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REPORT FEBRUARY 2024

RAISING AMBITION ON STEEL DECARBONISATION

2023 STEEL POLICY SCORECARD

KATINKA WAAGSAETHER, ALEKSANDRA WALISZEWSKA & JOHANNA LEHNE

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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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Our partners

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Solutions for Our Climate

SFOC
Solutions for Our Climate (SFOC) is an independent nonprofit organization that works to accelerate global greenhouse gas emissions reduction and energy transition. SFOC leverages research, litigation, community organizing, and strategic communications to deliver practical climate solutions and build movements for change.

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SUMMARY

Steel accounts for 8% of global CO_2 emissions. Despite growing momentum on green steel investments and private sector commitments, increasing global demand for steel means emissions from the sector are still rising. Far greater ambition in policymaking is needed to shift the sector to a 1.5 °C compatible pathway. This requires urgent and concerted efforts from the world's leading industrialised countries and major steel producers.

2024 will be a critically important year for moving this agenda forward. Brazil, a potential future green iron and steel powerhouse, is hosting both the G20 and the Clean Energy Ministerial; it has put green reindustrialisation at the centre of its new economic growth strategy.[1] Italy is a current front-runner on steel recycling, with only one major carbon-intensive primary steel site remaining; it is hosting the G7 and could advance the G7 Industrial Decarbonisation Agenda adopted in 2021, boosting G7 cooperation to lower the costs of the global transition to net zero industries.[2]

Decision makers, civil society and industry stakeholders following steel decarbonisation need more insight into the speed, pathways and policies being adopted by different countries. The goal of the E3G Steel Policy Scorecard is to fill that gap: it provides a framework, year-on-year, for tracking and comparing how G7 countries (and key steel producers outside of the G7) are meeting the challenge of phasing out coal use for steel and seizing the opportunity to future-proof their steel industries.

[1] Brazilian Government, n.d., **New Growth Acceleration Program** (PDF)

[2] 2021 UK G7 Presidency, 7 June 2021, **G7 Industrial Decarbonisation Agenda (IDA) (PDF)**

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Highlights from our 2023 analysis

Governments are starting to act but moving far too slowly. Scores did not change much for any of the G7 countries compared to our last assessment in 2022. The Scorecard remains a sea of mainly red and orange, indicating a continued lack of policy direction, investment and technology deployment across the board.

The 2023 Steel Policy Scorecard comparison

	Policy direction & clarity	Market signals		Material efficiency & circularity	Building demand		Infrastructure	
		Public funding	Carbon pricing		Green steel definitions	Public procure-ment	Hydrogen & CCS* for steel	Clean power for steel
Germany	B–	A	B+	C+	B+	B–	B+	B+
France	A	B+	B+	C+	C–	C–	B+	A–
Italy	C	C+	B+	C+	C	C+	B+	B+
UK	C+	B–	C+	C–	B	C+	C+	B+
Canada	C+	B–	C+	C–	C+	B	B–	B
US	B–	C	C–	C–	C+	C+	C+	A
Japan	B–	B–	C–	C+	C	C	C+	C
China	B–	C+	C	B–	C+	C–	C+	C–
South Korea	A–	C+	C+	B–	C–	C–	C–	C–

*CCS = carbon capture and storage

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Despite the lack of policy ambition, real economy trends indicate that the steel sector transformation is already underway in key G7 countries. None of the G7 countries currently have new coal-based steelmaking capacity additions planned; several have transition plans in development for significant shares of their remaining coal-based steelmaking capacity. In most G7 countries, however, a risk remains that the lifetime of existing coal-based steelmaking capacity may be extended, with furnaces relined; and no G7 countries have fully committed to phasing out coal-based steelmaking capacity.

Meanwhile beyond the G7, the pipeline for new coal-based steelmaking capacity is still growing and outstripping clean capacity additions. India alone is planning to build out an additional 153 Mtpa of blast furnace capacity by 2030.[3] G7 countries also have a critical role to play in shifting overseas steel investments. Companies and financiers headquartered in G7 countries, in particular in Japan, are driving coal-based steelmaking capacity investments in Southeast Asia.

Headlines on the key policy levers for steel decarbonisation

> **Leadership on policy direction and clarity remains absent**. None of the countries assessed have set ambitious emissions reduction targets specifically for the steel sector. This is a clear target for collective G7 regulatory ambition over the coming years.

> **The landscape for public funding for steel transition is patchy, reflecting different levels of fiscal resources and approaches**. European policymakers are offering a range of support covering R&D, capital investments and direct support for higher operational expenditure. In the US, tax credits for hydrogen are unleashing huge amounts of green investment but specific support for green iron and steelmaking remains lacking. Across the board, there is a lack of targeted support to help steel sites transition away from coal-based capacity.

> **Material efficiency and circularity, alongside scaled-up steel recycling, are critical to steel decarbonisation but continue to be underexploited across the countries we assessed.** None of the G7 countries scored higher than a C+. Notably, countries outside the G7 are showing the greatest leadership in this category.

> **Despite much international engagement on public procurement and standard-setting to build demand for near-zero emissions steel, this remains one of the weakest categories.** G7 countries (and beyond) need to focus on shifting from stated ambition, consultations and pledges to implementing domestic legislation to ensure procurement requirements and standards are driving real economy changes in the steel sector.

[3] Global Energy Monitor, June 2023, **GEM Steel Plants 2023 (PDF)**

> **G7 countries received higher scores on clean energy infrastructure than for other categories, reflecting broader progress on power sector decarbonisation and hydrogen development.** However, ensuring access to clean hydrogen for steel is still not sufficiently prioritised in countries' national decarbonisation strategies.

> **The global nature of the steel sector and its supply chains limits the effectiveness of policy measures targeted at national level alone.** Well-coordinated international efforts and trade policy are key to successfully decarbonising the steel sector.

Recommendations for accelerating policy ambition on steel decarbonisation in 2024

Priority actions for each of the 11 countries assessed in our analysis can be found in the companion "Country profiles" document.[4]

Our recommendations for collective efforts in 2024 are:

1. **Set emissions reduction targets and agree sectoral roadmaps to send a clear policy signal on the expected pace and direction of steel decarbonisation.**
   G7 countries should work towards collectively adopting steel decarbonisation targets and sectoral roadmaps, while agreeing on language that clearly recognises their role in the transition towards near-zero steelmaking. At the more ambitious end, the G7 should make the implicit trend of not building new coal-based steelmaking capacity an explicit policy commitment and encourage all other OECD countries to do likewise. To take this one step further, the G7 countries should also commit not to reline any existing coal-based steelmaking capacity that would extend the lifetime of this capacity beyond 2030.

2. **Move from ambition on building the market for green steel to implementation.**
   The G7 should set out a roadmap with a clear timeline for aligning emissions accounting methodologies and for implementing low and near-zero emission steel benchmarks in policies. G7 countries should explicitly commit to adopting net zero compatible mandatory standards from the mid-2020s.

[4] E3G, February 2024, **Country profiles – 2023 Steel Policy Scorecard**

3. **Scale up investment and improve lead times for deployment of clean energy infrastructure.**
   G7 countries should explicitly embed industry pathways in their power sector goals. First, they need to agree on language recognising the opportunities and challenges presented by industrial electrification; next, they should set out a pathway to develop a more robust understanding of infrastructure needs to manage these.

4. **Pursue partnerships to kick-start green iron trade and commit to providing finance, engaging in technology cooperation and opening up procurement and offtake arrangements internationally.**

   G20: Brazil hosting both the G20 and Clean Energy Ministerial in 2024 offers an unprecedented opportunity for a key future green iron and steel exporter to put international collaboration on green industrial supply chains on the agenda. The Brazilian government should initiate a workstream to define best practices in forging bilateral and plurilateral partnerships; it should also commission research to collectively build understanding on potential supply chain shifts.

   G7: Member countries should recognise the importance of partnerships to enable the steel transition internationally. They need to take action to kick-start the steel sector transition in industrial growth markets in developing countries: providing finance, engaging in technology cooperation and opening up procurement and offtake arrangements internationally, both within future partnerships and more broadly.

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CHAPTER 1
CONTEXT

Steel accounts for 8% of global CO_2 emissions and has long been referred to as a "hard-to-abate" sector.[5] However, the last few years have seen a strong sense of momentum that steel decarbonisation is possible. There has been an uptick in private sector commitments with 500 Mt (35%) of coal-based steel production now covered by net zero targets,[6] a string of announcements about near-zero emission steel pilots[7] and consumers signalling their willingness to procure green steel via emerging buyers' club initiatives.[8]

The shift to near-zero emission steelmaking processes also promises to reorganise global supply chains, with new production, processing and trading hubs emerging for low-carbon iron and steel production.[9] Countries with abundant, low-cost renewable electricity and access to iron ore resources, such as Brazil, Australia and South Africa, are looking to position themselves as potential major winners from this transition. Mining companies are already lining up to capitalise on this shift, making deals to establish mining and processing hubs where iron ore and plentiful renewable resources are located.[10]

The steel sector is not on track to meet net zero by 2050, despite this growing sense of momentum and opportunity. Private sector commitments still only cover a small share of the global market, and many steel companies with net zero commitments are yet to set out detailed roadmaps for how they expect to

[5] IEA, October 2020, **Iron and steel technology roadmap**

[6] According to Global Energy Monitor's **Global Steel Plant Tracker** (GSPT, last updated March 2023), 62% (1,397 Mtpa) of global crude steel capacity currently uses the BOF route. According to Agora, June 2023, **15 Insights on the Global Steel Transition**, 500 Mt of coal-based steel production is covered by net zero targets. Note: the BOF steel capacity captured in the GSPT predominantly uses the BF-BOF route, but some steelmakers are now considering alternative routes to feed DRI and scrap into BOFs. Thus, BOF steelmaking is referred to as a coal-based steelmaking route throughout this report, unless otherwise noted.

[7] Leadership Group for Industry Transition, **Green Steel Tracker** (webpage, accessed January 2024)

[8] Climate Group, **Steelzero** (webpage, accessed January 2024)

[9] Woodmac, October 2023, **Metalmorphosis: how decarbonisation is transforming the iron and steel industry**

[10] Ibid.

deliver their pledges. Overall, steel sector emissions are continuing to rise, and less than 1 Mt of near-zero emission steel is currently being produced.[11]

Most worryingly, the pipeline for new coal-based blast furnaces is still growing,[12] and continues to outstrip clean capacity additions: planned capacity for blast furnaces is 2.5 times greater than planned green iron and steel capacity.[13] India alone is planning to build out an additional 153 Mtpa of blast furnace capacity by 2030.[14] Given the long lifetime of these plants (~20–25 years or more depending on the location), any additional blast furnaces built today will lock in high emissions for a significant period.

This stands in stark contrast to the IEA's updated Net Zero by 2050 (NZE) Pathway, which indicates that all new heavy industry capacity must be near-zero emissions capable by 2030, if we are to keep warming below 1.5 °C.[15] Direct emissions from the global iron and steel industry must be lowered from 2.6 Gt CO_2 to 2.1 Gt CO_2 by 2030 and 0.2 Gt CO_2 by 2050, to align with this NZE Pathway.[16]

It is crucial that policymakers responsible for industrial and economic planning consider a faster transition of the steel sector in their respective countries and adjust policies accordingly. A big wave of steel capacity reinvestments (73% of current BF-BOF[17] capacity) is expected by 2030.[18] The key question is what technology pathway plant owners will opt for in the immediate future. The right policy signals are needed now to give plant owners the confidence to invest in near-zero emission steelmaking technologies, rather than locking in carbon-intensive production via refurbishments, or seeing these sites shut down.

2024 will be a critically important year for moving this agenda forward. Brazil, a potential future green iron and steel powerhouse, is hosting both the G20 and

[11] IEA, 2023, **The Breakthrough Agenda Report (PDF)**. Total global steelmaking capacity is 2.5 Gt (2022); see OECD, 2023, **Latest-developments in steelmaking capacity (PDF)**.

[12] Global Energy Monitor, **Global Steel Plant Tracker 2023, Steel Capacity (TTPA), by method and development status in each country**

[13] Global Energy Monitor, October 2023, **A Matter of Ambition: Examining the Steel Industry's Commitment to Net Zero by 2050**

[14] Global Energy Monitor, June 2023, **Pedal to the Metal** (PDF)

[15] IEA, September 2023, **Net zero roadmap: A global pathway to keep the 1.5 °C goal in reach**

[16] IEA, September 2023, **Net zero roadmap: A global pathway to keep the 1.5 °C goal in reach**

[17] The blast furnace-basic oxygen furnace method (BF-BOF) is one of the production routes used in steelmaking. A blast furnace is used to smelt iron from iron ore. This results in the creation of pig iron, which is then transferred to the basic oxygen furnace for the creation of steel.

[18] Global Energy Monitor, June 2023, **GEM Steel Plants 2023 (PDF)**

the Clean Energy Ministerial; it has put green reindustrialisation at the centre of its new economic growth strategy.[19] Italy, a current frontrunner on steel recycling, with only one major carbon-intensive primary steel site remaining, is hosting the G7; it could advance the G7 Industrial Decarbonisation Agenda adopted in 2021, boosting G7 cooperation to lower the costs of the global transition to net zero industries.[20]

[19] Brazilian Government, September 2023, **New Growth Acceleration Program (PDF)**

[20] 2021 UK G7 Presidency, June 2021, **G7 Industrial Decarbonisation Agenda (IDA) (PDF)**

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CHAPTER 2
NOTES ON THE 2023 METHODOLOGY

Scores based on five categories

E3G's 2023 Steel Policy Scorecard assesses country performance across five categories of action:

> **Policy direction and clarity:** Are countries sending clear signals on the expected pace and direction of travel for steel decarbonisation via decarbonisation strategies or broader policy frameworks?

> **Market signals:** Are countries creating sufficient market signals via public funding and/or carbon pricing to shift investment towards near-zero emissions steel production?

> **Material efficiency and circularity:** Are countries introducing policy frameworks to enhance the material efficiency and circularity of steel production?

> **Building demand:** Are countries sending clear signals via public procurement and standard-setting for future demand, as well as benchmarks for near-zero emissions steel?

> **Infrastructure investment:** Are countries planning for and investing in the required clean infrastructure to support rapid steel decarbonisation?

These categories are scored based on publicly available information about government policies in each country. Each policy lever is assigned an equal number of points across multiple indicators. The scores and the methodology were cross-checked with partners in each country assessed. The numerical scores for each policy lever are then translated into the visual ranking shown in Figure 3 (Chapter 3). See Annex B for the full methodology.

Changes since the 2022 Steel Scorecard

Expanding categories for a more robust assessment

We made changes to the methodology and composition of levers in 2023. While these changes complicate comparisons with the 2022 Steel Policy Scorecard, they make it more robust and give a fuller picture of steel transition progress across the countries assessed.

We introduced a sub-category on clean power under **infrastructure investment**, recognising that greening electricity consumption in the steel sector and planning for rising power demand from industrial electrification is central to the steel transition.

We also expanded some categories to allow for more granular analysis. Our public funding lever, for example, now distinguishes between funding for R&D, CAPEX and OPEX support.

From the G7 to 11 countries assessed

The biggest change from the 2022 Scorecard is adding four other countries beyond the G7 in our analysis. The G7 is still the central focus of our analysis and where we think the most meaningful comparison of government policies can be made. However, G7 countries only produce 17% of the world's steel (Figure 1),[21] and their share of global production is shrinking.

Accelerating steel decarbonisation will require a focus on industrial growth markets outside of the G7. Understanding non-G7 contexts can facilitate better international cooperation and give insight into policymaking.

In view of this, we expanded our scope to also include:

> **China** and **India**, as the largest[22] and most carbon-intensive[23] steel producers in the world.

> **Brazil**, due to its upcoming G20 Presidency, and in view of its great potential to become a green steel powerhouse.

[21] IEA, May 2022, **Achieving net zero heavy industry sectors in G7 members**

[22] Global Energy Monitor, July 2023, **Pedal to the Metal It's Time to Shift Steel Decarbonization Into High Gear [PDF]**

[23] EAF: Global Efficiency Intel, April 2022, **Part 2: Cleanest and Dirtiest Countries for Secondary (EAF) Steel Production**; Primary: Global Efficiency Intel, 2020, **Part 1: Cleanest and dirtiest countries: primary steel production: energy-CO2-benchmarking**

> **South Korea** as the largest consumer of steel per capita in the world[24] (and sixth largest steel producer).[25]

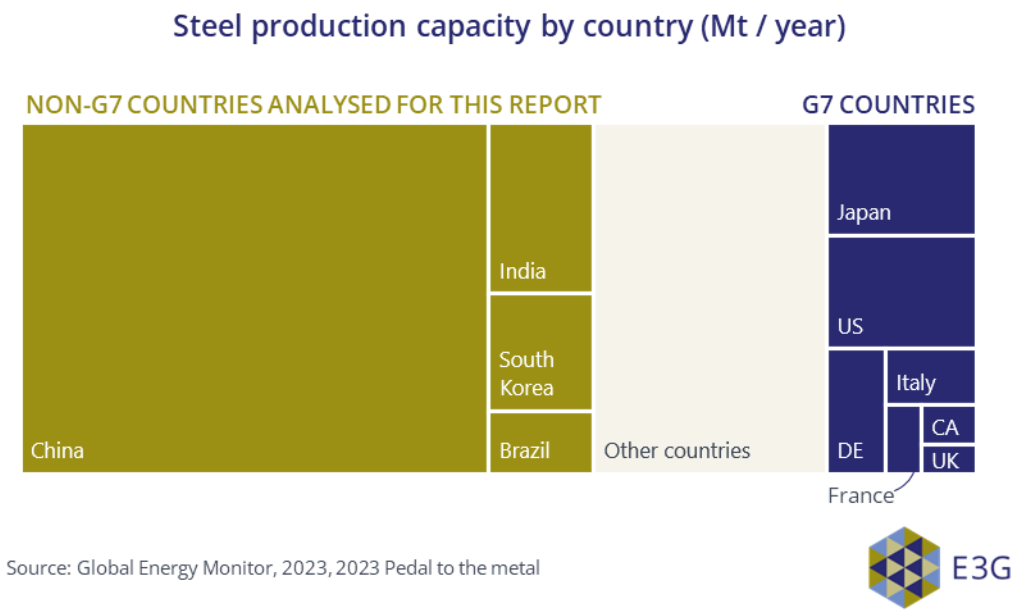

Figure 1: Combined, the G7 countries produce less than one-fifth of the world's steel. Decarbonising steel production requires a focus on markets outside of the G7. Adding four additional countries to the Scorecard analysis provides much more comprehensive coverage.

Figure 2 illustrates how including these countries enables us to understand the steel decarbonisation landscape in a greater diversity of contexts in terms of steel consumption and fiscal capacity, as well as steel production capacity.

Considering the vastly different starting points, fiscal resources and market structures these countries have from which to act to decarbonise steel, we did not include all of them in the Scorecard itself – India and Brazil are not included. China and South Korea, given their levels of economic development, were explicitly scored and presented alongside G7 countries in the Scorecard, though they are not formally ranked along with the G7 countries. However, deep dives on each of these four countries are included in our dedicated country profiles.[26]

[24] World Steel Association, 2022, **World steel in figures 2022**

[25] The third largest producer, Russia, was not considered due to the current complex geopolitical context, but we recognise and strongly encourage research in this direction. Further G20 countries were not included due to capacity reasons.

[26] E3G, January 2024, **Country profiles – 2023 Steel Policy Scorecard**

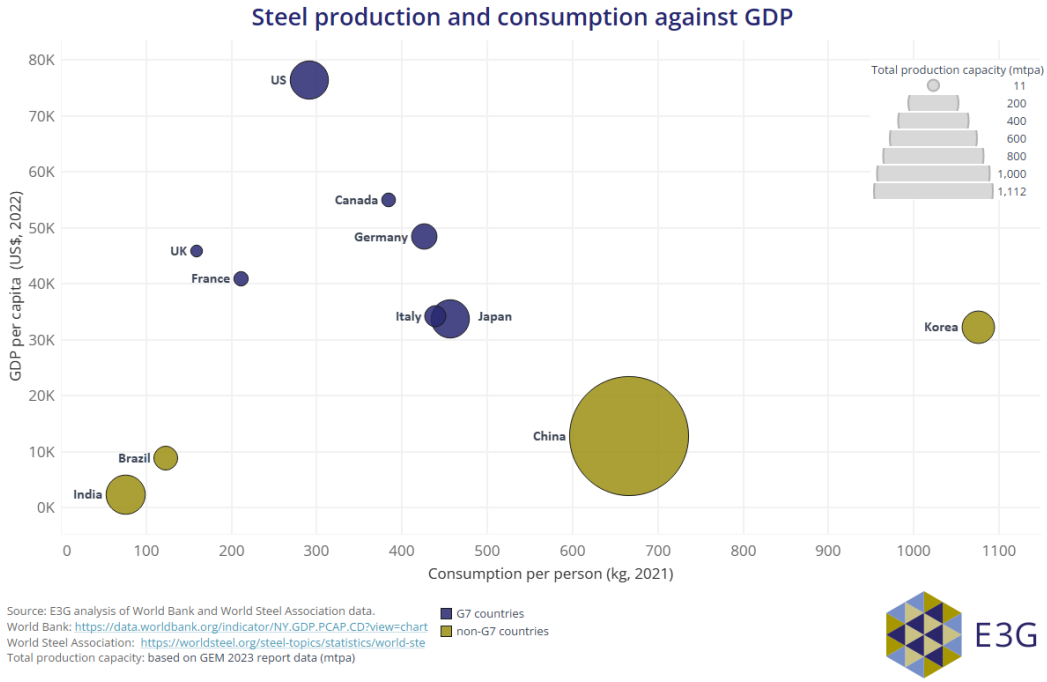

Figure 2: Steel production and consumption, and GDP per capita for the 11 countries analysed in the Steel Policy Scorecard. Introducing four non-G7 countries has provided understanding of progress in steel decarbonisation across a greater range of countries.

Putting policy into the real economy context

In 2023 we also analysed context of real economy data trends, to put the policy analysis reflected in the Scorecard into context. The results are shown in Table 1 in Chapter 3, and build on Global Energy Monitor's Global Blast Furnace Tracker.[27]

For each country we looked at the following trends and the drivers behind them:

1. The risk of new coal-based steel capacity being built.
2. The risk of relining existing coal-based steel capacity.
3. Whether existing coal-based steel capacity is being retired.

[27] Global Energy Monitor, last update June 2023, **Global Blast Furnace Tracker**

Remaining challenges and caveats

With changes made to the methodology noted above, we were able to address some of the limitations we faced with our 2022 Steel Policy Scorecard. However, there continue to be clear challenges, which we were not fully able to address owing to resource constraints among other factors. For example, we currently weight all policy levers equally to allow for meaningful comparisons across countries. In practice, different policy levers will have different impacts on steel sector transition in different locations. Data availability and granularity also varies across the different countries impacting our assessment of a given country's policy progress. Finally, in many of the countries assessed policy progress often takes place at regional levels not captured if the focus is only on policies issued by national governments. We were not always able to fully capture regional policy action.

CHAPTER 3
FINDINGS FROM THE 2023 STEEL POLICY SCORECARD

Policy progress

Figure 3 shows the 2023 Steel Policy Scorecard. Notably, scores did not change significantly across any of the G7 countries assessed compared to 2022. The Scorecard remains a sea of mainly red and orange, indicating a continued lack of policy direction, investment and technology deployment across the board. **Far greater ambition in policy making is needed to shift the steel sector to a 1.5 °C compatible pathway.**

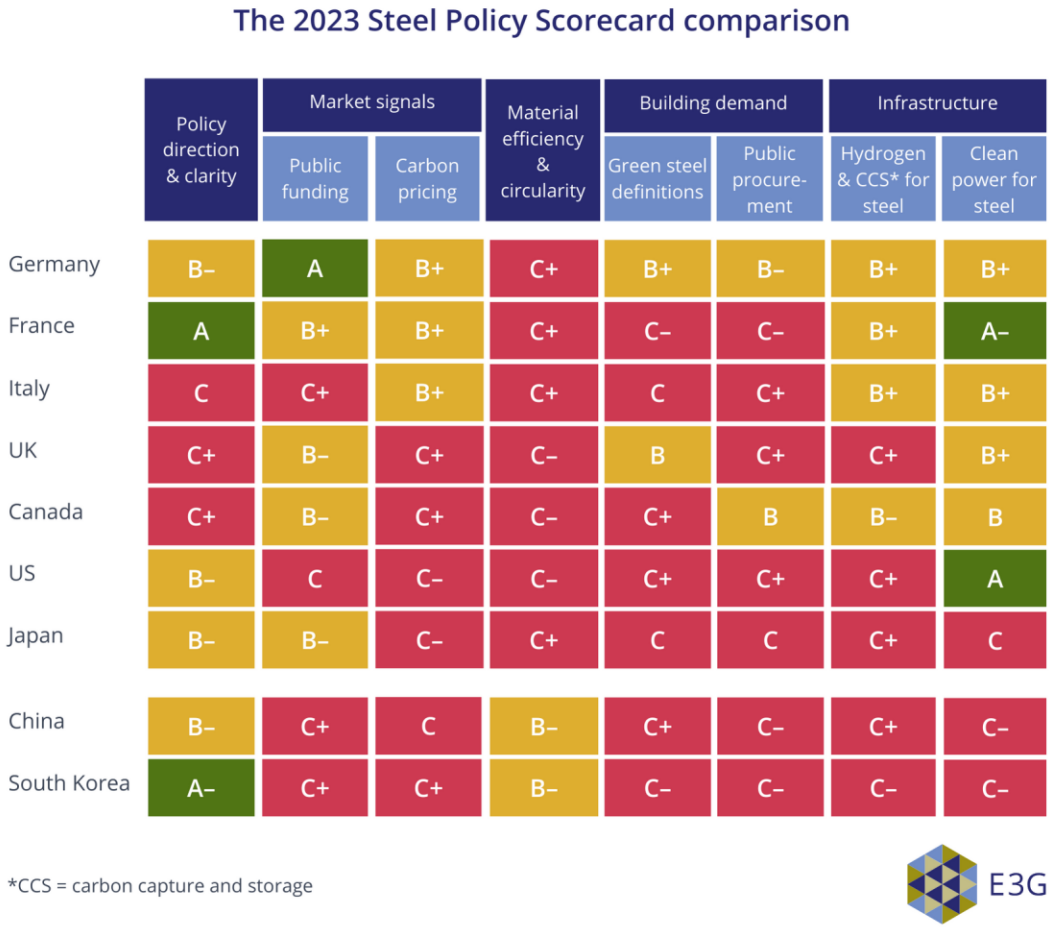

Figure 3: The E3G Steel Policy Scorecard 2023 (G7, China, South Korea).

Germany, **France** and **Italy** continue in leading positions. Each has made progress on domestic steel decarbonisation policy since the first edition of this Scorecard.[28] These countries also benefit from an ambitious climate policy framework set at the EU level, boosting scores across the set.

> **Germany** is one of the countries with the largest share of green primary steelmaking capacity under development.[29] The German government has introduced carbon contracts for difference (CCfDs) to support industrial transition and is moving swiftly towards a voluntary green steel labelling system.

> **The French government** has committed to supporting the transformation of its two main coal-based steelmaking sites.

> **Italy** announced the addition of a DRI[30] plant at its remaining coal-based steelmaking facility.

However, scores remain low in certain categories even among these front-runners. While Germany, France and Italy have each sent positive signals on investing in green steel capacity, there continues to be a risk of reinvestment in coal-based steelmaking capacity; and none of them have set clear targets for phasing out existing facilities.

The **UK** moved up the Scorecard to fourth place, with progress on transitioning its remaining blast furnaces to EAFs[31], and a move towards green steel definitions and green procurement criteria. It also benefited from the introduction of the clean power category relative to **Canada**, which it overtakes, and whose progress plateaued in 2023.

The **US** remained in sixth place. While the 2022 US Inflation Reduction Act (IRA) has unleashed huge amounts of green investment, including in hydrogen, CCS (carbon capture and storage) and heavy industry transformation, specific support for green ironmaking remains lacking. There is no regulatory framework to ensure accelerated decarbonisation of coal-based steelmaking sites.

[28] E3G, September 2022, **G7 Steel Policy Scorecard – shifting the pathway for steel**

[29] Global Energy Monitor, June 2023, **GEM Steel Plants 2023 (PDF)**

[30] Direct reduced iron (DRI), also called sponge iron, is a form of ironmaking that doesn't require melting and uses gas as a reducing agent.

[31] Electric arc furnace is a form of steelmaking that uses electricity. It uses steel scrap, direct reduced iron (DRI), or a combination of these materials as the primary feedstock.

Finally, **Japan** remains in last place in the Scorecard rankings. In fact, if **China** and **South Korea** were included in the ranking with the G7 countries, Japan would sit below them. Japan's strategy for steel decarbonisation remains heavily dependent on large-scale future CCS capacity, and on imports of green hydrogen for which the Japanese government has outlined no clear strategy. Despite a show of international leadership in joining the Industrial Deep Decarbonisation Initiative (IDDI), the Japanese government also failed to progress the international agenda on industrial decarbonisation under its G7 Presidency in 2023.

China and **South Korea**, newcomers to the Scorecard, generally scored at the lower end on each of the categories. While **China** has established an infrastructure for emissions reporting and targets for increasing scrap-based steel production, its current steel facility pipeline remains heavily dominated by coal-based production capacity. In South Korea, there are no new coal-based facilities in the pipeline; [32] however, its largest steelmaker, POSCO, is in the process of extending the lifetime of several coal-based facilities through relining.

For additional detail on the country-level assessments, including of Brazil and India, see the companion "Country profiles" document.[33]

Steel transition trends in the real economy

To put the Steel Policy Scorecard results into context, we also assessed the state of play for each country's current coal-based steel capacity (Table 1), asking whether (1) there is a risk of building new coal-based steel capacity; (2) there is a risk of relining existing capacity, thus extending their lifetime; (3) existing coal-based steel capacity is being retired. We also considered what the key drivers for these outcomes are.

Despite the general lack of policy ambition on steel highlighted above, real economy trends indicate that the steel sector transformation is already underway in key G7 countries. None of the G7 countries currently have new coal-based steel capacity additions planned and several (France, UK, Germany, Italy) have transition plans in development for large shares of their remaining blast furnace capacity.

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

[33] E3G, January 2024, **Country profiles – 2023 Steel Policy Scorecard**

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Table 1: State of the steel transition 2023 (G7, China, South Korea). Metrics are indicated as being driven by either the market (M), government policy (G) or private sector actions (P). G7 countries are ordered by overall performance on these metrics.

		Risk of new coal-based steel capacity		Risk of relining existing coal-based steel capacity			Coal-based steel capacity retirements				
Country	Number of existing BFs	Planned additions (M)	Commitment to build no new BFs (G)	Recent relinings (2020–23) (P)	Upcoming relinings (2024 and beyond) (P)	Commitment to no BF relinings (G)	Transition plans for **some** BFs* (P/G)	Transition plans for **all** BFs* (P/G)	Retirement dates for **some** BFs (P/G)	Retirement dates for **all** BFs (P/G)	Commitment to phase out BFs (G)
UK	4	NO✓	NO✗	NO✓	NO✓	NO✗	YES✓†	NO✗	YES✓	NO✗	NO✗
Japan	20	NO✓	NO✗	YES✗	NO✓	NO✗	YES✓	NO✗	YES✓	NO✗	NO✗
France	3	NO✓	NO✗	YES✗	NO✓	NO✗	YES✓	NO✗	YES✓	NO✗	NO✗
Germany	14	NO✓	NO✗	YES✗	YES✗	NO✗	YES✓	NO✗	YES✓	NO✗	NO✗
Canada	4	NO✓	NO✗	YES✗	NO✓	NO✗	YES✓	NO✗	YES✓	NO✗	NO✗
Italy	3	NO✓	NO✗	YES✗	YES✗	NO✗	YES✓	NO✗	NO✗	NO✗	NO✗
US	14	NO✓	NO✗	YES✗	YES✗	NO✗	NO✗	NO✗	NO✗	NO✗	NO✗
China	707	YES✗	NO✗	YES✗	YES✗	NO✗	YES✓	NO✗	YES✓	NO✗	NO✗
South Korea	11	NO✓	NO✗	YES✗	YES✗	NO✗	YES✓	NO✗	NO✗	NO✗	NO✗

* Plans to retire BFs and convert to green steel capacity. Source for number of existing BFs and planned additions: Global Energy Monitor, 2023, **Pedal to the Metal 2023**
† Note on the UK: Provisional plans have been released by Tata Steel and British Steel signalling intentions to close the remaining blast furnaces operating in the UK. However, at the point of publication, these plans have not been confirmed.

However, there remains a risk in most G7 countries of relining decisions extending the lifetime of existing coal-based steel capacity and none have committed to fully phasing this capacity out. Moreover, current progress in transitioning away from coal-based steelmaking in these countries is largely driven by broader market factors as opposed to concerted government efforts.

Table 1 also clearly highlights that G7 real economy progress on steel transition only gets us so far. Beyond the G7, the pipeline for new coal-based steel capacity is still growing[34] and outstripping clean capacity additions.[35] China has plans to build another 70 blast furnaces over the coming years and two-thirds of global relining decisions up to 2030 will also arise there.[36] India alone is planning to build out an additional 153 Mtpa of blast furnace capacity by 2030.[37] For every decision to retire or not reline a single blast furnace in the G7, we need at least 10 times that shift in capacity in other geographies.

Still, G7 countries have a critical role to play in shifting overseas steel investments. Companies and financiers headquartered in G7 countries, in particular in Japan, are driving coal-based steelmaking capacity investments in Southeast Asia. Beyond the G7, Chinese and South Korean companies are also heavily investing in new coal-based steel capacity overseas.

Box 1. State of the steel transition in China?

The analysis in Table 1 is complicated in the case of China by its Steel Capacity Swap Policy, which has been in place since 2014. Under this policy, all new steel capacity added requires a larger quantity of existing capacity to be retired.[38] In its latest form, if the new capacity being added is lower carbon, e.g. DRI or EAF, the capacity swap can be equivalent (1:1); if the new capacity is coal-based steel capacity (BF-BOF), the capacity swap can only be a reduced swap (1.5 : 1 in most regions). Capacity allocations can also be traded between companies.

[34] Global Energy Monitor, **Global Steel Plant Tracker 2023, Steel Capacity (TTPA), by method and development status in each country**

[35] Global Energy Monitor, Oct. 2023, **Top50 steel producers' commitment to netzero (PDF)**

[36] Global Energy Monitor, June 2023, **GEM Steel Plants 2023 (PDF)**

[37] Global Energy Monitor, June 2023, **GEM Steel Plants 2023 (PDF)**

[38] Centre for Research on Energy and Clean Air, Aug. 2023, **China's steel sector invests USD 100 billion in coal-based steel plants, despite low profitability, overcapacity and carbon commitments (PDF)**

This means that while China shows up with a score of "YES" under "transition plans for some BFs" and "retirement dates for some BFs", this score is hard to compare to equivalent scores elsewhere. Coal-based steel capacity is being retired in China. In some cases, it is being replaced by lower carbon alternatives but there is still a huge amount of coal-based capacity coming online.

Stocktake on key policy levers for steel decarbonisation

Policy direction and clarity

Targets and sectoral roadmaps play a key role in providing a clear policy signal on the expected pace and direction of steel decarbonisation. France and South Korea are the only two countries who score well in this category. Both countries have dedicated steel decarbonisation strategies.

France has taken this one step further and is now co-developing site-specific decarbonisation strategies for its remaining coal-based steelmaking sites. South Korea's steel decarbonisation strategy, meanwhile, falls short of setting a specific emissions reduction target for steel. Emission reduction targets for industry sectors overall, as set out in the South Korean nationally determined contribution (NDC), are not very ambitious – just over 10% by 2030.[39]

None of the countries assessed have set ambitious emissions reduction targets for the steel sector specifically. This is a clear target for collective regulatory ambition by the G7 (and beyond) over the next three years.

Market signals

An immediate challenge for governments is to create market signals that shift investment to near-zero steel production, given that the pipeline for new coal-based blast furnaces is still outstripping clean capacity additions. Many of the technology options for decarbonising steel are more expensive than conventional production processes and investments in innovative production sites carry higher levels of risk. Even in jurisdictions with higher carbon prices, like the EU with its emissions trading system (ETS), breakeven carbon prices for these technologies are considerably higher than those for coal-based production.

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

Some form of direct support will be required to cover higher operating and capital costs, though the costs of these technologies will come down as they scale up. The exact means of how such support is given varies in different national contexts, reflecting different levels of fiscal resources and different production costs.[40]

In the European countries we assessed, policymakers are exploring offering direct support, such as CCfDs, to cover higher operational expenditure for breakthrough clean production technologies.[41] Germany, for example, introduced CCfDs in 2023 to support its heavy industry sectors to transition. The UK government recently committed around £500m in taxpayer support to transition Tata Steel's Port Talbot blast furnace site to scrap-EAF. Funding in other countries is still mainly focused on R&D with funds available insufficient for supporting steel sites to transition away from coal.

Material efficiency and circularity

Material efficiency and circularity levers are critical to steel decarbonisation, as they help lower how much steel we use in the first place and grow the share of secondary steel production.[42] However, they continue to be underexploited across all countries we assessed. None of the G7 countries scored higher than a C+. Although the US and Italy stand out as front-runners on steel recycling, we specifically looked for clear signals and regulatory frameworks to support steel decarbonisation as linked to circular economy provisions, which were lacking.

For EU member states, the EU Circular Economy (CE) Action Plan released in March 2020 is critical in this regard.[43] It includes the recent revision to the Ecodesign for Sustainable Products Regulation (ESPR), which highlights steel as a priority product for future regulation.[44]

[40] Devlin, Kossen, Goldie-Jones, Yang, **Global green hydrogen-based steel opportunities surrounding high quality renewable energy and iron ore deposits**, *Nature Communications*, 14, Article number: 2578, 4 May 2023

[41] In the European context, steel production costs are projected to increase total production costs by at least €20 billion/y due to the introduction of net zero steelmaking technologies, and operational costs are estimated to be responsible for 20% of this increase. European Parliament, December 2021, **Moving towards Zero-Emission Steel (PDF)**

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

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

[44] Council of the EU, 2023, **Products fit for the green transition: Council and Parliament conclude a provisional agreement on the Ecodesign regulation**

Notably, China and South Korea are showing greater leadership in this category than the G7. 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;[45] 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.[46]

Beyond countries formally assessed in the Scorecard, India has also shown clear ambition and leadership on steel circularity. Under its G20 Presidency in 2023, India launched the Resource Efficiency Circular Economy Industry Coalition and released a technical paper entitled "Knowledge Exchange on Circular Economy in Steel Industry".[47] India has also launched a Scrap Metal Committee and Steel Scrap Recycling Policy which aims to create a framework to facilitate and promote establishment of metal scrapping centres across India.[48]

Similarly, Brazil is also pursuing circularity as a pathway to steel decarbonisation. Its 2023 Ecological Transformation Plan highlights the possible introduction of programmes to incentivise circular economy practices in the industrial sector.[49]

Building demand for green steel

Building demand for green steel is crucial to creating a more attractive business case for investment in steel decarbonisation. Without a clear incentive, it is likely that new investment will otherwise be stifled.

Governments have a critical role to play in building that demand. Mainstreaming lower carbon steel procurement would transform the business case for steel producers – reassuring companies that they will be able to find a market for their often more expensive, lower carbon steel and thereby recover the costs of required investments.

Governments can also play a critical role in helping to define what qualifies as "low-carbon", "near-zero" and "net zero" steel, in partnership with industrial

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

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

[47] G20, July 2023, **Knowledge Exchange on Circular Economy in Steel Sector [PDF]**.

[48] Indian Ministry of Steel, 16 March 2022, **Press release – Steel scrap recycling policy**

[49] Brazilian Government, n.d., **Casa Civil: Novopac**

stakeholders and civil society actors. Ambitious definitions and product requirements tied to transparent and trusted processes for certifying adherence to those definitions and standards are key tools in driving steel sector decarbonisation.

Canada, Germany and the UK have all demonstrated clear ambition on this front.[50] Canada is the only IDDI member to date to have 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.[51] The German government has initiated a stakeholder consultation process on green steel definitions and measurement standards, which is expected to result in a voluntary green steel labelling system.[52] Germany could be the first country to establish national green steel benchmarks and standards linked to procurement and market building policies. The UK government held a public consultation on the adoption of green steel definitions and IDDI green steel procurement pledges in its 2023 public consultation on a UK CBAM (carbon border adjustment mechanism).[53]

Despite a lot of policy developments in this area, this remains one of the weakest categories across all countries assessed. Shifting from stated ambition, consultations and pledges to actual legislation should be a target for collective G7 regulatory ambition.

Clean energy infrastructure investment

The transition to near-zero emissions steelmaking will require massive investment in new infrastructure: expanding renewables-based electricity generation, building electrolysers to produce hydrogen from renewable sources and providing CO_2 transport and storage infrastructure where required.[54]

[50] Canada, Germany, the UK and US issued public announcements about their current procurement initiatives and how they align with different IDDI pledge levels at COP28 December 2023. At the point of publication, we are still waiting for public information on which pledge levels they are officially committing to. IDDI, 5 December 2023, **IDDI green public procurement pledge announcement** (PDF)

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

[52] Plattform Industrie 4.0, 27 June 2023, **Gesetzesvorhaben: Öffentliche Konsultation zur Transformation des Vergaberechts**

[53] IDDI, 5 December 2023, **IDDI green public procurement pledge announcement** (PDF)

[54] Global electricity use in the iron and steel industry increases from 1,300 TWh EJ in 2019 to 1,900 TWh in 2050. Hydrogen use in the steel industry also sees considerable growth, reaching 4.5 EJ in 2050. (PNNL & E3G, 2021, **1.5°C Steel. Decarbonising the Steel Sector in Paris-compatible pathways**)

Governments will play a key role in making this happen. They need to send clear signals about infrastructure deployment plans and near-term investment strategies; they also can help stakeholders to develop a shared understanding of future infrastructure needs.

G7 countries consistently received higher scores in this category than others, reflecting broader ambition on power sector decarbonisation and hydrogen development. Government policies from across this set of countries demonstrated a clear recognition of rising demand for clean power from steel electrification; this included questions of siting and reinforcement considerations in grid development.

Greening the national power mix is only part of the equation for decarbonising the steel sector's electricity consumption; but government power system decarbonisation targets and policies send important signals. Together with electricity market design, they have a direct impact on decision making by renewables generators and industrial consumers whether to engage in direct clean PPAs (power purchase agreements) or other arrangements.

Not all the countries assessed have the same amount of catching up to do when it comes to greening their overall power mix. France and Brazil, for example, benefit from ample nuclear and controllable renewables capacity respectively. Meanwhile, other geographies face significant challenges in relation to land use (Japan, Germany) or to grid connection queues for new renewable capacity (UK).[55]

Ensuring access to clean hydrogen for steel, and heavy industry sectors in general, is not sufficiently prioritised in countries' national decarbonisation strategies. Most countries have either updated existing or published new hydrogen strategies since the last iteration of the Scorecard. Many of these still do not sufficiently prioritise the use of low carbon hydrogen for steel or heavy industry decarbonisation;[56] or they see it as an end-use that will only become relevant in the long run.

A further risk is connected to a lack of clarity over the emissions intensity of hydrogen investments that will be supported, as well as the social and

[55] IEA, 2023, **Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach - update (PDF)**

[56] IEA, January 2022, **Geopolitics of the Energy Transformation Hydrogen**

environmental sustainability of hydrogen imports – which come from usually less economically developed countries with abundant renewables potential.[57]

International coordination and trade policy for steel decarbonisation

While the Steel Policy Scorecard focuses primarily on domestic policy ambition among the G7 (and beyond), our analysis also includes benchmarks for assessing international engagement.[58]

The global nature of the steel sector and its supply chains limits the effectiveness of policy measures targeted just at the national level. Therefore, well-coordinated international efforts and trade policy will be key to successfully decarbonising the steel sector. Moreover, domestic and trade policies set in any one of the countries or jurisdictions we assess also have spillover effects in other geographies. Notable examples include:

> **Carbon border measures:** The implementation of the EU CBAM has given a regulatory push internationally to carbon pricing for steel. It also signals that a major market will for the first time give preferential treatment to lower carbon steel, incentivising decarbonisation efforts on steel more broadly. The UK, US and Canada are exploring introducing their own CBAMs. China is progressing with inclusion of steel in its ETS, with reporting requirements starting in 2023.

> **Sectoral arrangements:** The EU and the US launched negotiations on the Global Arrangement on Sustainable Steel and Aluminium (GSA) in 2021. They have proved challenging with both sides remaining far apart;[59] however, the stated ambition of both parties is to set global norms on measurement methodologies and benchmarks for green steel. This could include potentially applying these norms to trade and procurement measures, which would have major consequences for steel producers around the world.

> **Standards:** Standards for near-zero emissions steel set at the national level, such as those that have been presented for public consultation in the UK and are under development in Germany, could end up being adopted internationally and, ultimately, set the benchmark for supply chains globally.

> **Hydrogen or green iron trade flows:** Many of the G7 countries will have to rely on green hydrogen imports, or on importing its derivatives such as green

[57] Van de Graaf, Overland, Scholten, Westphal, *Energy Research & Social Science* 70, Dec. 2020, **The new oil? The geopolitics and international governance of hydrogen**

[58] Membership of the IDDI is, for example, a key factor we assess under the public procurement lever.

[59] E3G, July 2023, **The EU–US global arrangement on sustainable steel and aluminium**

iron. This becomes clear when comparing the production targets announced for green hydrogen with the volumes needed to decarbonise existing dirty steel capacity. Working with exporting countries on developing strategies with a long-term horizon and enabling exporters to also develop manufacturing sectors for clean hydrogen derivatives, such as green iron or steel, will be key to ensuring that such trade flows benefit both parties.

> **Transition finance**: While most countries examined in this Scorecard have sufficient financial resources to co-finance transitions of steel plants themselves, in other geographies, including India and Brazil, the role of international finance comes into play. Capital costs and access to skills and finance vary massively between geographies. G7 governments have a key role in scaling up investment, mobilising targeted support and technical assistance for steel decarbonisation, and bolstering international climate finance to facilitate the steel sector transition internationally.

> **Overseas investments:** Companies and financiers headquartered in G7 countries, in particular in Japan, are driving coal-based steelmaking capacity investments in Southeast Asia. Beyond the G7, Chinese and South Korean companies are also heavily investing in new coal-based steel capacity overseas.

> **Steel scrap trade:** As countries scale up secondary steel production via EAFs, there will be increasing demand for scrap. Countries are likely to act to try to secure their own supply and restrict exports with knock-on impacts for the steel transition in trade partners. The last few years have seen growing number of trade restrictions on scrap in Africa, the MENA region and Asia.[60] This is a live discussion in G7 countries. The EU will introduce restrictions of scrap exports to non-OECD countries from 2027 unless they can demonstrate sustainable practices. The UK currently only uses a quarter of the scrap it generates.[61] With talks underway to replace its remaining coal-based steel capacity with EAFs, there is an active discussion on how the UK can process and recycle more of its scrap domestically.[62]

Table 2 summarises participation from G7 countries (plus Brazil, China, India and South Korea) in key international initiatives relevant to steel decarbonisation. The US, UK, Germany and Japan stand out with particularly high levels of participation across the set of initiatives. However, it is unsurprising that they

[60] OECD, January 2022, **Raw materials, trade obstacles and the circular economy**

[61] Financial Times, January 2024, **Boom times for scrap metal as UK steel industry goes green**

[62] Ibid.

make up most of the membership given that, with the exception of India's role in the Leadership Group for Industry Transition and the IDDI, the majority of these initiatives have been driven by European countries, the US and Canada. It will be critically important to expand existing international initiatives on steel decarbonisation, ensuring these are inclusive and engage major steel-producing countries across geographies.

Table 2: Participation in international steel decarbonisation initiatives, up to 2023 (G7, Brazil, China, India, South Korea)

Initiative	CAN	FRA	DEU	ITA	JPN	UK	US	CHN	KOR	BRA	IND
IDDI	■		■		■	■	■			■	■
LeadIT		■	■		■	■	■		■		■
Steel Breakthrough*	■	■	■	†	■	■	■				
Clean Energy Ministerial	■	■	■	■	■	■	■	■	■	■	■
Mission Innovation: Net Zero Industries Mission	■	†	■	†		■	‡	■	■		
Global Forum on Steel Excess Capacity	■	■	■	■	■	■	■		■	■	
First Movers Coalition		†	†	■	■	■	■				■
IEA Working Party on Industrial Decarbonisation	■	■	■	■	■	■	■		■		
G7 Industrial Decarbonisation Agenda	■	■	■	■	■	■	■				
OECD Steel Committee	■	■	■	■	■	■	■		■	■	
Total	**8**	**9**	**10**	**8**	**9**	**10**	**10**	**2**	**6**	**4**	**4**

* Members supporting at least one steel priority action. † Through EU membership. ‡ Supporting member.

CHAPTER 4
RECOMMENDATIONS FOR COLLECTIVE EFFORTS TO ACCELERATE POLICY AMBITION ON STEEL IN 2024

2024 will be a critically important year for moving the steel decarbonisation agenda forward. Italy is hosting the G7 and could advance the G7 Industrial Decarbonisation Agenda adopted in 2021, boosting G7 cooperation to make the global transition less costly.[63] Brazil, a potential future green iron and steel powerhouse, is hosting both the G20 and the Clean Energy Ministerial; it has put green reindustrialisation at the centre of its new economic growth strategy.[64] The EU and US will be going into their third year of negotiations on the GSA with elections looming that could determine whether this agreement lives up to its initial promise to give a global push to steel decarbonisation.

Drawing on our analysis of how G7 countries (and certain key steel producers outside of the G7) are meeting the challenge of phasing out coal use for steel, E3G has identified priority actions for each of the 11 countries assessed in the Scorecard. These can be found in the companion "Country profiles" document.[65]

In this section, we offer recommendations for collective efforts in 2024.

1. Set emissions reduction targets and agree sectoral roadmaps to send a clear policy signal on the expected pace and direction of steel decarbonisation

None of the countries assessed in the Scorecard have set ambitious emissions reduction targets specifically for the steel sector. We believe this is a key area for collective **G7** regulatory ambition. The G7 aspires to take a leading role in shaping the multilateral agenda and in setting norms for government action and international cooperation more broadly. In 2021 G7 countries also explicitly

[63] 2021 UK G7 Presidency, June 2021, **G7 Industrial Decarbonisation Agenda (IDA) (PDF)**

[64] Brazilian Government, n.d., **New Growth Acceleration Program (PDF)**

[65] E3G, January 2024, **Country profiles – 2023 Steel Policy Scorecard**

committed to addressing industrial decarbonisation and in 2022 to providing clear policy direction on the industrial net zero transition: "By no later than the mid-2020s, develop or update national industry sector roadmaps and plans in collaboration with industry stakeholders, providing a robust signal on the direction and pace of travel by developing clear targets and milestones."[66]

Little progress has been made on this commitment to date. In 2024 the G7, under the Italian Presidency, should work towards collectively adopting steel decarbonisation targets, with agreement on language that acknowledges the role of targets and sectoral roadmaps in accelerating the global steel transition.

At the more ambitious end, the G7 should acknowledge that steel decarbonisation requires both green steel capacity additions **and** the phase-out of coal-based steel capacity. According to the IEA's updated net zero roadmap, all new heavy industry capacity must be near-zero emissions capable by 2030, if we are going to keep global warming below 1.5 °C. In practice, as our analysis highlights, none of the G7 countries currently have any new coal-based steel capacity additions planned.[67] However, there remains a risk in most G7 countries of relining decisions extending the lifetime of existing capacity.

The G7 should make the implicit trend of not building new coal-based steel capacity an explicit policy commitment and encourage all other OECD countries to do likewise. To take this one step further, the G7 countries should also commit to no relinings of existing coal-based steel capacity that extend the lifetime of this capacity beyond 2030.

2. Move from ambition to implementation on building the market for green steel

As our analysis highlights, building demand for green steel via standard-setting and public procurement remains one of the weakest categories across all countries assessed. That is despite the many international initiatives and fora focused on this goal. Shifting from stated ambition, consultations and pledges to implementing domestic legislation to start driving demand should be a target for collective regulatory ambition among key steel producers in the next couple of years.

[66] G7 Germany, 2022, **Conclusions regarding the Industrial Decarbonisation Agenda – Annex to the Climate, Energy and Environment Ministers' Communiqué (PDF)**

[67] Global Energy Monitor, 2023, **2023 Pedal to the metal (PDF)**

Another area for collective ambition needs to be focused on interoperability of standards for “low-carbon”, “near-zero” and “net zero” steel, as well as harmonised procedures and methodologies for reporting on the emissions intensity of steel production. This will be key to improve data collection and transparency, ensuring a level playing field and, ultimately, facilitating the greening of steel supply chains globally.

Progress on building green steel markets will be needed at different levels:

> **Domestic ambition:** Our analysis highlights Canada, Germany and the UK as likely leaders in this space. It will be key to see these countries commit to adopting mandatory low and near-zero emissions steel standards, and to implementing them in procurement and broader regulatory policies.

> **G7:** Market creation was another collective objective set under the G7 Industrial Decarbonisation Agenda (IDA) in 2022, as was policy clarity. The IEA published a report on emissions accounting methodologies in 2023 under the Japanese G7 Presidency, which was endorsed by the G7 in the Leaders’ Communiqué.[68] This is a strong foundation on which to build. In 2024, the G7 should set out a roadmap with a clear timeline for aligning emissions accounting methodologies and implementing low and near-zero emission steel benchmarks in policies. Moreover, G7 countries should explicitly commit to adopting net zero compatible mandatory standards from the mid-2020s, as recommended in the IEA’s 2023 Breakthrough Report.

> **EU–US GSA negotiations:** The GSA negotiations have been extended into early 2025, after negotiators failed to meet the initial deadline of October 2023. Agreeing an approach to emissions accounting for steel and aluminium is one of the elements negotiators have in their sights. This should be followed by thresholds for defining low-emission steel and aluminium, with a view to linking these to trade and procurement measures to green supply chains globally.

> **Climate Club:** The Climate Club launched at COP28 also plans to work with its 36 members on low-carbon definitions and accounting methodologies. As a forum that brings together all G7 countries with a broader set of countries, it will play a key role in allowing for greater regulatory alignment.

[68] IEA, 2023, **The Breakthrough Agenda Report (PDF)**

As this list shows, there is no shortage of possible venues to make progress on building lead markets for green steel. Moreover, it is not exhaustive – the IDDI, the WTO and a plethora of private sector initiatives are also important. Convergence and greater coordination among these different venues will be critical over the next few years to avoid duplicative efforts.

3. Scale up investment in clean energy infrastructure, improve planning and lead times for deployment

A growing body of recent research has shown that the most promising and mature pathways for decarbonising steel production will require a great increase in renewable electricity generation.[69] Clean energy infrastructure investment is one of the Scorecard categories in which G7 countries consistently receive higher scores (Figure 3). However, it is also an area that has been consistently underplayed in international initiatives on industrial decarbonisation. Initiatives to date have tended to focus on sectoral roadmaps, standard-setting, procurement and innovation, not investment. Although domestic ambition is going to be key here, collective regulatory ambition among key steel producers on accelerating electrification of industry and on infrastructure investment will also play an important role – as will planning and deployment for this push.

G7: In 2022, G7 leaders committed to achieving a predominantly decarbonised power sector by 2035.[70] This commitment is already a major boost to these countries' steel decarbonisation efforts.

To make real progress, G7 countries should explicitly embed industry pathways in their power sector goals. They should agree language recognising the opportunities and challenges presented by industrial electrification and set out a roadmap to develop a more robust understanding of infrastructure needs to manage these.

Another key area for collaboration would be on knowledge sharing and lessons learned among governments (potentially located at the IEA or IRENA), to develop

[69] In the IEA NZE Scenario, around 250 TWh additional low carbon electricity generation is needed by 2030 just to supply H2-DRI plants, integrated on the grid and contracted, for example, through power purchase agreements [elsewhere PPAs]. In total, direct and indirect low carbon electrification will need to accelerate by more than 5 percentage points between now and 2030 through increased scrap-based production, electrolytic hydrogen and electric arc furnaces. This compares with an increase of just 1 percentage point over the past decade. See IEA, **Steel** (webpage, accessed December 2023)

[70] Bundesministerium für Wirtschaft und Klimaschutz (German Ministery for Economy and Protecting the Climate), 2022, **G7 Konferenz: Klima Energie Umweltminister 05 2022: Abschlusskommunique (PDF)**

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a shared understanding of how to best address common barriers to industrial electrification and scale up clean energy infrastructure investment. For example, while there are different degrees of investment in clean energy infrastructure across this set of countries, one issue that seems to crop up across geographies is the issue of planning and consenting new clean energy infrastructure.

G7 countries should also come forward with near-term investment strategies to facilitate funding new, clean energy infrastructure for steel decarbonisation, especially where there are plans to transition blast furnace sites to EAF production, which require new, high-capacity grid connections.

4. Pursue partnerships to kick-start green iron trade and commit to providing finance, engaging in technology cooperation and opening up procurement and offtake arrangements internationally

Several recent studies have indicated that the shift to near-zero emission steelmaking has the potential to reorganise global supply chains, splitting iron- and steelmaking processes depending on resource availability.[71] Some countries have abundant, low-cost renewable electricity and access to iron ore. Others are looking to decarbonise domestic steel production but face high renewables costs and resource constraints. Developing partnerships between them could be mutually beneficial and also accelerate global steel decarbonisation.

For developing countries supplying green iron, partnerships could scale up finance, technology transfer and access to green steel demand centres internationally. For developed countries looking to secure green iron supplies internationally, partnerships could relieve pressure on domestic renewable electricity supply, reducing prices and overall decarbonisation costs.[72]

Steel and mining companies are already proactively engaging in partnerships and deal-making to capitalise on this shift. H2 Green Steel, for example, has entered

[71] Woodmac, October 2023, **Metalmorphosis: how decarbonisation is transforming the iron and steel industry**; Agora Industry, June 2023, **15 insights on the global steel transformation**; Trollip, H., McCall, B. and Bataille, C., January 2022, **How green primary iron production in South Africa could help global decarbonization**, *Climate Policy*, 22, pp. 236–247

[72] Agora Industry, June 2023, **15 insights on the global steel transformation**

into early agreements with Vale[73] and Anglo American in Brazil and South Africa respectively.[74]

It is unlikely, however, that this dynamic can be scaled successfully by private sector initiatives alone. The size of the investment required for renewable energy and hydrogen infrastructure buildout in potential green iron ore exporting countries is enormous; it will likely necessitate public–private and international partnerships. Proactive government policies and international collaboration on green iron trade and investment will be essential if this trend is going to deliver on the promise to accelerate steel decarbonisation.

Scaled up international cooperation on this front should focus on two elements:

> Governments should work openly and collaboratively to better understand the opportunities and risks from a potential reorganisation of iron and steel supply chains.

> Governments should ensure that international partnerships become a tool for supporting developing country decarbonisation.

The latter point is particularly important. As noted in the context section, most carbon-intensive capacity additions in the steel sector are set to happen in industrial growth markets in developing countries. Some of these countries are also prime locations for green iron production: Brazil, Gambia, Guinea, Namibia, South Africa and Venezuela. Green iron and steel partnerships will need to deliver:

> scaled-up transition finance to bridge capital and infrastructure investment costs

> enhanced technology cooperation and transfer

> offtake agreements to give green iron producers in these countries' confidence in demand

> access to procurement schemes for green iron and steel in importing countries.

[73] H2 Green Steel, September 2023, **Vale and H2 Green Steel sign agreement to study the development of green industrial hubs in Brazil and North America**

[74] Anglo American, April 2023, **Anglo American partners with H2 Green Steel to advance low carbon steelmaking**

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International agreement on principles to guide partnerships could help ensure that such trade flows benefit both parties and accelerate global steel decarbonisation.

G20: Brazil hosting both the G20 and Clean Energy Ministerial in 2024 offers an unprecedented opportunity for a key future green iron and steel exporter to put international collaboration on green industrial supply chains on the agenda. The Brazilian government should initiate a workstream to define principles for best practice in initiating bilateral and plurilateral partnerships; it should also commission research to collectively build understanding on potential supply chain shifts.

G7: G7 countries should recognise the importance of partnerships to enable the steel transition internationally. They need to commit to providing finance, engaging in technology cooperation and opening up procurement and offtake arrangements internationally to kick-start the steel sector transition in industrial growth markets in developing countries.

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ANNEX A: ABBREVIATIONS AND EXPLAINERS

Abbreviations

BF	Blast furnace
BOF	Basic oxygen furnace
CAPEX	Capital expenditure
CBAM	Carbon Border Adjustment Mechanism
CC(U)S	Carbon capture (, utilisation) and storage
CCfDs	Carbon contracts for difference
CO_2	Carbon dioxide
DRI	Direct reduced iron
EAF	Electric arc furnace
ETS	Emissions trading system
EU	European Union
GCAM	Global Change Analysis Model
GSA	Global Steel Arrangement
GDP	Gross domestic product
GHG	Greenhouse gas
H_2	Hydrogen
IAM	Integrated assessment model
IEA	International Energy Agency
IDDI	Clean Energy Ministerial Industrial Deep Decarbonization Initiative
OPEX	Operational expenditure
PPA	Power Purchase Agreement
RES	Renewable energy sources
RES-E	Electricity generated from RES

Explainers

Blast furnace (BF)

A type of metallurgical furnace used to produce industrial metals, generally pig iron, an intermediate product in conventional, coal-based steelmaking.[75] Pig iron is produced by reducing carbon (coke from coking coal) in the presence of a fluxing agent like limestone.[76] Alternating layers of coke, iron ore and fluxes/additives are input into the shaft of the furnace and then burned (up to 1000 °C).

BF-BOF

A method of steelmaking, where a blast furnace is used to smelt iron from iron ore. This results in the creation of pig iron, which is then transferred to a basic oxygen furnace for the creation of steel. Producing one tonne of steel through the BF-BOF steelmaking route emits around 2.2 tonnes of CO_2.[77]

Options for decarbonising the BF-BOF steelmaking route are difficult and limited because of the use of metallurgical coal as a reducing agent in the ironmaking process. As coal is heated to melt the iron ore, carbon monoxide is produced that reduces oxygen in the iron ore but releases CO_2 as a byproduct, called process emissions. Together, clean electricity and hydrogen injection can abate a maximum of 28.8% of CO_2 emissions in BF-BOF steelmaking, based on current estimates.[78]

Clean/low-emission/low-carbon hydrogen

The IEA[79] defines clean hydrogen as derived from renewables, nuclear or using fossil fuels with CCS. It highlights the importance of developing certification schemes and standards for low-emission H_2, and working towards mutual recognition. However, there is no globally established way to differentiate low-carbon hydrogen from fossil-based hydrogen. There are multiple ongoing efforts on hydrogen certification that could breach this gap.[80] ECOS calls for a low-carbon emissions intensity of 2.26 kg CO_2eq / kg H_2 or an 80% reduction

[75] World Steel Association, **Glossary** (webpage, accessed January 2024)

[76] Global Energy Monitor Wiki, **Blast furnace** (webpage, accessed December 2023)

[77] IEA, October 2020, **Iron and steel technology roadmap**

[78] Fan, Zhiyuan; Friedmann, S. Julio, April 2021, **Low-carbon production of iron and steel: Technology options, economic assessment, and policy**, *Joule,* 5 (4): 829–862. Doi:10.1016/j.joule.2021.02.018. ISSN 2542-4351.

[79] IEA, **Hydrogen** (webpage, accessed December 2023)

[80] IRENA, **Hydrogen** (webpage, accessed December 2023); Weltenergierat Deutschland, January 2022, **Global harmonisation of hydrogen certification**

compared to fossil fuel-based production.[81] There is a global movement away from hydrogen differentiation based on production method (or color-based typology) towards emissions-based standardisation.

DRI

Direct reduced iron (DRI), also called sponge iron, is a form of ironmaking that doesn't require melting and uses gas as a reducing agent. The gas can be natural gas or gasified coal (syngas), which can be accompanied by CCUS. Alternatively, the gas can be hydrogen created by renewable energy, making the DRI production process easier to decarbonise than BF ironmaking.[82] Depending on the production setup, the DRI can then be fed either into a blast furnace as hot briquetted iron (HBI), in which case the blast furnace runs much more efficiently and uses less coke, or into an electric arc furnace (EAF).[83]

EAF

Electric arc furnace is a form of steelmaking that uses electricity. It uses steel scrap, direct reduced iron (DRI), or a combination of these materials as the primary feedstock. The scrap steel and electric arc furnace (scrap-EAF) process has the potential to be zero emissions where powered by renewables. The direct reduced iron and electric arc furnace (DRI-EAF) process uses syngas, which is made from natural gas or gasified coal, and also electricity to power the electric arc furnace.[84]

H_2-DRI

Hydrogen-based direct reduction of iron.[85] The Scorecard tried to track any announcements on DRI plants moving closer to running fully on clean hydrogen. It does not label plants as H_2-DRI or H_2-ready unless clear plans for the use of clean hydrogen were present. This is because the label "H_2-DRI" is not standardised. Data on "H_2-readiness" of planned DRI plants is limited: we have used the GEM database, and tracked public announcements through desk research and partner interviews to determine the stage of H_2-DRI projects. There are no clear assessments available yet for looking into plants that are locked into more emissions intensive processes like coal-based rotary kilns. A starting point

[81] Ecostandard, March 2023, **Ensuring the right definition of low-carbon hydrogen**

[82] Global Energy Monitor, 2023, **2023 Pedal to the metal (PDF)**, page 13

[83] Malvern Panalytical, August 2023, **DRI: the 'direct' route to greener steel**

[84] Institute for Energy Economics and Financial Analysis, n.d., **Fact sheet: The facts about steelmaking – Steelmakers seeking green steel (PDF)**

[85] World Steel Association, June 2022, **Fact sheet: Hydrogen (H2)-based ironmaking (PDF)**

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can be MIDREX's assessment that up to one-third of the natural gas fed to a MIDREX plant can be replaced by hydrogen.[86]

Green steel/near-zero emission steel

Steel that is produced with near-zero emissions.[87] We apply the near-zero emission steel definition proposed by the IEA.[88] In this definition the emission intensity thresholds are formulated as a function of the proportion of scrap use in the metallic inputs, and 30% scrap use is used as the cut-off to distinguish between primary production (<30% scrap) and secondary production (>30% scrap). Scrap use in production inherently reduces emissions intensity, and the more scrap that is used the lower the emission threshold for green steel.

Primary steelmaking

Where iron is smelted into steel, lowering the carbon content of molten iron and converting it to steel. It generally includes a proportion of steel scrap, though no more than 30% as per the IEA near-zero emission steel definition.

Secondary steelmaking

Where steel scrap is melted and mixed with carbon to make new steel. It generally includes a proportion of pig iron, but must have a minimum of 30% steel scrap input as per the IEA near-zero emission steel definition.

[86] MIDREX, September 2017, **MIDREX H2: Ultimate low CO_2 ironmaking and its place in the new hydrogen economy**

[87] With near-zero there is a recognition that there are residual emissions that are expensive, impractical or technically difficult to eliminate on a gross basis.

[88] IEA, May 2022, **Achieving new zero heavy industry sectors in G7 members (PDF)**

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ANNEX B: METHODOLOGY

This Annex outlines the details of the scoring applied in the 2023 Steel Policy Scorecard, and highlights methodological changes made since the first analysis in 2022.[89]

The evolution of the Scorecard methodology

Scoring

This is the second iteration of the Steel Policy Scorecard, following the initial version published in 2022. Based on discussions with partners we have amended the original methodology. Compared to the seven policy levers developed in 2022, only the lever on implementing carbon pricing remains exactly the same.

The policy levers on public funding and providing hydrogen and CCS infrastructure for electrified steelmaking have undergone substantial changes, including developing more granular indicators. This means that for these two policy levers the comparability with the 2022 Scorecard is limited. Further details on changes are presented below in lever-specific sections.

Minor adjustments were made to the following four levers:

> Providing policy direction and clarity.

> Adopting a green steel definition with an emissions intensity threshold and a measurement standard.

> Giving policy direction on material efficiency and circularity.

> Creating lead markets through green steel public procurement.

Lastly, we have developed an entirely new policy lever on providing clean power for steel production. This was based on discussions with stakeholders highlighting the role of power system decarbonisation, considering growing demand for clean electricity due to increasing electrification of steel production.

[89] E3G, September 2022, **G7 Steel Policy Scorecard – shifting the pathway for steel**

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Country choice

The 2024 edition of the Scorecard includes all previously examined G7[90] countries. We also decided to add four G20 countries in our analysis:

> **China** and **India**, as the world's largest[91] and most carbon-intensive[92] steel producers.

> **Brazil** – due to its upcoming G20 Presidency, and in view of its great potential to become a green steel powerhouse.

> **South Korea** as the largest consumer of steel per capita in the world[93] (and sixth largest steel producer).[94]

This is part of an effort to diversify the countries considered in the Scorecard and increase understanding of non-G7 contexts for designing better policies and improving international cooperation.

China and South Korea, given their economic development, have been explicitly scored and presented alongside G7 countries in the Scorecard. It was agreed in discussion with partners that a comparison with G7 countries was justifiable. South Korea is now considered a high-income country, while China – officially classified as a higher-middle-income country[95] – has one of the highest saving rates in the world.[96] Recognising China as a unique case that defies easy classification, we decided to include it in the official scoring, as decarbonising Chinese steel capacity would constitute most of the effort needed to decarbonise global steel production.
India and Brazil, meanwhile, were not explicitly scored in view of the different starting point they face vis-à-vis the G7 countries. India and Brazil are still

[90] Even though the EU is a standalone member of the G7, we decided not to provide a separate score for the EU for the sake of simplicity. Instead, we incorporated EU policies into the scores for each EU member state that is included in this Scorecard. This is because, according to principles of EU law, EU policies are either directly applicable in EU member states or have to be implemented into national legal systems.

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

[92] EAF: Global Efficiency Intelligence, April 2022, **Part 2: Cleanest and Dirtiest Countries for Secondary (EAF) Steel Production**, Primary: Global Efficiency Intelligence, April 2022, **Part 1: Cleanest and Dirtiest Countries for Primary Steel Production**

[93] World Steel Association, 2022, **World Steel in Figures 2022**

[94] The third largest producer, Russia, was not considered due to the current complex geopolitical context, but we recognise the need for, and strongly encourage, research in this direction. Further G20 countries were not included due to capacity reasons.

[95] World Bank, 2023, **New World Bank country classifications by income level: 2022-2023:** World Bank Open Data, **GNI per capita, Atlas method (current US$)** (retrieved: November 2023)

[96] ECB Economic Bulletin, Issue 7, 2017, **China's economic growth and rebalancing and the implications for the global and euro area economies (PDF)**

classified as middle-income countries and have the lowest GDP per capita among countries analysed. A side-by-side comparison with G7 countries was not deemed appropriate.

However, these countries are of strategic importance for global steel decarbonisation efforts. They were therefore still included in the main briefing analysis and the descriptive country profiles.[97]

While Indian steel is the most emissions-intensive in the world (in terms of t CO_2/t crude steel),[98] China's is almost just as emissions-intensive. Considering China's percentage of global steel production, Chinese steel accounts for ca. 60% of global emissions from the steel industry. For this reason, we decided to explicitly score China but not India even though their GDP and GNI levels differ very little.

Providing policy direction and clarity

Cooperation on global net zero steel transformation, with ambitious emission reduction targets, will give the necessary push to governments and the private sector. It makes a timely and well-planned transition, where local economies and jobs are taken into account, more likely.

A steel decarbonisation strategy, with ambitious emissions reduction targets, provides a clear direction and is awarded the highest points in our scoring. However, a steel decarbonisation focus may also be embedded in broader policies, such as a national climate policy or industrial decarbonisation policy. This can also provide direction and ambition and is recognised and rewarded in our scoring.

General emissions reduction targets for industry count, but a higher score is given when emissions reduction targets are set specifically for the steel sector.

We define what count as ambitious emissions reduction targets using the pathway and intermediate targets outlined in the 1.5 °C Steel report by E3G and PNNL.[99] In it, a cost-effective 1.5 °C pathway for the steel sector requires a 50%

[97] E3G, January 2024, **Country profiles – 2023 Steel Policy Scorecard**

[98] Global Efficiency Intelligence, April 2022, **Part 2: Cleanest and dirtiest countries for secondary (EAF) steel production** and **Part 1: Cleanest and dirtiest countries for primary steel production**

[99] E3G & PNNL, October 2021, **1.5C steel: Decarbonising the steel sector in Paris-compatible pathways**

reduction by 2030 and 95% by 2050 (both relative to 2020).[100] In the coming years we also hope to see the setting of phase-out timelines for carbon-intensive steel production, such as commitments to no new unabated coal-based steel plants after 2025. These are currently not formally discussed by any G7 government, but we hope such ambition will start to emerge in the future.

Comparing and evaluating this lever among G7 countries means dealing with a range of different policy contexts. Industrial and steel decarbonisation targets are found in everything from steel sector roadmaps to climate action plans to industrial decarbonisation strategies. The ownership and enforceability of these different documents is generally not clear. Potential future scorecards could strengthen the analysis of targets by looking at their enforceability.

Scoring

Policy focus and priority (Countries receive one score, for the highest indicator that they qualify for. For example, a country with both a climate policy and a steel decarbonisation policy only receives points for the latter.)	Points
Has a climate policy with focus on industrial decarbonisation	0.25
Has a climate policy with focus on industrial decarbonisation, including steel	0.50
Has a steel strategy with some focus on decarbonisation	0.50
Has an industrial decarbonisation strategy	0.75
Has an industrial decarbonisation strategy with a focus on steel	1.00
Has a steel decarbonisation strategy	1.50

[100] This is higher than the IEA net zero pathway for G7 countries, which is: –7% by 2030, –70% by 2040 and –95% by 2050.

Targets (Countries receive one score, for the highest indicator that they qualify for.)	Points
Regionally (transnationally) enforced target[101]	0.25
Outlines an emissions reduction pathway for steel[102]	0.25
Is exploring a target for steel	0.25
Has an unambitious target for industry	0.75
Has an unambitious target for steel	1.00
Has an ambitious target for industry	1.25
Has an ambitious target for steel	1.50

Public funding for steel decarbonisation

It is also important to evaluate the extent to which governments are committing to funding parts of the steel decarbonisation process, as costs for near-zero emission steelmaking are projected to be between 30 and 60% higher than conventional coal-based steelmaking without CO_2 costs.[103] To do so, we have looked at government announcements on subsidies in the form of grants or tax incentives. In practice, this meant looking primarily at grants, since this is the dominant form of sector-specific support for industry in most countries.[104]

Financial expenditures (loans and guarantees) were omitted for capacity reasons since, on average, they play a comparatively smaller role in the sectoral industrial policies of major G7 countries.[105] However, this is not the case for all countries represented in the Scorecard and must be considered a limitation of this methodology.[106] Excluding loans and guarantees does increase comparability with the 2022 Scorecard, which also considered only grant-based funding.

[101] New indicator, introduced in 2023.

[102] Change to indicator since 2022 version: The indicator "Showing an emission reduction pathway for industry" was deemed inadequate for scoring and taken out. Accordingly, this indicator, "Showing an emissions reduction pathway for steel" was downgraded from 0.50 to 0.25 points.

[103] IEA, January 2023, **Energy technology perspectives 2023**

[104] OECD, June 2023, **Quantifying industrial strategies across nine OECD countries (QuiS)**

[105] Ibid.

[106] According to the QuiS database, financial instruments, such as loans and guarantees, play a big role in sectoral industrial support in Italy and Canada. This is based on an assessment of support across all

Compared to the 2022 version, the 2023 Scorecard attempts to distinguish between different types of funding related to steel decarbonisation: whether going towards research and development, or capital expenditure for implementing site-specific projects, as well as support towards operational expenditure. In doing so, we focused on support for development or deployment of technologies with the highest abatement potential.[107]

When assessing operational cost support, conditionality upon meaningful decarbonisation efforts was also considered. Steel industries across countries examined already receive significant support for their OPEX costs, including electricity or carbon price support.[108] Only targeted OPEX support instruments for plants showing ambition to decarbonise, such as a CCfD,[109] were considered. Also considered desirable is a CfD scheme for hydrogen production sufficiently targeted at priority end-use sectors.[110]

The lines here are, however, often not easy to draw, and at times funding could not be easily categorised as falling neatly into one or the other category.

We also recognise that funding announcements are not always ultimately binding, and that monetary pledges may falter with changes in government or pending crises. Tracking the extent to which announcements convert into actual policies and direct investments is an intricate job that requires substantial resources.

In the specific case of EU countries, regional funding from the European Union was often available and included in the scoring.

industrial sectors. A study of this granularity and scale focussing on the steel sector specifically was not identified. The QuiS database is based on an analysis of nine OECD countries: Canada, Denmark, France, Ireland, Israel, Italy, the Netherlands, Sweden and the United Kingdom.

[107] Fan, Z. & Friedmann, S. J., April 2021, **Low-carbon production of iron and steel: Technology options, economic assessment, and policy**, *Joule*, vol. 5, pp. 829–862. Doi: 10.1016/j.joule.2021.02.018

[108] Fraunhofer & Ecofys, July 2015, **Electricity costs of energy intensive industries – An international comparison (PDF)**

[109] Clean Air Task Force, August 2022, **Why Carbon Contracts for Difference could be the policy measure Europe needs to decarbonise industry**

[110] IRENA, January 2022, **Geopolitics of the energy transformation: The hydrogen factor**

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Scoring

R&D funding (Countries receive one score, for the highest indicator that they qualify for.) – volume as a percentage of GDP[111]	Points
Has funding that could be used for R&D of net zero steel production methods	0.25
Has funding explicitly earmarked for R&D of net zero steel production	0.50
Has funding explicitly earmarked for R&D of net zero steel production methods which constitutes > 0.01% GDP	0.75
Has funding explicitly earmarked for R&D of net zero steel production technologies which constitutes > 0.05% GDP	1.00
CAPEX funding (Countries receive one score, for the highest indicator that they qualify for.) *– proportion of country´s BF-BOF capacity supported*[112]	**Points**
Has funding that could be used for capital investment support for steel plants trying to decarbonise	0.25
Has funding explicitly earmarked to support decarbonisation of specific plants awarded to at least one-third of the country's BF-BOF plants	0.50
Has funding explicitly earmarked to support decarbonisation of specific plants awarded to at least one-third of the country's BF-BOF plants, as well as significant additional national funding for capital investment support for industry decarbonisation	0.75
Has significant funding explicitly earmarked to support decarbonisation of specific plants decarbonisation awarded to the majority of the country's BF-BOF plants	1.00

[111] The World Bank, **GDP (current US$)** (retrieved November 2023)

[112] Global Energy Monitor, updated March 2023, **Global Steel Plant Tracker**. Where no direct grants were earmarked to specific sites, residual scoring was awarded based on the assumption that transitioning a standard-size primary steelmaking facility (ca. 3 Mtpa) to H_2-DRI would cost ca. $20bn: Agora Industry, Future Camp, Wuppertal Institut, 2022, **Carbon Contracts for the transformation of industry: Calculator for the assessment of transformation costs for low-CO2 primary steel production Model version 1.1 (Excel)**

OPEX funding	Points
Has funding dedicated to supporting operational costs of companies transitioning to net zero steel production[113]	1.00

Implementing carbon pricing

There is plenty of scope for getting lost in the details of carbon pricing. For clarity and simplicity we have chosen to look at whether an emission trading system (ETS) or carbon tax applicable to the steel sector exists. If so, its significance is assessed in terms of the carbon price and any intention to phase out free allowances or other types of (partial) exemptions.

We are aware that this might not capture the full picture, even if not noted explicitly in the scoring. For example, there is a big difference between a benchmark for free allowances that is based on the average emissions of the 10% best performing installations, such as in the EU ETS, versus one set at a historical average emission intensity of all steel installations, as in Canada.

Since some countries analysed have a federal structure (Canada, US, Germany) or a complex unitary structure with de facto federal elements (China), the mandate for carbon pricing policy is often split between the national government and lower levels of governance. This is partially reflected in the scoring to the extent possible but the depth of analysis is limited for capacity reasons.

Scoring

Countries can only receive a score on one set of indicators; the highest overall score possible is therefore 3 points.

[113] Conditional upon detailed near-zero transition plans.

Low ambition carbon pricing (Countries may score on one of these indicators.)	Points
ETS with free allowances	1.00
Insignificant carbon tax	1.00
Medium ambition carbon pricing (Countries may score on one of these indicators)	**Points**
National ETS with free allowances and a set phase-out date	2.00
Significant carbon tax with some steel exemptions	2.00
High ambition carbon pricing (Countries may score on one of these indicators.)	**Points**
ETS up and running and no free allowances	3.00
Significant carbon tax without exemptions	3.00

Policy direction on material efficiency and circularity

The importance of steel material efficiency and circularity is reflected in various modelling work, including the IEA Net Zero Scenarios[114] and the 1.5°C Steel report by E3G and PNNL.[115] This is alongside measures such as technology and fuel shifts. Measures that reduce demand, including material efficiency and circular business models, are therefore an integral part of a 1.5°C pathway for the steel sector.

Policy options and regulations for steel circularity are available across a wide variety of spaces. They range from the handling of steel scrap through waste and end-of-life vehicle regulations to building codes that ensure efficient use of steel in construction, to measures that drive circular business models such as car sharing over individual ownership.

It is beyond the scope of this Scorecard to delve into these very different policy spaces. Our focus is therefore on the direction set through circular economy policy. We look at whether circular economy plans, strategies or policies are in place, and whether they have any explicit focus on steel. The most explicit steel

[114] IEA, 2023, **Net Zero Roadmap: A Global Pathway to Keep the 1.5°C Goal in Reach – 2023 Update**

[115] E3G & PNNL, October 2021, **1.5C steel: Decarbonising the steel sector in Paris-compatible pathways**

focus in evidence to date, in the context of a circular economy, is on the increased use of steel scrap. This level of detail is awarded extra points.

We also recognise international leadership on circular economy, through setting up international initiatives, or through membership of such initiatives.

Clear national policy direction (Countries may only score on one of the indicators below, which will be the highest they qualify for.)	Points
Dedicated circular economy plan/strategy/roadmap	0.50
Dedicated circular economy plan/strategy/roadmap with a steel focus	1.00
Dedicated circular economy plan/strategy/roadmap with a steel focus, including steel scrap[116]	1.25
Dedicated steel reuse and scrap recycling targets/policy framework	2.00
Clear regional (transnational) policy direction	**Points**
Dedicated regional circular economy plan/strategy/roadmap	0.25
International circularity initiatives (Countries may score on both the indicators below.)	**Points**
Partnership in circularity initiatives	0.25
Initiation of circularity initiatives[117]	0.50

[116] Added in 2023, to recognise/award more detailed and explicit steel circularity focus.

[117] Added in 2023, to recognise international leadership on circularity.

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Creating lead markets through green steel public procurement

Scaling green steel demand is about making sure that there are buyers committed to purchasing green steel and paying the initial premium that comes with near-zero-emissions production. This provides reassurance for producers investing in new technology and clean energy sources that will likely increase operational costs.[118] Governments are major buyers of steel and can play a pivoting role in building a market for green steel through public procurement.

The end goal of this policy lever is governments setting mandatory green public procurement targets or requirements for steel,[119] together with the signing of pre-purchase agreements with producers.

We recognise a declared intention to do so as an interim step, as well as membership of, and commitments made under, initiatives that are working towards this end. The Industrial Deep Decarbonisation Initiative (IDDI) is currently the only actor working towards such government commitments.

We also recognise that there are already broader efforts towards lowering the environmental impacts of purchases made through public procurement, while using this purchasing power as a driver for positive change. Public procurement processes already include a large variety of often highly detailed requirements or voluntary measures relating to sustainable or environmentally friendly procurement. These can implicitly or explicitly cover steel, either through public infrastructure projects or building material requirements, or through requirements related to various products (for instance the government's car fleet). We give some credit to such efforts, and differentiate between those that are voluntary or mandatory as well as whether they explicitly cover steel.

[118] Though noting that this depends on geographic location and energy access. Devlin, A., Kossen, J., Goldie-Jones, H., & Yang, A., May 2023, **Global green hydrogen-based steel opportunities surrounding high quality renewable energy and iron ore deposits**, *Nature Communications*, vol. 14, article no 2578.

[119] To distinguish between targets and requirements: A target could be that all steel sourced for public works projects is green steel by 2040, while a requirement could be that 80% of steel products supplied under a public works contract must be green steel.

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Scoring

Green public procurement (GPP) (Countries may only score on one of the indicators below.)	Points
Has a mandatory or voluntary GPP that does not explicitly cover steel	0.25
Has a voluntary GPP that explicitly covers steel	0.25
Has a mandatory GPP that explicitly covers steel	0.50
Membership of global initiatives and related procurement commitments (Countries may only score on one of the indicators below.)	**Points**
Is a member of IDDI	0.25
Has committed to a pledge under the IDDI[120]	0.50
Has committed to the most ambitious pledge under the IDDI[121]	0.75
Intention-setting	**Points**
Has announced its intention to set an explicit green steel PP target or requirement	0.50
Explicit green steel public procurement and pre-purchase agreements (If a country scores on this section, it automatically erases scores from previous sections.)	**Points**
Has a mandatory GPP with ambitious GPP target or requirements for steel	2.50
Pre-purchase agreements (Points awarded independently from scores in the sections above.)	**Points**
Has entered into pre-purchase agreements on steel	0.50

[120] Added in 2023 as the IDDI pledges have become public and several members have moved to consult on or adopt pledges.

[121] Added in as the IDDI pledges have become public and several members have moved to consult on or adopt pledges.

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Adopting a green steel definition with an emissions intensity threshold and a measurement standard

Common green steel definitions provide clarity for both steel producers and buyers (including public procurers); they can also ensure a shared view of the way forward for the global steel sector. National governments play a central role by ensuring that in-country definitions are adopted and enforced, as part of a set of globally aligned definitions.

As outlined by the IEA,[122] a green steel definition requires both an agreed emissions intensity threshold and a measurement standard (including the supply chain boundary and the emission scope).

The end goal of this policy lever is for governments to formally adopt (ambitious) green steel definitions, with related emissions intensity thresholds and measurement standards, and the integration of these into national industrial and climate policy and reporting. Setting up a working group, or another official process to establish green steel definitions, is recognised as a stepping stone, a sign that an in-country process towards adoption is under way.

Membership of international initiatives that formally recognise the importance of green steel definitions, and enable collaboration and movement in this direction, are another sign that a country has recognised the importance of this lever. We are scoring membership of international initiatives, including the Industrial Deep Decarbonisation Initiative (IDDI) whose focus includes common standards, and the First Movers Coalition (FMC), which has already defined what qualifies as near-zero-emission steel. We also recognise being part of a forum or coalition that has formally expressed a movement towards adopting a common definition, such as the G7.

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

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Scoring

Recognising the importance of adopting definitions with emissions intensity thresholds and measurement standards (Countries may score on all indicators.)	Points
Is a member of IDDI	0.25
Is a member of FMC	0.25
Is part of an intergovernmental forum/coalition (e.g. G7, G20, EU) that has formally expressed a movement towards the adoption of a definition	0.25
Movement towards national adoption of a definition	**Points**
Working group, or other official process in place for adopting a green steel definition[123]	1.00
Adopting and implementing a definition (If a country scores on this section, it automatically erases scores from previous sections.)	**Points**
Have a formally adopted definition of green steel, with related emissions intensity thresholds and measurement standards	2.50
Have a formally adopted (ambitious) definition, with related emissions intensity thresholds and measurement standards, which has been integrated into reporting and national industrial and climate policy	3.00

[123] The slight change in the wording compared to 2022, going from "National announcement of a green steel definition adoption being in progress" to "Working group, official process in place for adopting definition with standards." The points awarded stay the same, but the new wording indicates that there is a need to go beyond an announcement.

Enabling hydrogen and CCS for steel

As explained in our main briefing, the current most viable technological routes for decarbonising primary steel production are shifting to direct reduced iron (DRI), ideally using clean hydrogen, as well as retrofitting existing blast furnaces with carbon capture and storage (CCS). Therefore, the scoring methodology evaluates the policies and actual project delivery for both hydrogen and CCS at national level.

A switch to DRI facilities has a higher emissions abatement potential.[124] Hydrogen-related advancements are therefore favoured in our scoring over direct CCS application to blast furnaces, as the latter would enable the continued use of coal-fuelled blast furnaces. Very high carbon capture rates (>73%)[125] are difficult to achieve and applying carbon capture technologies incurs a significant energy efficiency penalty.[126] Carbon capture would largely decarbonise the production process, but not defossilise it – keeping upstream emissions intact.

This iteration of the Steel Policy Scorecard, unlike the previous one, further differentiates between different production methods of hydrogen – green (generated by electrolysis using renewable energy), blue (generated through steam methane reforming with CCS) and grey (generated through unabated steam methane reforming). Pursuing grey hydrogen does not score any points. The scoring also distinguishes between green and blue hydrogen, with governments gaining more points if they place an explicit or implicit emphasis on developing green hydrogen. A country's score is lowered if it has relatively unambitious production or consumption targets, though increased if the opposite is the case, even if the overall focus on either green or blue hydrogen is unclear. The same differentiation applies to developments in deployment.

Scoring based on production methods was chosen over a typology based on emissions intensity due to lack of available data and the fact that efforts to adopt

[124] Harpprecht, C., Naegler, T., Steubind, B., Tukker, A. & Simon, S., December 2022, **Decarbonization scenarios for the iron and steel industry in context of a sectoral carbon budget: Germany as a case study**, *Journal of Cleaner Production*, vol. 380, 134846

[125] Agora Energiewende, 2023, **15 Insights on the Global Steel Transformation**

[126] On top of this, retrofitting with CCS always comes with additional energy requirements to cool, compress and separate the CO_2, thus increasing the amount of energy needed per tonne of output. See Vasudevan, S., Farooq, S., Karimi, I. A., Saeys, M., Quah, M. C. G., & Agrawal, R., May 2016, **Energy penalty estimates for CO_2 capture: Comparison between fuel types and capture-combustion modes**, *Energy*, vol. 103, pp. 709–714, or **Global CCS Institute, March 2021, Technology readiness and costs of CCS**

definitions and standards based on emissions intensity are still ongoing. However, we support work towards adopting those.[127]

Announcements on project deployment often lack clarity in terms of setting a timeline for full decarbonisation of reducing agents. The Scorecard tries to take this into account as far as possible and not simply follow labels on "hydrogen-readiness".[128] It scores developments in physical infrastructure according to clarity of plans for actual deployment of the enabling clean energy infrastructure, based on the ranking outlined above.

Since some countries analysed have a federal structure (Canada, US, Germany) or a complex unitary structure with de facto federal elements (China), the mandate for energy policy is often split between the national government and lower levels of governance. This is partially reflected in the scoring to the extent possible but the depth of analysis is limited for capacity reasons.

Scoring

Hydrogen and/or CCS as a dedicated policy priority (Countries may receive points for one or both indicators for **either** hydrogen with CCS, **or** green hydrogen. If aspects of both are in place, the hydrogen score is counted.) *– scoring 0.5 more in case of a low-emission H_2 target (usually blue and green, assuming 1 Mt H_2 can decarbonise 20 Mt DRI steel[129])* *– scoring 0.5 less in the opposite case*	Points
Where hydrogen is a policy priority through inclusion and focus in national plans or through a dedicated plan, there is nuance provided in terms of CCS application	0.25
CCS for hydrogen for steelmaking and/or CCS on natural gas for DRI is a policy priority through inclusion in national plans or through a dedicated plan	0.25

[127] IRENA, **Hydrogen** (webpage, accessed December 2023); Weltenergierat Deutschland, January 2022, **Global harmonisation of hydrogen certification**

[128] Data on H_2-readiness of planned DRI plants is limited. We have used the Global Energy Monitor Global Steel Plant Tracker database, and tracked public announcements through desk research and partner interviews to determine the stage of H_2-DRI projects.

[129] The theoretical limit for operation on 100% HBI (without H_2 losses) amounts to 51 kg per tonne of steel (translates to ca. 1 Mt H_2/20 Mt DRI steel). This assumption does not factor in potential scrap use. Vogl, V., Åhman, M., Nilsson, L. J., December 2018, **Assessment of hydrogen direct reduction for fossil-free steelmaking**, *Journal of Cleaner Production*, vol. 203, pp. 736–745. Doi: 10.1016/j.jclepro.2018.08.279

OR	
Where hydrogen is a policy priority, there is emphasis on green hydrogen	0.50
Where there is emphasis on green hydrogen, there is emphasis on its use for steel	0.50
Hydrogen and CCS infrastructure for steel already being implemented (Countries may receive points for **either** CCS, **or** hydrogen. If both are in place they are scored on hydrogen.) *– differentiated by number of pilot facilities relative to BF-BOF capacity*[130]	Points
CCS infrastructure for hydrogen production for steel and/or CCS on natural gas for DRI is being rolled out	0.75
OR	
Green hydrogen production facilities for use in steel sector are being rolled out	1.00
Final stage – hydrogen and CCS infrastructure for steel are available at commercial scale (Countries may receive points for **either** CCS **or** hydrogen. If both are in place the hydrogen score is counted.)	Points
CCS infrastructure is available and in use in the production of hydrogen for steel and/or natural gas for DRI	2.50
OR	
Green hydrogen is available and in use in steel production	3.00

[130] Global Energy Monitor, updated March 2023, **Global Steel Plant Tracker**

Clean power for steel

This newly added lever focuses on providing the necessary clean electricity infrastructure to enable steel decarbonisation.[131] It considers all clean electricity, including nuclear and electricity derived from controllable renewable energy sources. This is to take into account specific country contexts in terms of their choice of electricity mix.

Since the intersection of power system decarbonisation and industrial decarbonisation remains a nascent policy area, this policy lever focuses mainly on exploring whether countries make the strategic connection between power system decarbonisation and industrial/steel electrification. This Scorecard's objective is primarily to rate policy ambition; therefore, it does not look in detail into clean energy consumption data in the steel sector, whose availability across countries is limited.

Strategies we have evaluated include industrial or steel decarbonisation strategies where available, and hydrogen strategies. Where none of these were available, any general national decarbonisation strategy was examined (NDC[132], NECP[133]). Dedicated power system decarbonisation strategies were not looked at in the context of the first indicator group for capacity reasons. Examples of best practices that were rewarded in the scoring under this group of indicators include modelling of an electricity demand spike due to industrial electrification and plans to adapt the grid accordingly, policies aimed at ensuring electricity infrastructure roll-out to/at steel sites, and policies facilitating relationships between renewable energy producers and industrial consumers.

The second and third indicator groups have a more general focus. The second considers a country's general ambition in cleaning grid-based electricity through tracking implicit or explicit targets in national strategies, which has an impact on steel decarbonisation.[134] In order to acknowledge countries' different starting

[131] Coal currently meets around 75% of the energy and feedstock demand of the sector, comparable to its share over the past decade. Alongside a higher use of bioenergy, low-carbon electrification needs to accelerate rapidly to substitute coal in the NZE Scenario, rising by more than 5 percentage points between now and 2030 through increased scrap-based production (often referred to as "secondary production"), electrolytic hydrogen and electric arc furnaces. This compares with an increase of just 1 percentage point over the past decade. IEA, **Steel** (webpage, accessed December 2023)

[132] Nationally Determined Contribution (Paris Agreement governance mechanism).

[133] National Energy and Climate Plan (EU governance mechanism).

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

points and energy mixes, we added an indicator based on the percentage change in clean electricity share in total electricity mix (2022–30).

The third indicator group looks at the market and policy environment for private procurement of renewables by all industrial consumers. This general approach was chosen over a more specific one so as to measure policy ambition. We acknowledge that data on MW of renewables capacity procured by steel companies or at steel sites would have potentially given a more accurate picture of actual progress on this front; however, such data is of limited availability and/or reliability.

Since some countries analysed have a federal structure (Canada, US, Germany) or a complex unitary structure with de facto federal elements (China), the mandate for energy policy is often split between the national government and lower levels of governance. This is partially reflected in the scoring to the extent possible but the depth of analysis is limited for capacity reasons.

Scoring

Ensuring clean electricity infrastructure to meet growing electrified steel demand (Countries may only score on one of the indicators below, which will be the highest they qualify for.)	Points
National industrial decarbonisation strategies connect the needs of power system decarbonisation with rising power demand due to industrial electrification	0.50
National industrial decarbonisation strategies connect the needs of power system decarbonisation with rising power demand due to industrial electrification, with specific policies to achieve it	1.00
National industrial decarbonisation strategies connect the needs of power system decarbonisation with rising power demand due to industrial electrification, with specific policies to achieve it and detail on the steel sector	1.50
National industrial decarbonisation strategies connect the needs of power system decarbonisation with rising power demand due to industrial electrification, with specific policies to achieve it, including clear timelines on clean electricity infrastructure roll-out for all steel-producing sites	2.00

Ambition on cleaning up the power grid[135] (Countries may only score on one of the below)	Points
Has a 95–100% 2030 clean power target[136]	0.25
Has a >25% change between 2022 share of clean power generation and 2030 target	0.50
Enabling corporate renewable power procurement – *policy and market environment*[137]	**Points**
Relatively well developed PPA market	0.25
Highly developed PPA market	0.50

Converting scores to Scorecard ratings

For each policy lever a government can receive a maximum of 3 points. The scores are then converted as per the table below.

Score	Colour/Letter	–		+
0 up to and including 1	Red/C	0–0.25	0.5	0.75–1
Greater than 1, up to and including 2	Orange/B	1.25	1.5	1.75–2
Greater than 2, up to and including 3	Green/A	2.25	2.5	2.75–3

The cut-off date for data collection was 1 November 2023. Developments thereafter have not been included.

[135] Using Ember data and own mapping. Ember, **Ember's Global Renewable Targets Data (2030)** and Ember, last updated March 2022, **G20**

[136] With the exception of India, whose target was reported for 2031 in the Ember dataset.

[137] According to EY, June 2023, **PPA attractiveness index 2023**