

# Sustainable Metals

Carbon neutrality - The new sustainability frontier for manufacturers



# Executive summary



Industry players are adopting innovative technologies, such as carbon capture and storage (CCS) and inert anode technology, and using renewable energy sources to manufacture carbon-neutral steel and aluminium

- However, the scale of adoption remains small, the production cost high, and demand fragmented



Europe is making great strides toward its decarbonization goal, accounting for about two-thirds of the total number of carbon-neutral steel projects globally, many of which are close to commercialization

- Compared to 37 steel decarbonization projects in Europe, only 2 are currently underway in the US and 4 in China



The transition to green metals can only be accelerated through a close collaboration between manufacturers, suppliers, customers, and governments, as they all have a critical role to play:

- Manufacturers need to invest in better production processes, and research and development (R&D)
- Suppliers need to consider onshoring or nearshoring to reduce global exposure, in order to decrease carbon footprint across the supply chain

The steel and aluminium industries contribute **10%** and **2%** to global CO2 emissions, respectively<sup>1</sup>

Hydrogen-based production in US and Europe can cut steel industry emissions by **20%-40%**<sup>2</sup>

Small-scale CCS technologies can cut aluminium sector emissions by **35%**<sup>3</sup>

- B2B customers must be willing to pay a 'green premium,' as the cost of manufacturing carbon-neutral metals will remain high until production is scaled up
- Governments and regulators need to create robust domestic policies and enter into global trade agreements for greater international collaboration on green metal investments and reduced dependence on fossil fuels

# Use of innovative process technologies key to decarbonizing steel and aluminium production

In a bid to decarbonize, steel manufacturers are increasingly replacing coking coal with alternative energy sources in the steel production process, exploring ways to recycle scrap steel, and inventing low-carbon or carbon-neutral production technologies (see Figure 1). One such carbon-neutral technology is Hydrogen Breakthrough Ironmaking Technology (HYBRIT) — developed collectively by steelmaker SSAB, iron ore producer LKAB, and energy supplier Vattenfall. The three companies are leveraging this technology to develop fossil-free steel that has the potential to reduce Sweden’s total carbon dioxide emissions by at least 10%<sup>4</sup>.

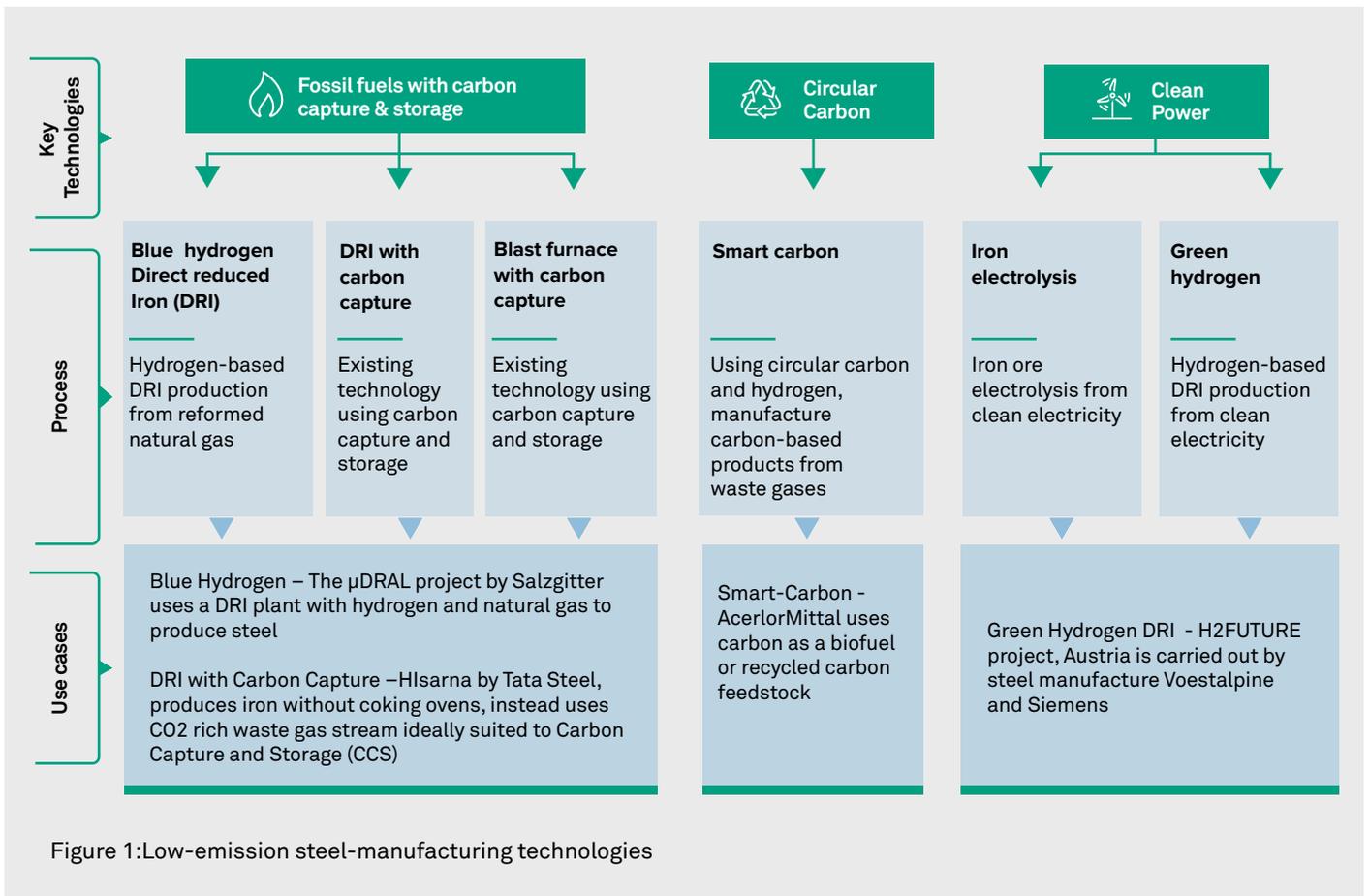
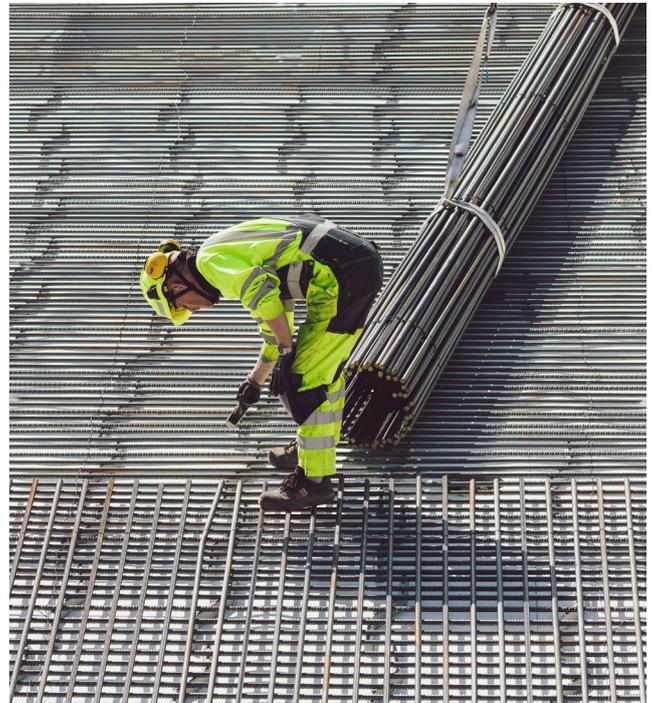


Figure 1:Low-emission steel-manufacturing technologies

Source: Wipro Insights based on [Climate Action Report](#), ArcelorMittal

While decreasing their environmental impact is a clear imperative for companies, substantial investment in R&D is required for the industry to decarbonize. Steel manufacturers’ investments in new processes and products as a percentage of revenue dipped from 8.8% in 2010 to 8.0% in 2020<sup>5</sup>.

# Global steel decarbonization tracker: Europe leading in steel decarbonization projects

We analyzed steel decarbonization projects worldwide and created an index using a normalized scoring methodology based on three key variables – 1) Number of steel decarbonization projects; 2) Scale of the project (R&D, demo, pilot, full scale); and 3) Expected commercialization

Europe leads with the highest number of active steel decarbonization projects, accounting for about two-thirds of the total. Within Europe and globally, Germany and Sweden have the highest number of steel decarbonization projects, which are expected to reach full-scale production by 2025 and 2024, respectively.

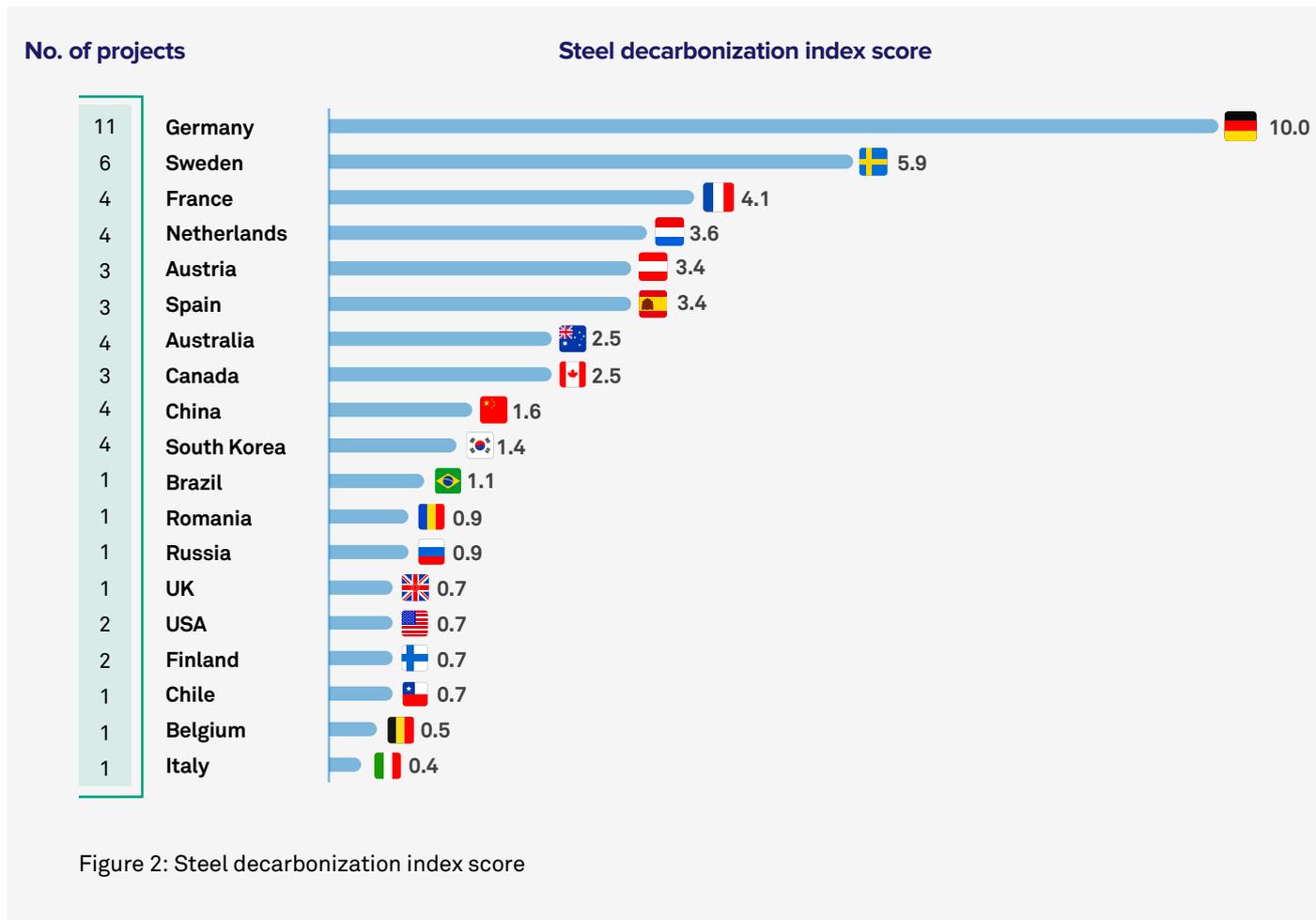


Figure 2: Steel decarbonization index score

Source: Wipro Insights' analysis based on data from [Green Steel Tracker](#), accessed on January 3, 2022; Note: Steel decarbonization index score for each region is calculated using a scoring methodology based on the number of projects, scale of projects, and expected commercialization of steel decarbonization projects; the scores have been scaled using MIN-MAX normalization.

Similarly, various initiatives — such as shifting to renewable energy sources for smelting and adopting technological advancements such as carbon capture and storage (CCS) — are being undertaken to decarbonize aluminium production.

### Alternative energy sources

Alternative heat generating processes are being considered, including solar water heaters, hydroelectricity, biomass, geothermal energy, and green hydrogen

Norsk Hydro, a Norwegian aluminium and renewable energy company produces two-thirds of its aluminium using renewable energy sources

### Inert anode technology

Inert anodes are being used instead of conventional carbon anodes to avoid oxidation, thus limiting the emission of greenhouse gases

Elysis, a JV of Rio Tinto and Alcoa, aims to replace carbon-based anodes used in aluminium smelting. Inert anodes release only oxygen, reducing carbon emissions

### Small-scale CCS technology

Small-scale CCS can help decarbonize the aluminium industry, with the potential to deliver a 35% reduction in emissions

Figure 3: Low-emission aluminium-manufacturing technologies

Source: Wipro Insights, World Economic Forum, Norsk Hydro, Elysis

## Collaboration between stakeholders key to achieving carbon neutrality in steel and aluminium production

The cost of manufacturing steel and aluminium increases substantially when green technologies are leveraged. Early estimates suggest that the cost of steel decarbonization technologies is expected to be 30%–80% higher than that of conventional steel production technologies<sup>7</sup>. Likewise, carbon-neutral aluminium is more expensive to manufacture than regular aluminium, resulting in manufacturers charging a 'green premium' to compensate for the high production costs.

The European steel industry plans to reduce emissions by 30% through 2030 and by as much as 95% by 2050<sup>6</sup>



Given the barriers to commercialization, a successful transition to carbon-neutral steel and aluminium will require a collaborative effort between the key stakeholders — manufacturers, suppliers, customers, and governments.



Source: Wipro Insights, SSAB, Norsk Hydro, LKAB, Volvo Group, BMW AG

While some progress has been made by ecosystem stakeholders, large-scale commercialization of carbon-neutral metals remains a distant goal. At the COP26 in Glasgow, SSAB accepted the invitation to hbe a Founding Member of the First Movers Coalition, a joint initiative by the US Special Presidential Envoy for Climate, John Kerry, and the World Economic Forum. The coalition will provide a platform for companies to make purchasing commitments for low-carbon technologies<sup>8</sup>.

“We are committed to be a first mover and show that it is both possible and necessary to develop a complete fossil-free steel value chain with virtually no carbon footprint. We will be a committed partner to those who seek to create fossil-free value chains while helping to strengthen our customers’ competitiveness. We will also use our purchasing power to accelerate change”

— Martin Lindqvist, President & CEO, SSAB<sup>8</sup>

## Green metals are a long-term bet

It is imperative for steel and aluminium manufacturers to reduce energy consumption, cut carbon emissions, and develop more sustainable products over the long term. The above measures will help them achieve their net climate goals and enhance their overall competitiveness.

However, ecosystem stakeholders need to act now to gradually move toward carbon-neutral products, with their primary focus on the following:

- Continuous investments and R&D spend on innovative process technologies
- Use of emerging technologies to the largest possible extent
- Collaboration with key stakeholders
- Development of a solid decarbonization pathway



## Wipro's role as a sustainability partner for steel and aluminium manufacturers:

- We can help our partners leverage digital solutions for supply chain management, process improvement, ERP, and migration of legacy systems
- We offer end-to-end digital solutions to metal and steel companies for IT portfolio rationalization and consolidation, purchasing and transport management, supply chain management, logistics tracking and optimization, process improvement, asset management, and environment, health, and safety management
- Our intelligent data analytics solutions and expertise in emerging technologies can help manufacturers control CO2 emissions and energy consumption, and can also recommend proactive optimization approaches to reduce their energy use
- Wipro's solutions are backed by a large pool of industry-specific resources that have strong technological expertise and cross value chain experience, enabling clients to respond to changing market demand, enhance customer satisfaction, and improve operational excellence by automating and optimizing business processes

## Authors



**Vinay Firake**  
Sr. Vice President &  
Managing Director – Nordics



**Ulf Weibahr**  
Head of Manufacturing  
Consulting – Nordics



**Co-author:**  
**Siddhant Mehra**  
Manager, Manufacturing Insights

## Contributions

**Arto Kuusinen, Pursuit Leader, Growth Office**

**Avneet Anand, Senior Analyst, Insights**

**Vatsala Srivastava, Manager, Writing &  
Editorial, Insights**

## Reference

- 1) **Green metals: the journey to decarbonisation, 7 October 2020, Wood Mackenzie**
- 2) **Aluminium for Climate: Exploring pathways to decarbonize the aluminium industry, November 2020, World Economic Forum**
- 3) **The Disruptive Potential Of Green Steel, September 2019, Rocky Mountain Institute**
- 4) **Fossil-free steel – a joint opportunity**
- 5) **Sustainability Indicators, World Steel Association**
- 6) **Ambitious EU climate law must show how EU climate policy can lead global emissions reduction efforts, 5 March 2020, The European Steel Association**
- 7) **European Steel Sector Initiation, 1 June 2021, UBS**
- 8) **SSAB joins climate initiative First Movers Coalition at COP26 in Glasgow - SSAB**



---

**Wipro Limited**  
Doddakannelli  
Sarjapur Road  
Bengaluru – 560 035  
India

Tel: +91 (80) 2844 0011  
Fax: +91 (80) 2844 0256  
**wipro.com**

Wipro Limited (NYSE: WIT, BSE: 507685, NSE: WIPRO) is a leading global information technology, consulting and business process services company. We harness the power of cognitive computing, hyper-automation, robotics, cloud, analytics and emerging technologies to help our clients adapt to the digital world and make them successful. A company recognized globally for its comprehensive portfolio of services,

strong commitment to sustainability and good corporate citizenship, we have over 240,000 dedicated employees serving clients across six continents. Together, we discover ideas and connect the dots to build a better and a bold new future.

For more information,  
please write to us at [info@wipro.com](mailto:info@wipro.com)