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TOOLKIT FOR THE PROCUREMENT OF LOWER EMISSION STEEL

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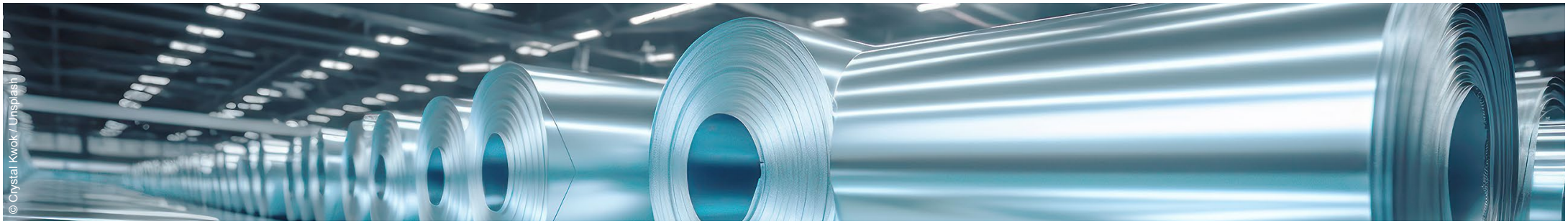
Dear reader,

Reducing emissions from global steel production requires strong commitment from businesses procuring steel. This is why the involvement of WWF corporate partners all over the world is essential. This toolkit provides a strategic framework for driving meaningful change.

Welcome aboard.

WHAT THIS TOOLKIT IS FOR

This toolkit explains why it is important to increase demand for steel with lower GHG (greenhouse gas) emissions and what the short, medium and long-term benefits are for the steel procuring company, for the steel sector and for the planet's climate.



STEEL PRODUCTION HAS MAJOR CLIMATE IMPACTS

Steel production accounts for 7–8 % of global greenhouse gas emissions and 11% of global carbon dioxide emissions, making it one of the largest industrial contributors to climate change. Limiting global warming to less than 1.5°C compared to pre-industrial levels to avoid the worst hazards of climate change will not be possible without significantly reducing emissions from the steel sector.

As steel remains critical to modern infrastructure and the ongoing green transition, global demand is expected to remain high.

Traditional steelmaking processes, particularly the blast furnace-basic oxygen furnace (BF-BOF) route, emit more than 2 tons of CO_2-eq per tonne of crude steel. In order to be compliant with targets set under the Paris Agreement, emissions from steel production need to fall to 0.11 t CO_2-eq per tonne of crude steel by 2050.[3] This shift is a challenging one, both because changing production methods involves large capital investments and infrastructure needs, and because steel production technology is typically used for decades after installation. The good news is that the technology to make this transition exists today and thus steel buyers can play a major role in driving the transition to lower emission steel.

ANNUAL EMISSIONS FROM COAL-BASED STEEL PRODUCTION

STEEL PRODUCTION	PURCHASED ELECTRICITY	COAL MINING
Scope 1	Scope 2	Scope 3
2.6 Gt	1.1 Gt	1 Gt

The largest share of GHG emissions are from the chemical process of coal-based steel making, but the production of power used in steel mills and the mining of coal, which results in methane emissions, are also both significant sources of GHG emissions at over one billion tonnes of carbon dioxide equivalent per year each.

Source: Global Energy Monitor and Global Steel Plant Tracker

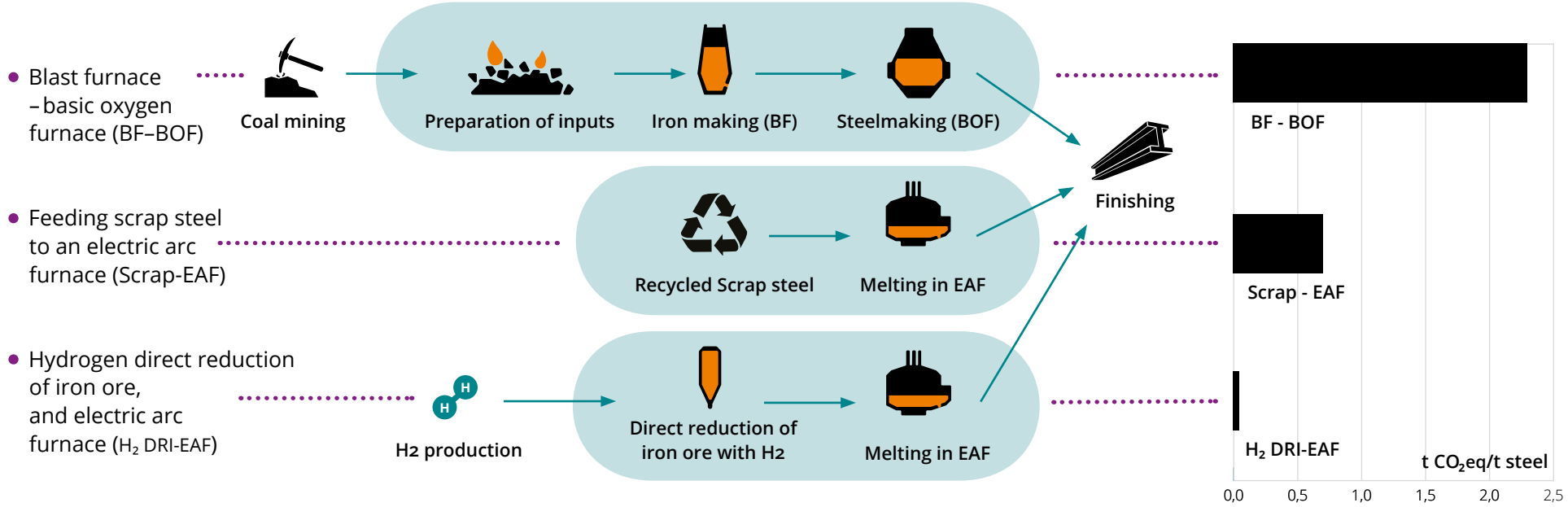
Steel production accounts for approximately 8% of global greenhouse gas emissions, or 11% of global carbon dioxide emissions.

THE TECHNOLOGY TO DECARBONISE STEEL PRODUCTION EXISTS

Today, steel production happens largely through two main methods, the blast furnace–basic oxygen furnace (BF–BOF) route and the scrap steel –electric arc furnace (EAF) route, with a third emerging technology, Hydrogen direct reduction of iron ore (H_2 DRI-EAF), now commercially available:

Producing steel via the green hydrogen DRI route reduces emissions by up to 97% compared to BF-BOF

Source: JRC, 2022



The technology to decarbonise steel production is known and commercially available. Production via the hydrogen-based direct reduced iron -route uses hydrogen instead of coal as a reducing agent, enabling near-zero emissions when powered by renewable energy and green hydrogen*. Leveraging scrap steel to produce new steel products via electric arc furnaces also reduces emissions significantly when powered by renewable electricity.

* The term "green hydrogen" refers to hydrogen produced using renewable energy sources, such as wind, solar, or hydro power, through a process called electrolysis. Electrolysis splits water (H_2O) into hydrogen (H_2) and oxygen (O_2) using electricity. When this electricity comes from renewable sources, the entire process generates zero carbon emissions, making it "green." Unlike gray hydrogen (produced from natural gas, emitting CO_2) or blue hydrogen (produced from natural gas with carbon capture), green hydrogen is completely greenhouse-gas free and independent of fossil fuels.

EMISSIONS-BASED DEFINITIONS OF STEEL

There are several global standards, protocols and initiatives that define lower emission steel in different ways. In addition, there are national policies, taxonomies, standards and green public procurement initiatives which include some kind of emission threshold. Finally, several steel producers have developed their own "green brands", created to separate steel products that carry a lower carbon footprint than the producer's average output. It is important to note the distinction between third-party validated schemes and companies' own brands, as well as the fact that standards, protocols and initiatives may be created for use in differing contexts.

The concept of lower emission steel introduced in this toolkit encompasses both near-zero (compatible with 1.5°C based on the IEA's net zero scenario analyses) and low-emission (substantially lower emissions than current average) steel. To drive the shift towards a 1.5°C compatible steel industry, procurement strategies should focus on favouring near-zero steel.

	Examples (March, 2025)
Standards & Protocols	ResponsibleSteel Standards & Certification, WRI's GHG Protocol for Steel, LESS, World Steel Association's Protocols, ISO 14404 Series– Plant Level CO_2 Emissions Intensity From Iron and Steel Production
International Initiatives	Industrial Deep Decarbonization Initiative (IDDI), Science Based Targets Initiative, First Movers Coalition Initiative, RMI Center for Climate Aligned Finance Initiative – Sustainable Steel Principles, SteelZero Initiative
National & Regional Policies	European Union Green Public Procurement and other EU-Level Standards, United States Federal Buy Clean Initiative, India's Green Steel Taxonomy, China Low Carbon Emission Steel Standard
Corporate's own green brands *Not third-party verified, often utilising mass balance.*	XCarb (Arcelor Mittal), Zeremis Carbon Lite (Tata Steel), Bluemint Steel (ThyssenKrupp), JGreeX (JFE), Kalyani Ferresta (Saarloha), Circle Green (Outokumpu), SSAB Zero steel and SSAB Fossil-free steel (SSAB), NSCarbolex (Nippon Steel), Greentec Steel (Voestalpine), Greenate Carbon Reduced Steel and Greenate certified steel (POSCO).

Table 1. Overview of standards, protocols, initiatives and policies that define lower emission steel.

Source: Hasanbeigi, A.; Sibal, A. 2023. What is Green Steel? - With the addition of the GSCC standard, published after the publication of the source report.

The multitude of certifications and definitions of lower emission steel raise the question of comparability. The Steel Standards Principles initiative, a multilateral initiative launched in 2023 at COP28, aims to develop common emissions accounting methodologies to reduce fragmentation and incompatibility of standards and methodologies, thereby accelerating the transition to near zero.

While there are differences in scope and methodology between the different schemes defining lower-emission steel, several of the international initiatives, amongst them IEA's Definition of Low-Carbon Steel, Responsible Steel, the Industrial Deep Decarbonization Initiative (IDDI), SteelZero and First Movers Coalition Initiative, all define near-zero steel as 0.05–0.4 tCO_2eq/t steel depending on scrap content (0–100 %).

Robust claims concerning lower emission steel should include one or more of the following criteria:

1. Emissions of 0.05-0.4 tCO_2/t steel depending on scrap content.

2. Disclosing the emissions intensity of energy and/or share of renewable energy used in the production of steel.

3. Disclosing the share of scrap used in the production of the steel.

Several international initiatives define near-zero steel as 0.05-0.4 tCO_2-eq/t steel.

Corporate's own green brands

Many steel producers have developed their own green brands to facilitate marketing of their lower-emission steel products. While such brands can offer information about the sustainability of a certain line of production, it is important to note the distinction between third-party validated schemes and companies' own brands. Sending signals to steel producers that sustainable product lines are more attractive than others is beneficial, but WWF suggests not using corporate's own brands as a criteria in procurement processes.

Beware of mass balance calculation methods

A mass-balance approach refers to an accounting method used to track how materials and energy flow through a process, ensuring that what goes in equals what comes out. In the context of steel decarbonisation however, where emission reduction is possible both through near-zero emissions technologies and through marginal emission reductions with conventional technologies detaching emissions from the physical product in this way can lead to a misrepresentation of the emissions associated with a given product.

For example, one could track emissions from two steel production facilities, with one investing in H2-DRI and the other only making incremental energy saving changes to their BF-BOF production line. Using mass balance could result in some batches of steel from the BF-BOF plant being sold as "low-carbon" or "carbon-neutral" when they are in fact low emission only due to the creative accounting method.

We strongly recommend that you as a buyer don't accept mass balance based offers.

CRUCIAL FACTORS IN THE DEFINITION OF LOWER EMISSION STEEL

Scrap content is a crucial factor in the definition of lower emission steel

TERMINOLOGY:

Primary steel = steel produced from virgin iron ore 

Secondary steel = Steel produced from scrap, i.e. recycled steel 

There is debate in steel decarbonisation around the "sliding scale" scrap-share-based accounting methods which is often linked to the ResponsibleSteel standard. By utilizing scrap steel as a feedstock, it is possible to significantly reduce emissions compared to the traditional blast furnace - basic oxygen furnace (BF–BOF) method, which relies on virgin iron ore. Increasing the use of recycled steel contributes to lowering the lifecycle carbon footprint of the products your company manufactures. However, since a significant portion of global scrap steel is already recycled, using secondary steel provides only marginal climate benefits on a global scale since the scrap used to make steel for customer A would otherwise have been used for customer B's products. Due to this, decarbonising steel production from virgin iron ore, or primary steel, remains a high priority. Scrap-share based methodologies have been designed to drive this critical shift, while simultaneously incentivising the decarbonisation of secondary steel production. It is also important to note that steel mills rarely use 100 % scrap or 100 % virgin iron ore, which is another reason why the granular scrap-share methodology is commonly used.

Minimising emissions from the steel sector as a whole includes three major steps: Minimise the use of steel through smarter design and material substitution; maximise the recycling of steel and the quality and reusability of recycled steel products, and mitigate emissions from virgin steel production. Maximising the recycling of steel and incentivising the maintenance of high quality of recycled steel is key both from a climate perspective and from the perspective of minimising the overall footprint of human activity and impact thereof on habitats and biodiversity.

The Steel Climate Standard by Global Steel Climate Council (GSCC) is built on a methodology strongly favouring scrap-based production as primary and secondary steel are measured against the same criteria. The design of the standard is reflecting the interests of the key stakeholders of the GSCC.

CCUS and Direct Reduced Iron with natural gas

Steel suppliers might approach you with concepts based on DRI utilising natural gas as a reduction agent or concepts based on carbon capture, utilisation and storage (CCUS). It is critical to note that both of these technologies reduce emissions only marginally, while locking in production on a technology dependent on fossil fuels.

Natural gas-based DRI is often promoted as a step toward green hydrogen DRI, but this is debated. Industrial-scale hydrogen use requires major investments and infrastructure, which take time to develop. Investing in gas-based DRI today delays the adoption of green hydrogen technologies.

Carbon capture has proven to be an expensive option for steel decarbonisation, and to date, the majority of investments in steel decarbonisation have been made in DRI technology in favour of CCUS. Carbon capture projects in the steel sector make up only 1 % of the total carbon capture capacity currently in operation worldwide, and less than 20 % of this capacity is in use for a BF-BOF plant. Mitigating emissions from BF-BOF steel production with carbon capture is challenging due to the multiple points of emissions at a BF-BOF site.[9]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PRODUCER-FOCUSED STANDARDS AND PROTOCOLS FOR LOWER EMISSION STEEL

The following is a non-exhaustive list of the most important product-focused steel standards and protocols:

1. **ResponsibleSteel:** A global certification framework that assesses environmental, social, and governance criteria across the steel supply chain, including carbon emissions. The ResponsibleSteel standard for steel production establishes four performance levels for steel emissions intensity, providing specific numerical targets for the tonnes of CO_2 emitted per tonne of steel produced adjusted for the proportion of recycled scrap used.

2. **WRI's GHG Protocol for Steel:** The Greenhouse Gas Protocol is the global standard for companies and organisations to measure and manage their GHG emissions. Emissions are divided into Scopes (1–3). The GHG Protocol for Steel sets a framework for GHG intensity (emissions per tonne) calculation methods. The WRI GHG Protocols do not include a numerical target for green steel.

3. **World Steel Association's Protocols:** A set of Principles and Guidelines providing transparency and clarity on the application of chain of custody approaches within the steel industry. The protocols are intended to provide guidance to steel producing companies who choose to use chain of custody approaches to assign GHG emission reductions to specific products, and also to provide input to other organisations developing such approaches.

4. **ISO 14404 Series– Plant Level CO_2 Emissions Intensity From Iron and Steel Production:** specifies calculation methods to evaluate the total annual carbon dioxide emissions, and the emission factor of CO_2 per unit of steel production of the entire steel production process. The standard supports steel producers to establish CO_2 emissions attributable to a site.

Environmental Attribute Certificates

Many companies struggle to directly invest in decarbonising their (steel) value chains. To scale and speed up finance for value chain decarbonisation, both the Greenhouse Gas Protocol and the Science Based Target Initiative are currently looking into the potential use of indirect market mechanisms such as Environmental Attribute Certificates (EAC). EACs could be used for commodities such as steel to count against companies' emission abatement targets. Whether currently available steel certificates are eligible to that end will depend on the target metrics, use cases, guardrails and quality criteria currently being defined by both organisations.

LOWER EMISSION STEEL PROCUREMENT: HOW TO GET STARTED

By prioritizing the procurement of lower emission steel, corporations can mitigate their own Scope 3 emissions substantially and align with climate goals, drive demand for innovative, low-carbon technologies, and demonstrate leadership in the transition to a net-zero economy. This is how to get started:

1. SET CLEAR SUSTAINABILITY GOALS:

The emissions from steel production are a key part of Scope 3 emissions for many companies. To minimise emissions from steel procurement, consider using designs that require less steel and include lower emission steel procurement in your net-zero or carbon reduction targets.

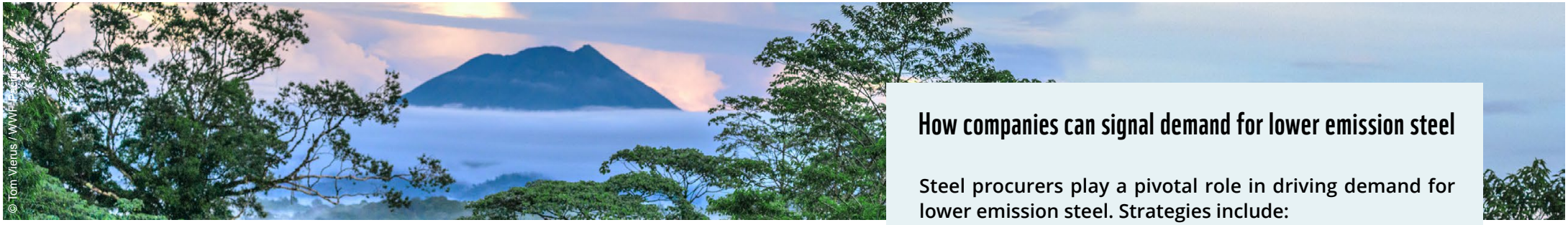
2. LEVERAGE STANDARDS AND CERTIFICATIONS:

Make use of wide-spread standards such as ResponsibleSteel, World Steel Association's Protocols, ISO standards or the Science Based Target Initiative's Steel Sector Guidance when selecting steel producers and steel batches for your value chain. For instance, ResponsibleSteel Level 4 certification means near-zero emission steel.

3. ENGAGE SUPPLIERS:

Signal demand for high quality lower emission steel from your upstream value chain partners. Use your purchasing power to encourage the development and deployment of new lower emission steel production technologies.

ALIGNING WITH SBTi IRON & STEEL GUIDANCE:
Companies for which steel is a key material can use the SBTi iron and steel guidance to set emission reduction targets.



WHY THE TIMING IS NOW

The steel industry stands at a critical juncture. By 2030, 71% of all the blast furnaces in use globally will reach the end of their operational lifespans. This means that if demand for lower emission steel is insufficient, these facilities risk reinvestment in traditional, high-emission technologies, locking in carbon-intensive production for another 15+ years. This is a development that puts not only climate targets, but also jobs, the future of the steel industry and the predictability of steel availability at risk. Acting now to make visible the demand for lower emission steel can catalyse investment and secure the future availability of high-quality, lower emission steel.

STRONG SIGNALS OF DEMAND ARE NEEDED

Corporate procurement of lower emission steel sends a powerful market signal that accelerates the transition to lower emission production technologies. Strong demand incentivises steelmakers to prioritise investments in sustainable technologies and reduces the cost of lower emission steel through economies of scale.

How companies can signal demand for lower emission steel

Steel procurers play a pivotal role in driving demand for lower emission steel. Strategies include:

- **Public Commitments: Announce lower emission steel procurement goals or ambitions aligned with SBTi and other frameworks.**
- **Engage in Demand-Side Initiatives:**
  - **SteelZero (Climate Group): Commits participants to procuring 50 % lower emission steel by 2030 and 100 % by 2050, using ResponsibleSteel or similar certifications.**
  - **First Movers Coalition: Purchase a minimum percentage of near-zero steel by 2030. Near-zero steel is defined as 0.05–0.4 tCO_2-eq/t steel depending on scrap content.**
  - **Rocky Mountain Institute (RMI) Sustainable Steel Buyers Platform (SSBP): is a buyers' group accelerating steel decarbonisation through collaborative procurement of lower emission steel. The SSBP provides the next step towards offtake for buyers and is thus complementary to efforts like the SteelZero and the First Mover Coalition's Near-Zero Steel by 2030 initiative that focus on gathering commitments.**
- **Sign offtake agreements → Investments in new industrial-scale steel mills using breakthrough technologies to drastically reduce emissions generally require a significant amount of binding offtake agreements. Signing offtake agreements is thus one of the most impactful actions a steel procurer can take.**

BENEFITS IN THE SHORT, MEDIUM AND LONG-TERM FROM COMMITTING TO THE PROCUREMENT OF LOWER EMISSION STEEL

The shift to lower emission steel is an essential step in decarbonising supply chains while ensuring long-term sustainability and competitiveness for industries reliant on steel. By committing to lower emission steel, companies can:

1. Drive Climate Action

The steel sector is pivotal to achieving global net-zero targets. By sourcing lower emission steel, corporations can directly reduce their supply chain emissions, a critical component of achieving Scope 3 emission reductions.

2. Enhance Competitiveness

Consumers increasingly prefer brands that align with sustainability values. The use of lower emission steel enhances brand reputation and adds substantial credibility to green claims, opening up new market opportunities and increasing competitiveness[4].

3. Meet Investor and Stakeholder Expectations

Investors, shareholders and financial institutions are raising their awareness of carbon risk and the risk of stranded assets. Coal-based steel production is a substantial carbon risk, from which it is reasonable to expect financial flows to be diverted over the next decade or two. Establishing procurement criteria guiding towards the use of lower emission steel not only fulfils shareholder expectations for Environmental, Social, and Governance (ESG) performance, but can also strengthen brand and share value and reduce financing risk[5].

4. Enhance Resilience

The procurement of lower emission steel can shield companies from future regulatory and carbon pricing risks, positioning them as early adopters of sustainable solutions and safeguarding long-term profitability. With regulatory frameworks such as the EU's Carbon Border Adjustment Mechanism (CBAM) being adopted, overseeing value chain emissions and how to reduce these is part of future-proofing current business models.

5. Enhance Market Momentum

By committing to lower emission steel, corporate partners send a powerful demand signal, incentivising further investments in lower emission steel technologies and speeding up the transition to a future of a net-zero steel industry. Being a driver of this transition can open up new opportunities to join consortia with front-runners in your industry.

SHORT-TERM BENEFITS

MEDIUM-TERM BENEFITS

LONG-TERM BENEFITS

Strong Signals of Demand for lower emission steel create opportunities both for the procuring company and for the steel sector, while simultaneously aiding in keeping the world on track for a 1.5°C future.

A GLOBAL PROBLEM WITH LARGE LOCAL DIFFERENCES

One of the key challenges of defining lower emission steel on a global scale is the fact that there are big regional differences in the steel industry. These differences are not limited only to steel production technology in use or the age thereof, but include questions of surrounding infrastructure (e.g. robustness of electricity grids; steel production site accessibility for shipments by sea or rail) and resources (e.g. availability of renewable energy resources; availability of iron ore suitable for use in DRI, the emissions intensity of the electricity grid, availability of scrap steel) as well as socio-economic factors and geopolitical factors. In order to decrease emissions from the steel sector, production methods need to be improved continuously all over the world. Some areas and production technologies allow for leapfrogging in terms of technology and emissions from production, while others are currently in a stage where incremental changes along with strong policy advocacy to influence the surrounding economic, social or governance landscape is needed to enable a future larger shift. It is crucial that any actions intended for mitigating greenhouse gas emissions from the steel industry are tailored to the surrounding environment and that multinational agreements and standards leave room for different action in different regions.

CONCLUSION: A SHARED RESPONSIBILITY

Corporate commitment to lower emission steel procurement represents a transformative opportunity to decarbonize supply chains, meet stakeholder expectations, and drive innovation in the steel industry. By adopting lower emission steel, companies can contribute meaningfully to the fight against climate change while positioning themselves as leaders in sustainable development. Together, steel procurers and steel producers can reshape the future of steel production and secure a liveable planet for generations to come.

WWF encourages all corporate partners to think critically about their steel use and to prioritize lower emission steel procurement to join us in our mission to promote sustainable practices across industries.

A final point

As shown in this toolkit, the technology to produce steel with near-zero emissions exists. However, as iron ore is a limited resource and all mining and production of power and heat has negative impacts on nature, it is critical to note that the most effective way to reduce emissions from steel use will always be to use less steel. This is a goal obtainable both through smarter product design; material substitution as well as exploring the new steel grades with superior features making it possible to achieve the same result with less material.

FURTHER RESOURCES TO MAKE ACTION EASIER

- ResponsibleSteel
- Science-Based Targets Initiative (SBTi): Guidance on aligning the corporate climate strategy with net-zero pathways.
- International Energy Agency (IEA): Definition of low-carbon steel, reports on low-carbon steel technologies.
- Industry Collaborations: Demand side initiatives that promote and facilitate lower emission steel procurement (mentioned earlier in this Toolkit) are:
  - SteelZero
  - RMI Sustainable Steel Buyers Platform
  - First Movers Coalition

WWF AND STEEL DECARBONISATION

The climate crisis is one of the key drivers of biodiversity loss and halving humanity's footprint by 2030 is one of the strategic goals of WWF. WWF has been engaged in climate action for decades, and the Steel Decarbonisation Workstream (founded in 2024) focuses, amongst other things, on engaging WWF corporate partners in driving the demand for lower emission steel. Because the investments needed to shift steel production toward lower-emission technologies are large, strong signals of demand for lower emission steel are key to driving the transformation.

This toolkit is developed by the WWF Steel Decarbonisation Workstream.

WWF

Steel Decarbonisation Workstream

SOURCES:

1. Global Energy Monitor

2. Hasanbeigi, 2022, Steel Climate Impact - An International Benchmarking of Energy and CO_2 Intensities

3. SBTi, 2023. Steel Science-Based Target Setting Guidance

4. Joint Research Centre (JRC), 2022. Technologies to Decarbonise the EU Steel Industry

5. Hasanbeigi, A.; Sibal, A. 2023. What is Green Steel?

6. WTO, Steel Standards Principles

7. Agora/ Global Steel Transformation Tracker

8. WRI, 2023 Green procurement of cement and steel

9. IEA, CCUS Projects Database, IEA, Paris, Licence: CC BY 4.0

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