

Towards carbon neutrality

A European Partnership for Clean Steel

“Breakthrough innovation investment needs breakthrough policy”

WHAT IS OUR VISION?

The most significant challenge of our time is climate change. The European steel industry is fully committed to the mitigation of greenhouse gas emissions, to helping meet the objectives of the Paris Agreement and the EU’s target of **reducing domestic CO₂ emissions by 80% to 95% by 2050** compared to 1990 levels. The required breakthrough innovation investments can only be made if the EU’s *Long-Term Climate Change Policy Strategy* sets out the ambition to apply:

1. The right Research & Innovation framework to develop key low-CO₂ technologies;
2. The use of low-carbon energy at globally competitive prices for energy intensive industries, given that a huge amount of additional carbon-lean energy - and the associated infrastructure - will be needed for the transition of the industry;
3. Effective policy measures that keep European low-CO₂ industrial production competitive on both internal and global markets.

This will ensure that low- CO₂ production, and the improved circularity of materials, is fostered. It will also support innovation, jobs and growth – strengthening these bases and securing a bright future for the EU’s economy and its citizens.

WHAT ARE WE DOING AND GOING TO DO?

European steel companies have already begun developing new technologies and will continue to accelerate this work in order to achieve the objective.

The technological paths for CO₂ mitigation in steelmaking of at least 80% compared to 1990 levels are Smart Carbon Usage (SCU) and Carbon Direct Avoidance (CDA). The European steel industry aims to further develop promising projects along these pathways.

Carbon Direct Avoidance develops (new) processes that would produce steel mainly from virgin iron ore and/or suitable scrap gradually maximising the use of carbon-lean or fossil-free electricity and/or hydrogen. The intention is the large-scale replacement of existing, mainly coal-based metallurgy, instead using direct reduction, plasma smelting reduction or electrolysis processes for iron ores, among others. This pathway includes two groups of promising technologies: mainly hydrogen-based metallurgy, and electricity-based metallurgy.

Smart Carbon Usage means making further use of existing, mainly coal-based steelmaking routes, using the CO₂ generated during the steel production process to produce chemical feedstock whilst employing carbon-lean or fossil free electricity. This pathway includes two promising groups: Process Integration (further development of existing processes) and Carbon Valorisation (also called Carbon Capture and Usage - CCU). Carbon Capture and Storage (CCS) will form an integral part of this pathway.

The European steel industry is working on a range of technologies to bring about the most sustainable outcome by 2050. To meet the Paris Agreement objectives, several technologies may be needed depending, for instance, on regional circumstances and national policies.

Research activities with partners from other sectors of the economy, alongside research and technology organisations, will aim to develop several pilot and demonstration projects. **By 2027**, at least two pilot projects will have entered deployment and could be upscaled to become industrial

scale demonstrators, reducing CO₂ emissions from these installations by around 50%. Examples are the application of carbon valorisation (CCU) to produce fuels and chemicals and the demonstration of new low- CO₂ – mainly hydrogen-based – direct reduction processes (in combination with large scale electrolyzers).

By 2034, at least four projects are planned to have been upscaled to become industrial scale demonstrators, of which at least two reach 80% CO₂ reduction from steelmaking, with or without Carbon Capture and Storage.

The roll-out of some of these may already begin in the second half of the 2020s, if there is sufficient technological progress, and if energy supply and infrastructure are available, as well as if there is a legislative and economic framework that allows for the investment and operational costs of these new technologies to be (globally) competitive. The complete roll-out and transition of the whole steel industry will take up to the year 2050.

Synergy effects between projects, technologies and sectors will create the dynamics needed to drive low- CO₂ industrial production. These synergies will help build up greater skills, jobs and open up new markets, including for low- CO₂ steel, hydrogen, alternative fuels and feedstocks for the chemical industry, enhancing the circular economy.

By 2050, a new low- CO₂ steel value-chain should be in place. The industry endeavours to have shifted from a fossil-energy-based linear industry to a low-carbon energy-based sector integrally part of the circular economy, and emitting at least 80% less CO₂ compared to 1990 levels. Europe could become a leading provider of low- CO₂ products, services and technologies in steelmaking worldwide.

WHAT DO WE NEED?

The European steel industry estimates that bringing ongoing projects up to industrial scale will require an additional financing of up to 11 billion euros in the years 2021-2034. The 2021-2027 timeframe will be a crucial preparatory phase. There are plans to initiate some of the industrial scale projects in the first years of Horizon Europe, while others will start later, following different technological pathways and timelines. Other sources of financing, including the EU ETS Innovation Fund and Important Projects of Common European Interest (IPCEIs), will support the scaling up of projects at industrial scale, both in the 2021-2027 and 2028-2034 periods.

Given the urgency of the global challenge that climate change brings it is crucial to back-up the transformation to low- CO₂ steel production through a strategic and long-term research agenda for the sector. In order to effectively work together over an extended period of time, we call on the European Union to adopt a holistic approach - in other words: a clear and predictable collaborative framework.

By prioritising research into low- CO₂ and fossil-free breakthrough technologies in sectors with a high share of global greenhouse gas emissions, the European Union will pave the way for significant CO₂ emission reductions in Europe and globally. Dedicated European Partnerships under Horizon Europe, together with other support schemes, such as the EU ETS Innovation Fund, Invest EU, Connecting Europe Facility, and Important Projects of Common European Interest (IPCEI) should be coordinated to function in a mission-oriented approach, supporting the transition to Low CO₂ Industry.

A EUROPEAN PARTNERSHIP FOR CLEAN STEEL

Horizon Europe should include a **European Partnership for Clean Steel** in form of a co-programmed partnership. The overall financial support required for research up to industrial scale demonstrator level activities in Technology Readiness Levels (TRLs) 3 to 9 is **2 billion euros for the years 2021-2027** (from the total of up to 11 billion euros required up to 2034). 50% will be contributed by the industry, and 50% will be financed by Horizon Europe. The European steel industry will be ready to make 1

billion euros available for research and the initial implementation steps of the breakthrough technologies in the years 2021-2027, so long as the Long-Term Climate Change Strategy foresees a positive perspective; i.e. that these technologies can be successfully rolled out into the market.

The deployment of the technologies, in the form of first-of-a-kind industrial installations - including their operation - needs to be eligible to apply for additional funding from the aforementioned EU and national support schemes. The partnership should also serve as the platform for industry and policymakers to identify R&D projects for such additional financing.

Objectives of the European Partnership and Key Performance Indicators (KPIs) 2021-2027

- Create at least five clusters of EU collaboration:
 1. hydrogen and natural gas steelmaking and processing
 2. carbon valorisation
 3. process integration of low- CO₂ solutions in the steel industry
 4. circularity in steelmaking and manufacturing
 5. digital solutions for the steel industry
- Technologies in Carbon Direct Avoidance and Smart Carbon Usage are demonstrated through at least two projects implemented at pilot and possibly upscaled to become industrial scale demonstrators.

These projects will demonstrate the CO₂ reduction potential:

 - In Carbon Direct Avoidance projects: 50% or higher by 2027 (and at least 80% by 2034) (cluster 1)
 - In Smart Carbon Usage projects: around 50% by 2027, or higher if combined with Carbon Capture and Storage or use of low CO₂ hydrogen (and at least 80% by 2034) (clusters 2 & 3)
- Demonstration of circularity of steel by-products (e.g. slag) from new technologies (clusters 1 to 4)
- Improve current steel recycling technology and solve the problem of impurities (cluster 4)
- Investigate application of digital solutions to steelmaking (industry 4.0) (cluster 5)
- Prepare workforce for use of new production technologies (including digital solutions) (clusters 1 to 5)

The Clean Steel partnership would be the suitable instrument for the preparation of the European steel industry for the upscaling and roll-out of low CO₂ technologies. To be successful, mitigating CO₂ emissions requires pooling of all available resources. The steel industry is ready and able to work successfully in joint research and upscaling projects under the umbrella of a co-programmed partnership. Furthermore, this would be open to cooperation with other interested stakeholders, such as providers of fossil-free energy, the chemical industry, technology providers, etc.

The European steel industry therefore calls on policymakers to match our ambition and launch a **European Partnership for Clean Steel**, and to take effective policy measures that keep European low-carbon energy supply and industrial production competitive in the internal market – and *vis-à-vis* global competitors. Investment in the steel industry is very capital intensive and requires a long planning horizon. In order to support successful investment management in the steel industry it is key that effective and reliable measures are in place that allow for the planning of long-term investments related to innovation and carbon costs, including after 2030. A policy that neutralises the costs of these challenges versus global competitors needs to be in place as soon as possible to allow for these investments in the EU.