget (for instance as part of Italy's National Recovery and Resilience Plan).

> Ensure that industrial decarbonisation is high on the agenda during Italy's 2024 G7 Presidency, moving G7 countries towards committing to financially supporting the phase-out of high-emissions technologies and a shift to near-zero emission technologies.

Failing to move on the one coal-based facility left

Italy is the eleventh largest global producer. It has a high share of secondary, scrap-based EAF production – 67%, twice that of its European counterparts.[87] Only 33% of its production is coal-based primary steelmaking. This is limited to one facility, Taranto, with a crude steel capacity of 11.5 Mtpa. However, in recent years, the plant has been running at a historical minimum, not even meeting half of its theoretical capacity.[88] Taranto's industrial area is situated near its residential area; its size is comparable to that of the built-out area of the local community. It is also a major source of local air pollution, causing local protests and legal battles.[89] The facility is a large employer, with a workforce of 8,200 people, a large number of whom are subject to a redundancy fund.

An addition of a DRI plant to the Taranto site has been announced. However, there is a lack of clarity as to the related phase-out of coal-based processes and public co-financing: recent (2022) and upcoming (2024) lifetime extensions (relining) for the coal-based furnaces confuse the picture. The majority shareholder at Acciaierie d'Italia – ArcelorMittal – has committed to paying their share.[90] However, the current draft of the Italian National Recovery and Resilience Plan no longer includes resources to fund the planned H_2-DRI unit in Taranto, originally earmarked for this purpose.[91] The plan does, however, still carve out over €2bn for hydrogen use in hard-to-abate sectors.

[87] Calculated from Appendix C in Global Energy Monitor, 2023, **Pedal to the Metal 2023**.

[88] GMK Center, October 2023, **Acciaierie d'Italia needs to restore liquidity**

[89] ECCO, 2022, **Taranto, primary steel production in the challenge of decarbonisation**

[90] GMK Center, December 2023, **Acciaierie d'Italia shuts down blast furnace №2 for maintenance**

[91] GMK Center, 4 August 2023, **Italy Proposes to cut funding for Acciaierie d'Italia DRI project**

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No pushing and minimal pulling to work towards decarbonising industry

The Italian government has to date put minimal emphasis on industrial decarbonisation; there are no sectoral emissions reduction targets or industry roadmaps. Instead, Italy relies on the 2019 Integrated National Energy and Climate Plan (NECP) which defaults to EU-ETS targets.[92] National direction on industry and steel decarbonisation is thus largely absent. The 2024 Italian G7 Presidency provides an opportunity for Italy to change its course, making the Industrial Decarbonisation Agenda (IDA) a focus and point of advocacy.

There is no movement towards a set of aligned definitions and standards for green steel. Italy has, however, shown some progress in public procurement: the Minimum Environmental Criteria (CAM) include explicit mandatory minimum requirements for recovered and recycled material content in steel and for steel produced through the secondary (EAF) route.[93] While no green steel public procurement requirements per se, these can be a starting point for green steel public procurement targets.

Some direction on green hydrogen and high clean power ambition

The Italian Hydrogen Guidelines seem to implicitly focus on green hydrogen: they set a target for electrolyser capacity (5 GW) that would be sufficient to decarbonise the country's current primary steelmaking capacity.[94] The guidelines create favourable policy conditions for their construction and operation; they also dedicate funding to ensuring renewable electricity roll-out to fuel them. The guidelines recognise the necessity of hydrogen imports, but without providing any detail about volumes, origin and type of hydrogen. Italy's National Energy and Climate Plan clearly prioritises use of hydrogen in hard-to-abate sectors (including steel); it further highlights the necessity of industrial electricity consumers constructing additional RE capacity.[95]

However, regulatory barriers are stifling the development of both publicly deployed renewables and the private PPA market. This all while Italy is planning tremendous progress on clean power generally: it is the only EU country without a nuclear fleet planning to jump by more than its RES-E share target by 2030

[92] Ministry of Economic Development, Ministry of Environment and Protection of Natural Resources and the Sea and Ministry of Infrastructure and Transport, 2019, **Integrated National Energy and Climate Plan**

[93] Directorate-General for Circular Economy (EC), no date, **Green Public Procurement – Minimum Environmental Criteria: Current CAM,** accessed Novenber 2023

[94] Ministry of Economic Development, no date, **National Hydrogen Strategy - Preliminary Guidelines**

[95] Ministry of Economic Development, Ministry of Environment and Protection of Natural Resources and the Sea and Ministry of Infrastructure and Transport, 2019, **Integrated National Energy and Climate Plan**

compared to 2022 levels. However, Italy might be underplaying its ample solar and wind energy potential:[96] It is simultaneously planning to add the largest fossil gas-powered electricity generation among EU states (+24 TWh). Combined, Italy and Germany still account for 40% of the EU's power sector carbon emissions.[97]

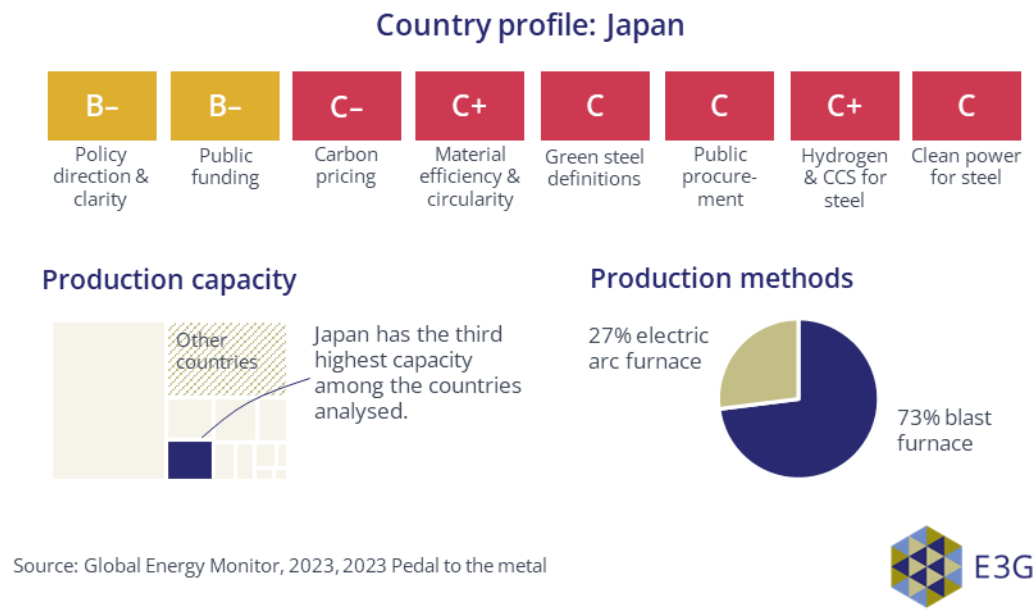
[96] Global Wind Energy Council (GWEC), 2021, **Offshore Wind Technical Potential in Italy**

[97] EMBER, 2020, **Vision or Division? What NECP tells us about the EU power sector in 2030**

Japan – lagging behind on deep decarbonisation

A major long-standing steel producer and key steel exporter, Japan is a clear laggard dragging its feet on steel decarbonisation. The lack of domestic ambition is reflected in the failure to progress the international agenda on industrial – and steel – decarbonisation under its G7 leadership in 2023.

Japan scores poorly across the board in this analysis, taking the bottom position among the G7 – its scores are also below those of fellow Asian countries China and South Korea. Prospects for carbon pricing and commitments on public procurement are positive but have not yet come to fruition**.** The lack of direction on clean power and hydrogen is a real concern, and ambition on emission reductions and public funding is limited. Japan's hesitation to lead on international ambition during its 2023 G7 Presidency further indicates a lack of intent towards industrial decarbonisation.



Priority recommendations for Japanese steel policy

> Explicitly earmark resources available for steel sector decarbonisation for specific facility upgrades, prioritising support for technologies with an emissions reduction potential of at least 90%.

> Introduce a mandatory carbon pricing mechanism with a clear timeline for phasing in coverage of the steel sector.

> Clearly prioritise the steel sector as an end-user in hydrogen strategy.

> Rapidly increase Japan's ambition on greening the power grid to ensure it can meet rising demand from steel electrification in an environmentally sustainable manner.

A major producer focusing on production pathways with low or incremental emission reduction potential

Japan is the world's third largest steel producer and a major steel exporter, with a long history of steelmaking. Japan's steel industry accounts for 14% of the country's total CO_2 emissions.[98] Production capacity is still predominantly coal-based (73%);[99] the pipeline for green primary production is non-existing, with no commercial scale H_2-DRI capacity announced or under way.

Instead, steel decarbonisation to date has centred around the "COURSE50" and "SuperCOURSE 50" projects. They aim to demonstrate CCUS technologies in steelmaking, often combined with increasing hydrogen concentration in the coke oven gas. The overall emissions reduction potential of this technology is only in the realm of 30–50%.[100] Recent research by Transition Asia further[101] shows that the application of COURSE50 technology at one of the production sites of Nippon Steel (Kimitsu Area BF), responsible for 10% of the company's total emissions, will only result in a 1–2% drop in Nippon's annual emissions by 2026.

Japan's strategic policy documents reflect a focus on technological shifts in steelmaking coming from both hydrogen and CCUS. However, the strategies do not offer a clear picture of how these will come together. For instance, the

[98] Eguchi, E., and Shinkai, T., in *The Asashi Shimbun*, 2021, **Steel industry sets 2050 target for net zero CO_2 emissions**

[99] Calculated from Appendix C in Global Energy Monitor, 2023, **Pedal to the Metal 2023**

[100] Renewable Energy Institute (REI), 2023, **The Path to Green Steel – Pursuing Zero-Carbon Steelmaking in Japan**

[101] Transition Asia, 2023, **Transition Asia's response to Nippon Steel's proposed plans to increase share of EAF-based technology in bid to achieve net zero**

recently updated Japanese hydrogen strategy (2023), with only a supply target, assumes high reliance on imports from abroad.[102] It also includes plans for a CfD scheme to bridge the price gap between "clean" and "unabated" hydrogen; but without introducing a clear timeline for adopting the emission threshold for low-carbon hydrogen. Its foreseen end-use sectors include DRI steelmaking, though the strategy's main focus is in the power sector.

Since the hydrogen strategy will depend on scaling up CCS, there is a carbon storage capacity target – yet there are concerns as to whether there will be sufficient capacity for the steel sector to store its emissions once captured.[103] Japan's 2021 Green Growth Strategy highlights the role of CCUS in steel decarbonisation, but without clarity on sectoral prioritisation for storage capacity targets.[104] The government has provisionally announced readiness to back Nippon Steel's CCS projects.[105]

Concerning lack of direction on clean power

Japan does not yet have a viable plan to achieve the G7 2035 power sector carbon neutrality commitment. Its 2021 Green Growth Strategy mentions growing demand for electricity due to widespread electrification; at the same time it stresses the importance of growing gas supply to meet heat demand, while focusing on energy saving measures.

Emphasis on co-firing hydrogen and ammonia with fossil fuels has also significantly increased since the 2017 iteration of the Japanese hydrogen strategy. An analysis from E3G shows this is costly and inefficient and risks delaying decarbonising the power sector, while taking away a premium resource which remains the only viable solution for steel sector decarbonisation.[106]

Limited ambition on emission reductions and funding

The strongest signal for policy clarity and direction comes in Japan's NDC: the emissions reduction target for industry is 174 Mt CO_2e by 2030 (38% relative to 2013).[107] However, the 2021 Technology Roadmap for "Transition Finance" in

[102] Ministerial Council on Renewable Energy, Hydrogen and Related Issues (third meeting), 2023, **Policy Framework for Realizing a Hydrogen Society (draft)**

[103] Renewable Energy Institute, 2022, **The Path to Green Steel**

[104] Cabinet Secretariat & Ministries, 2021, **Green Growth Strategy – Through Achieving Carbon Neutrality in 2050**

[105] Global CCS Institute, June 2023, **Seven CCS Project to Receive Support from the Japanese Government**

[106] E3G, 2023, **Explained: Why ammonia co-firing in coal power generation is a flawed approach**

[107] Government of Japan, 2021, **Japan's Nationally Determined Contribution (NDC)**

Iron and Steel Sector fails to provide a clear immediate direction.[108] It speaks only to the very long-term aim of reaching carbon neutrality by 2050, without setting any interim emissions reduction targets.

The Japanese government does provide funding towards steel decarbonisation, largely through R&D. The Green Innovation Fund dedicates over $3bn to the use of hydrogen in the steel sector.

Prospects for carbon pricing and commitments on public procurement

A Japanese Emission Trading System (ETS) is currently in the works, referred to as GX-ETS. The Japanese Iron and Steel Federation has been found to actively lobby against the ETS;[109] it will be based on voluntary participation until at least 2026. The GX-ETS is set to focus on power system decarbonisation well into the 2030s, and there are no clear plans to include heavy industry sectors.

The Japanese government sent a positive signal on public procurement when it joined the IDDI at COP27 (2022). This showed an intention to set green steel public procurement targets or requirements – an important pull factor for the industry. However, as of December 2023, no apparent in-country process was under way to create a green steel market through public procurement; that is despite a long-standing focus on green public procurement, with relevant policies and regulations dating back to the 1980s.[110]

Hesitant to lead on international ambition for decarbonising steel

In 2023 Japan had the opportunity to demonstrate international leadership on industry and steel decarbonisation through its G7 Presidency. It picked up on Germany's 2022 steel decarbonisation focus by commissioning a report from the IEA focused on Emissions Measurement and Data Collection for a Net Zero Steel Industry.[111] However, there was no move towards a G7 agreement on definitions and standards, nor is there currently any domestic action towards these.

[108] Ministry of Economy, Trade and Industry, 2021, **Technology Roadmap for "Transition Finance" in Iron and Steel Sector**

[109] InfluenceMap, no date, **Emission Trading Schemes**

[110] Global Energy Intelligence (GEI), 2023, **Green Public Procurement of Steel in India, Japana and South Korea**

[111] IEA, 2023, **Emissions Measurement and Data Collection for a Net Zero Steel Industry.**

The current in-country movement towards mass-balance methods[112] by companies like Kobe Steel, Nippon Steel and JFE Steel indicates the need for direction on green steel definitions and standards: according to such methods, a 10% emissions reduction across 100 tonnes of manufactured steel is translated into the sale of 10 tonnes of zero-emission steel.[113]

[112] In this method, steel manufacturing companies issue reduction certificates by GHG or CO_2 emissions reductions from "projects" with additionality (actual emission reductions) and supply steel products with the reduction certificates. The Japan Iron and Steel Federation, October 2023**, Green steel applying mass balance approach**

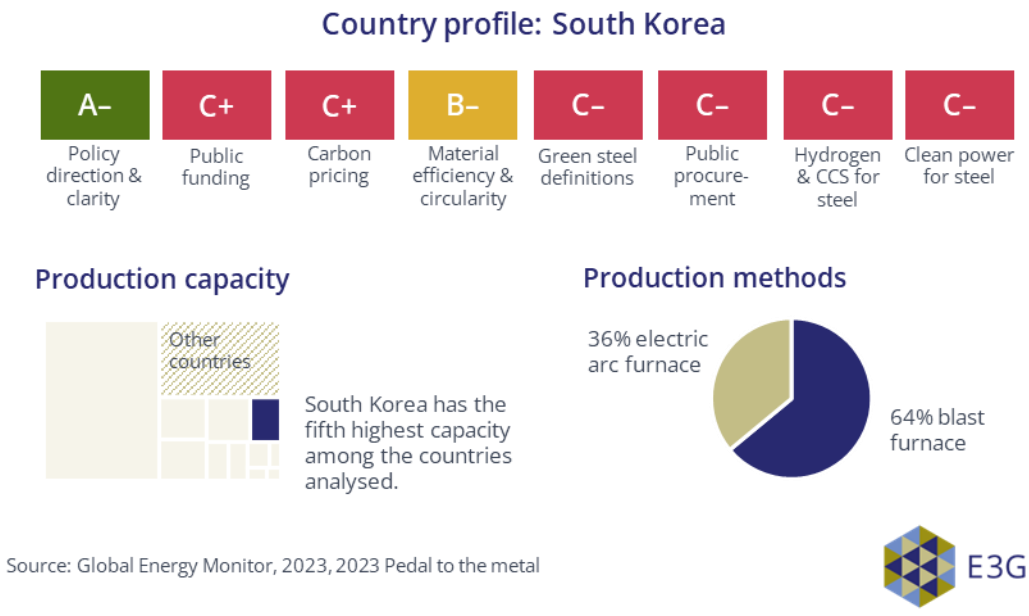
[113] Renewable Energy Institute, 2022, **The Path to Green Steel.**

South Korea – not yet an Asian front-runner

CO-AUTHORED BY DASEUL KIM, SFOC

Korea could become an Asian front-runner in steel decarbonisation as a major global steel producer with a highly developed and mixed economy. However, with an energy sector still dominated by fossil fuels, and the lack of an ambitious decarbonisation pathway and supporting policies, the signals on steel decarbonisation are ambiguous at best.

The South Korean government has a long way to go to get its steel industry on track for a 1.5 °C future. It is dragging its feet on clean power, with a renewable energy target of under 20% by 2030. Korean policy also falls short of making the connection between clean hydrogen and steel production. There is ample potential for South Korea to leverage both policy pushes and pulls to get the steel industry on track: these include leveraging its emissions trading system, K-ETS, and channelling government funding towards near-zero emission steel technology.



Priority recommendations for South Korean steel policy

> Shift funding for R&D and capital expenses towards technologies with emissions reduction potential of at least 90%.

> Set a timeline for phasing out free allowances for the steel sector in the next phase of K-ETS (from 2026).

> Clearly connect clean power ambition and green steel production by: addressing the steel sector's renewables and green hydrogen procurement in the national steel strategy; and creating an enabling policy environment for economical and flexible direct renewable power purchases for corporates.

Unambitious emission reduction targets and lifetime extensions for coal-based production

South Korea is currently the sixth largest global steel producer, with 64% of its 83 Mtpa steelmaking capacity coal-based.[114] Steel is directly responsible for 16.7% of national GHG emissions as the largest industrial emitter in the country.[115] No **new** coal-based facilities are in the pipeline domestically,[116] but Korea's largest steelmaker, POSCO, is in the process of extending the lifetime of several coal-based facilities through relining.[117] There is a pipeline for green steel production, but it is minuscule in relation to the country's production capacity: just 1 Mtpa H_2-DRI capacity by 2030.[118]

South Korea is home to several large and medium-sized steel makers, including POSCO, Hyundai Steel, Dongkuk Steel and KG Dongbu Steel. In February 2023, the Ministry of Trade, Industry and Energy (MOTIE) announced South Korea's Steel Industry Development Strategy for Transition to Low-Carbon Steel Production.[119] It is one of few countries with a dedicated steel decarbonisation strategy, though that strategy falls short of setting an emissions reduction target for steel. Emissions reduction targets for industry overall, as set out in the NDC,

[114] Calculated from Appendix C in Global Energy Monitor, 2023, **Pedal to the Metal 2023**

[115] SFOC, 2023, **Industry Trends Brief - Korean Government's Low Carbon Steel Production Strategy: Key Challenges and Improvements**

[116] Global Energy Monitor, 2023, **Pedal to the Metal 2023**.

[117] SteelWatch & SFOC, 2023, **Redline not reline: 4 leading steel companies in OECD set to lock in almost half a billion tonnes of CO2**

[118] Global Energy Monitor, **Global Steel Plant Tracke**r (retrieved: November 2023); Eurometal, September 2023, **POSCO plans 1 mty hydrogen steelmaking plant by 2030**

[119] Ministry of Trade, Industry and Energy (MOTIE), 2023, **Steel Industry Development Strategy for Transition to Low-Carbon Steel Production**

are minor – just over 10% by 2030.[120] Thus the government is not sending a clear signal for the swift reduction in emissions from the Korean steel sector.

Dragging its feet on clean power, and a missing link between clean hydrogen and steel production

Korea is not sending a promising signal on clean energy – an element central to the green steel transition. Its power sector is still dominated by imported fossil fuels and the share of renewables capacity is planned to increase by only around 10 percentage points from 7.15% in 2022 to 18.2% in 2030.[121] A strategic focus on meeting rising renewable energy demand from the steel sector is missing. Yet this demand is only set to grow due to a shift in production methods to EAFs and H_2-DRI, which require significant quantities of green electricity. More remains to be done to ensure competitive access to renewables in Korea although 2022 saw some developments in the corporate PPA market: consumers are now able to purchase electricity directly from renewables generators.

South Korea's hydrogen strategy is to incrementally reduce its reliance on imports of "clean hydrogen" (with specific targets for blue and green hydrogen). To achieve this, it aims to increase domestic production of clean hydrogen to 34% by 2030 and 60% by 2050. Recognising the need for clean hydrogen for the steel sector transition, Korea's national hydrogen policy mentions the possible introduction of incentives for steelmakers to produce clean hydrogen.[122] However, the hydrogen policy lacks a clear prioritisation of end-uses, focusing on its application in commercial vehicles and in the power sector.

An alternative to hydrogen imports or local production is the import of green iron ore, which is being scoped out by several steelmakers globally. However, this raises concerns over whether increased reliance on imports of green steel raw material would hinder maximising domestic renewable energy and green hydrogen production.

[120] Government of the Republic of Korea, 2021, **The Republic of Korea's Enhanced Update of its First Nationally Determined Contribution**

[121] SFOC calculation excluding the "new energy (i.e., hydrogen, fuel cell, coal gasification/liquefaction energy that utilizes existing fuels in a new way or through chemical reactions)" included in the government definition of "new-renewable energy" which is unique to South Korea.

[122] Ministry of Trade, Industry and Energy of the Republic of Korea, 2019, **Hydrogen Economy Roadmap;** OECD STIP Compass, 2022, **Act on Hydrogen Economy Promotion and Safety Management**

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Not yet fully leveraging its emissions trading system and untapped potential on public funding and green procurement

As the first East Asian country to implement an ETS back in 2015, South Korea has helped set an example for the region. The K-ETS is however not applied to the steel sector, which remains fully covered by free allocations.

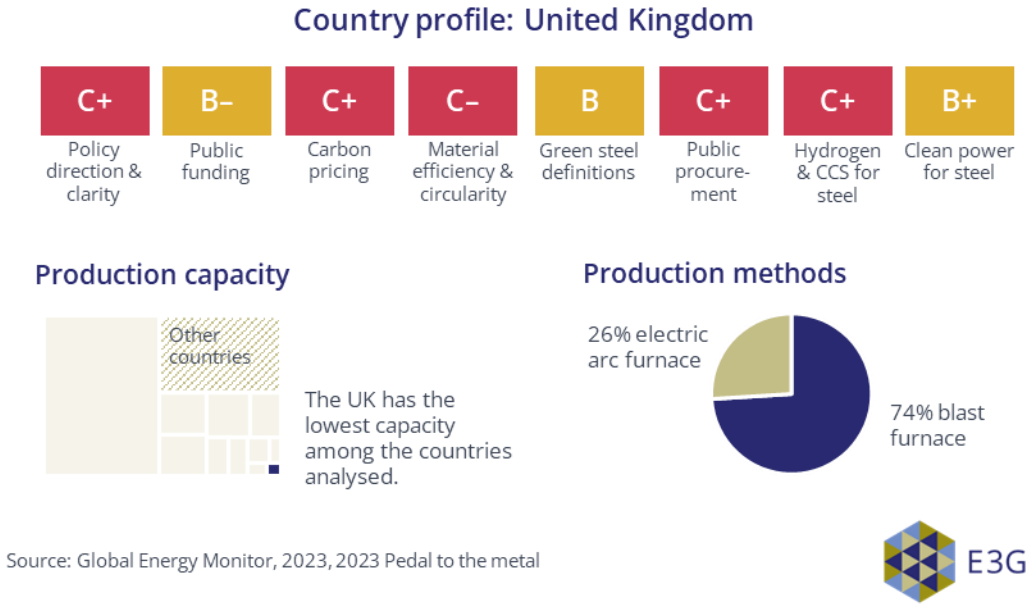
The pull effect from public funding for low-carbon steel technology is missing as much as a policy push through carbon pricing. Currently, the private sector has to carry the bulk of the financial burden of the transition. Public funding for capital expenses is miniscule, and support for operational expenses is lacking. Targeted R&D funding for steel decarbonisation is available, but the proportion going towards technologies with high abatement potential (for example, green hydrogen DRI) and CAPEX funding is highly insufficient.

The South Korean government is also not making use of another important policy lever: green public procurement (GPP). Growing demand for green steel through requirements or targets in public procurement could not only enable the transition but also accelerate it. There is also a lack of focus on establishing a common definition for green steel, and related emissions intensity thresholds and measurement standards. this keeps the door open to product lines that are marketed as “green” without clear assurances for customers on the accuracy of these claims (such as Greenate Steel, POSCO’s new product line based on a mass balance methodology).

UK – moving towards green steel but without a clear strategy

CO-AUTHORED BY LAITH WHITWHAM, E3G

Once the steelmaking capital of the world, in recent years the UK has struggled to put forward a comprehensive strategy for the decarbonisation of its remaining primary steel sites. However, there was substantial progress in 2023 on an agreement for financial support from the government to transition Tata Steel's blast furnace site to electric arc furnace steelmaking. There have also been several consultations on demand-side policies and carbon leakage mitigation, moving the UK towards a clean steel future. However, the UK government has drawn criticism for its piecemeal approach, lack of proactive inclusion of unions, and the absence of a broader industrial policy outlining whether the UK will retain primary steel capacity, or how it will sustain a completely electrified sector.



The UK is not far behind its European counterparts in our Steel Scorecard. There have been some positive policy steps since our 2022 Scorecard, including a commitment to implementing a Carbon Border Adjustment Mechanism (CBAM), a tightening of emissions allowances in the UK Emissions Trading Scheme (ETS), and consultations on mandatory product standards, green public procurement pledges, and the adoption of low-emission thresholds for steel. There has also been a small expansion of the Industrial Energy Transformation Fund and partial alleviation of high electricity prices via the British Industry Supercharger. Together with progress on deals to transition its remaining blast furnace sites, the UK is on firmer footing for a decarbonised steel sector. However, the UK government has not outlined how the sector will access the levels of scrap steel and green iron needed for this scale of EAF steelmaking, and has made little progress on the electricity network expansion needed to deliver mass low-carbon power to EAFs. There is also slow progress on demand-side mechanisms, and a lack of clarity on the commercial viability of a steel sector with no primary steelmaking capacity and what that means for other sectors' supply chains.

Priority recommendations for UK steel policy:

> Establish a long-term Industrial Strategy that includes a vision for the future role of the steel sector in the UK economy and how it will be integrated in other UK manufacturing sectors. This should guide how the UK decarbonises steel, with explicit aims on the retention of primary steelmaking. It will also need to include plans for reducing high industrial electricity prices, increasing the retention and recovery of scrap steel, and establishing a secure supply of hydrogen and/or green iron.

> Adopt a target for near-zero emissions steelmaking by 2035 – which has been endorsed by both the Climate Change Committee and UK Steel – and assess whether this could in fact be brought forward following the recent agreement with Tata Steel and negotiations with British Steel.

> Take immediate action to reduce planning delays for new renewable energy generation and grid infrastructure projects, and work with the energy regulator and industry to support new connections queue management rules to speed up the time it takes for generators and off-takers – such as electric arc furnace steelmakers – to connect to the grid.

Last-minute funding pushes to green the UK's primary steel sites

The UK was one of the first large-scale global steel producers; today it ranks twenty-fourth and is the smallest steel producer among G7 countries. It currently

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relies heavily on coal-based production, centered at two large sites: Tata Steel in Port Talbot and British Steel in Scunthorpe. Having seen key manufacturing sites disappear in a wave of chaotic closures in the 1980s, these remaining plants hold strong symbolic value, especially among their workers and local communities.

After a drawn-out, closed-doors process, official public funding (£500m) for transitioning Tata Steel's Port Talbot site was announced in September 2023. This was soon followed by an announcement in November 2023 from British Steel that they intend to transition their Scunthorpe coal-based facilities to EAF production at two different sites, pending government support.

These announcements indicate a significant shift in the UK's steelmaking capacity away from coal-based blast furnaces towards secondary, scrap-EAF steel production. Closure of all four of the UK's last operational blast furnaces, which contribute 15% of all UK industrial emissions,[123] would represent a substantial emissions reduction for the UK. Indeed, the transition of Tata Steel's Port Talbot site alone could reduce the UK's overall territorial emissions by 1%.

While not formally set out by the UK government, these announcements suggest the UK is firmly banking on steel recycling and green iron imports as its future steel production pathway. This would make the UK the only country in the G20 without primary steel capacity, and stands in stark contrast to other countries – such as Germany, who intend to retain significant primary production capacity with H_2 or CCUS. The approach has also been criticised on the grounds that retention of some primary production, while more costly and energy-intensive, could result in the retention of more jobs and the ability to produce a wider suite of goods. It is estimated that the closure of Tata's coal-based assets in Port Talbot will lead to 2,800 job losses.

The government's focus on secondary production alone has also come without a strategy for achieving the necessary step-change improvement in collection, separation, and treatment of scrap steel, nor manufacturing and design changes to improve the quality and quantity of scrap steel available within the UK. There have also been no announcements on how the UK will retain the scrap steel that is recovered domestically but exported to other secondary steelmaking countries. Without adequate supplies of scrap, a 100% EAF-based sector will rely on imports of iron, which are currently available at a domestic level.

[123] Green Alliance, Dec. 2021, **Making the UK a World Leader in the Production of Clean Steel**

Moreover, long-term action to reduce industrial electricity prices has not been outlined. UK industrial electricity prices are far higher than those in key competitor nations – such as France, Germany, and Spain – which has led to existing EAFs in the UK reducing their output to well below maximum production capacity. Without action it is highly likely that new EAF sites will face fierce international competitiveness pressure on an electricity price basis.

The impact of a steel decarbonisation pathway based solely on secondary production

The Scunthorpe and Port Talbot announcements suggest that hydrogen and CCUS will not play a role in decarbonising steel in the UK, with current plans leaving no domestic primary steelmaking and therefore no need for hydrogen to reduce iron ore, or CCUS to capture emissions from blast furnaces.

Switching to scrap-EAF only will result in the closure of coking ovens and iron production, which, as above, has drawn criticism for potential job losses and increased dependency on global supply chains.

As the global steel sector decarbonises, demand for finite supplies of scrap steel will also become increasingly competitive, so the UK will be particularly exposed to fluctuations in international supply and demand. While increased retention of domestic supplies of scrap will be good for EAFs in the UK, it will diminish the scrap available for use in other countries, which could slow steel decarbonisation in other geographies. This said, the UK's increasingly low-carbon grid makes it an ideal place to produce steel in an EAF.

In the immediate transition to EAF-only steelmaking, the number of steel products the UK can produce domestically will be curtailed. For example, EAFs cannot produce steel of the required quality to make automotive parts. This limits the capabilities of the sector and increases the dependence of other manufacturing sectors on international supply chains. There is a risk that without the ability to produce a diverse suite of products, some steel companies may suffer from negative commercial outcomes from weaker business models, irregular cash flow, and unanticipated changes in global procurement trends.

Elsewhere in the economy, the move away from H_2- and/or CCUS-enabled low-carbon steelmaking may influence the expansion of H_2 and CCUS use. For example, in its 2021 Hydrogen Strategy, the UK government set a very ambitious target for 10 GW of domestic production capacity of low-emission H_2 by 2030, demand for which was forecast to come in part from the use of hydrogen in

steelmaking from the mid-2030s.[124] With this now looking increasingly unlikely, investor confidence could take a hit, with prospective H_2 generators concerned about overall demand in the mid-2030s – though demand from elsewhere should be more than sufficient for a thriving H_2 economy.

Similarly, the UK government's updated 2023 CCUS roadmap includes plans for a CCUS cluster close to Scunthorpe,[125] which includes several businesses and economic sectors. However, with British Steel's Scunthorpe facility now looking to electrify, it seems unlikely that CCUS will be required at that site, leaving other sectors in the cluster unsure of their future access to CCUS pipelines and storage.

Increased demand for power from industry in the face of grid bottlenecks

On top of its commitment to decarbonising the electricity system by 2035, the UK government has highlighted the importance of working with energy regulators and industrial clusters to ensure the electricity networks can accommodate increased demand from industrial sites. However, there are currently severe delays to new renewable energy developments and the grid infrastructure needed to connect them to industrial off-takers.

At present, new renewables face wait times of up to 14 years before they can begin delivering clean electricity to users. This is due to a combination of inefficient queue management rules delaying grid connections; bureaucratic, overlapping, and under-resourced planning regimes; and a lack of anticipatory investment in the energy system to ensure that infrastructure is already in place for new renewables. This delays the delivery of clean electricity to users across the economy. For industry, this is worsened by delays to their own grid connections, which threatens the viability of electro-intensive EAFs.

While there has been some movement from the UK government on speeding up Nationally Significant Infrastructure Projects (NSIPs) and reducing planning delays, and from Ofgem and National Grid on introducing new connections queue management rules, significant progress on grid constraints is yet to materialise.

In addition, industry itself still suffers from high electricity prices in comparison to key competitors, damaging the commercial viability of electrification.

[124] Department for Energy Security and Net Zero, 2021, **UK Hydrogen Strategy** (accessed 30/11/2023)

[125] Department for Energy Security and Net Zero, 2023, **Carbon capture, usage and storage net zero investment roadmap** (accessed 30/11/2023)

Corporate PPAs, which offer long-term predictable electricity prices, have gained in significance during years of limited availability of public subsidies for renewables, however many industrial off-takers have struggled to access them due to their own financial uncertainty. To-date, there has been no action from government to increase the steel sector's access to PPAs. Similarly, proposals for a "Green Power Pool" of low-cost clean electricity, sold in priority to industry, have been ruled out due to their potential impact on electricity markets. The British Industry Supercharger has exempted industry from some network charges, but the steel sector still suffers from its exposure to high wholesale costs. Some stakeholders in the sector have also argued there is insufficient action to ensure that the industry is able to maximise potential gains from DSR and capacity market involvement, though this is currently unclear.

Backsliding on 2035 policy ambition and mixed progress in the UK ETS

The UK had shown promising signs on policy clarity and target setting with its 2021 Industrial Decarbonisation Strategy, which promised to consider setting a 2035 decarbonisation target for the steel sector.[126] However, this strategy failed to provide a comprehensive vision for the long-term, sustainable decarbonisation of steel in a way that ensured carbon leakage and deindustrialisation will be avoided, with a more comprehensive industrial strategy needed. A 2035 decarbonisation target for steel also waits to be seen.

Meanwhile post-Brexit, the UK ETS has replaced the UK's participation in the EU ETS, with developments in the UK ETS mixed. Emissions allowances are trading at considerably lower prices than in the EU ETS, weakening the incentive to decarbonise. Without linkage of the UK and EU schemes, this divergence is likely to continue. In addition, the steel sector still receives free allowances with no clear phase-out date. However, in 2024, the UK ETS Authority introduced a significantly lower cap on emissions allowances, which tightens the limit on emissions from industry and will likely increase carbon prices throughout the year. Moreover, the EU–UK Trade and Cooperation Agreement has signalled readiness to forge cooperation on linking emissions trading systems, which would increase the effectiveness of both systems.

The UK has also announced that it will introduce a Carbon Border Adjustment Mechanism in 2027, following consultation on the policy in 2023. Similar to the EU CBAM, this would cover the steel sector and will have implications for trade-

[126] Department for Energy Security and Net Zero and Department for Business, Energy & Industrial Strategy, 2021, **Industrial decarbonisation strategy**

partner and international engagement on industrial decarbonisation. However, the UK's CBAM would come into effect a year later than the EU equivalent, which risks the UK becoming a dumping ground for high carbon steel destined for the EU.

Consulting on green steel definitions and public procurement pledges

The UK government has made promising progress on green steel definitions and standards. It held a consultation on the adoption of an IEA-developed approach to green steel definitions in its 2023 public consultation on a UK CBAM. This happened in combination with consulting on the adoption of IDDI green steel public procurement pledges, and the phased introduction of mandatory product standards on embodied emissions, indicating that the UK sees a CBAM and product standards as going hand in hand. However, there has been no concrete progress on green public procurement criteria.

Strong international leadership on steel despite domestic setbacks

Despite its stop-start approach on domestic industry decarbonisation, the UK government has shown notable leadership internationally. In 2021, the UK used its G7 and COP26 Presidencies to move industrial decarbonisation up the international policy agenda, initiating the Industrial Decarbonisation Agenda (IDA) at the G7, and Steel Breakthrough Agenda at COP26. It has also played a key role in initiating and supporting the UN's IDDI as Co-Chair, seeking to increase the number of countries pledging to low-carbon steel and cement policies. The UK is also a member of the Climate Club, an international partnership aiming to help developing nations decarbonise industry.

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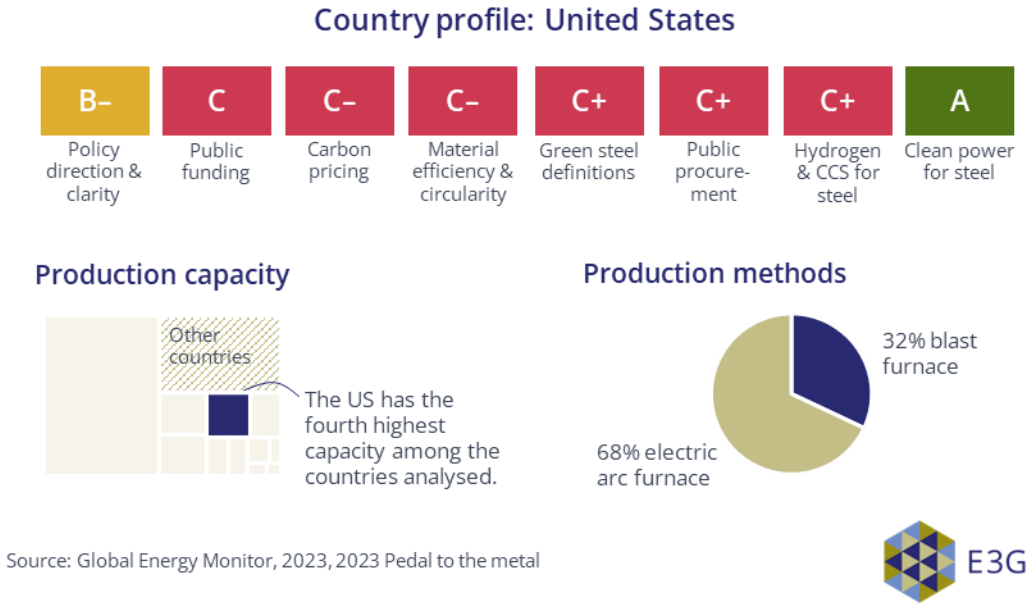
US – a steel recycling front-runner without a plan to get out of coal

As a major climate player internationally and a front-runner on steel recycling, the US can pave the way for more concerted international cooperation on steel decarbonisation. However, there is a diminishing window ahead of the 2024 elections in which the US can resolve tensions over Section 232 tariffs and up domestic ambition on industry decarbonisation to ensure more active international engagement. The US Inflation Reduction Act (IRA) has unleashed huge amounts of green investment including in hydrogen, CCS and conversion to EAFs; but specific support for green ironmaking remains lacking and there is no regulatory framework to ensure accelerated decarbonisation of coal-based steelmaking sites.



The US has shown progress in some areas such as the introduction of hydrogen production tax credits under the IRA and the development of green steel public procurement requirements. However, the US has continued to perform poorly overall across most policy levers. The government has still not introduced concrete plans for the transformation of remaining coal-based steelmaking facilities.

Priority recommendations for US steel policy:

> Ramp up the ambition of the federal BuyClean initiative by setting out a rapid decrease in embodied carbon thresholds in the product requirements.

> Develop a 1.5 °C aligned net zero roadmap for the US steel sector, with intermediate targets for 2030.

> Ensure adequate resources are available for decarbonising primary steel and offer dedicated support for plants in transition.

A significant producer, though with relatively low emissions intensity

The US dominated global steel markets in the nineteenth century, together with Germany and the UK. It still is a major producer today – the fourth globally. Unlike most other major steel producers, US production is largely secondary steelmaking. There are 99 EAF plants accounting for around 68% of production,[127] owned by 51 companies; nine integrated BF-BOF steel mills mainly located on the East Coast are controlled by just three companies.[128] This means the average emission **intensity** of US steelmaking is lower than most countries, despite the scale of its coal-based production capacity being on a par with Germany.

While the US leads on steel recycling globally, concrete private sector and government initiatives to accelerate steel decarbonisation and decarbonise the remaining coal-based primary sites have been lacking. Plans for lifetime extensions on existing coal-based production facilities are under way.[129] In contrast to European counterparts, there has been a notable lack of investment in green primary steel production sites.

[127] Calculated from Appendix C in Global Energy Monitor, 2023, **Pedal to the Metal 2023**

[128] Global Efficiency Intelligence, November 2019, **How Clean is the U.S. Steel Industry?**

[129] SteelWatch & SFOC, 2023, **Redline not reline: 4 leading steel companies in OECD set to lock in almost half a billion tonnes of CO2**

Steel decarbonisation caught in a geopolitical tangle

The EU and US are currently trying to resolve tensions relating to international steel trade, through a Global Arrangement on Sustainable Steel and Aluminium (GSA). Tensions peaked when the US introduced tariffs on steel and aluminium in 2018, under section 232 of the Trade Expansion Act. The tariffs were rooted in wider global, and to a large degree Chinese-influenced, challenges related to steel overcapacity; this spurred the EU into taking rebalancing measures. As outlined in a recent E3G briefing, the parties remain stuck on how to address and balance both overcapacity and decarbonisation.[130]

Domestic policies: some enabling factors, but no overall clear direction and little funding

Steel is an important element in the US 2022 Industrial Decarbonization Roadmap:[131] it features different modelling scenarios and pathways, but steers away from setting any emissions reduction targets. The roadmap does focus on enabling elements, making both steel electrification and clean electricity provision close to steel production sites a clear priority. The US is also the most ambitious out of the countries assessed when it comes to power system decarbonisation goals by 2030, when compared to current generation shares; it is the only one planning to achieve full neutrality by the end of the decade.

The US also has ambitious targets for scaling up low-emission hydrogen production: 50 Mtpa of green hydrogen and 30 Mtpa of blue hydrogen by 2030. This is backed up by a large production tax credit dependent on emission intensity (worth ca. $100bn). One of the Roadmap's priorities is the need to replace fossil-based feedstocks in steelmaking. However, there are no clear announcements or policies targeted at transforming coal-based steelmaking sites. The US's long-term net zero strategy[132] foresees use of both hydrogen and CCUS in hard-to-abate sectors, and the Bipartisan Infrastructure Law and Energy Policy Act are projected to mobilise close to $20bn in CCUS investments.[133]

The IRA has mobilised large sums of money for clean technology manufacturing and deployment. Nonetheless, relatively few resources are available or explicitly

[130] E3G, 2023, **The EU-US global arrangement on sustainable steel and aluminium**

[131] U.S. Department of Energy (DoE), 2022, **Industrial Decarbonization Roadmap**

[132] United States Department of State and the United States Executive Office of the President, November 2011, **The Long-Term Strategy of the United States: Pathways to Net-Zero Greenhouse Gas Emissions by 2050**

[133] The White House, February 2022, **Fact Sheet: Biden-Harris Administration Advances Cleaner Industrial Sector to Reduce Emissions and Reinvigorate American Manufacturing**

earmarked for steel decarbonisation, and no federal carbon tax exists. The overall volume of funding for installing and implementing advanced industrial technology at energy-intensive industrial and manufacturing facilities amounts to $4bn; this would barely be sufficient to transform two average-sized BF-BOF plants into H_2-DRI – the US has 13 operating blast furnaces. No direct grants to transform specific plants have been identified.

Public procurement is an important pull factor for green steel manufacturing. The US is the first country to launch a federal BuyClean Initiative, aimed at scaling up the demand for products such as green steel. However, BuyClean has not yet lived up to the initial ambition set out in the Presidential Announcement in 2022: the initial interim embodied carbon requirements published for steel are far from the IEA proposed thresholds of 50 $kgCO_2e/t$ (for 100% scrap) and 400 $kgCO_2e/t$ (for 0% scrap).[134]

[134] IEA, 2022, **Achieving Net Zero Heavy Industry Sectors in G7 Members**

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About E3G

E3G is an independent climate change think tank with a global outlook. We work on the frontier of the climate landscape, tackling the barriers and advancing the solutions to a safe climate. Our goal is to translate climate politics, economics and policies into action.

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