

# SymbioSteel Newsletter No.6, 2026

## Industrial Symbiosis (IS) in the Era of Low-Carbon Steelmaking

### How will steel decarbonization reshape industrial symbiosis?

The European steel industry is undergoing a profound transformation. Emerging low-carbon steelmaking technologies such as hydrogen-based Direct Reduced Iron (H<sub>2</sub>-DRI), Electric Arc Furnaces (EAF), smelting reduction technologies, and Carbon Capture, Utilization and Storage (CCUS) are expected to significantly reduce CO<sub>2</sub> emissions. However, these changes will also reshape material and energy flows that industrial symbiosis has relied upon for decades.

Deliverable 5.1 of the Symbio-Steel project analyses the future challenges and opportunities for industrial symbiosis in this changing landscape

*Follow our Deliverable 5.1 on SymbioSteel website for more details (website link on Page 3).*

## Why IS matters

Industrial symbiosis is already deeply embedded in the steel sector through the exchange and valorization of: Slags, Dusts and sludges, Energy and off-gases, Water resources, Secondary raw materials, Logistics and infrastructure, etc.

These collaborations help reduce waste, improve resource efficiency, and create value across sectors. As steelmaking technologies evolve, ensuring the adaptation of these symbiotic relationships becomes increasingly important

### **Consortium team:**



## Key findings

- **By-products will become more variable**

Future steelmaking routes will change the quantity and characteristics of slags, dusts and sludges. Variations in composition, mineral phases and physical properties may affect their suitability for existing applications such as cement, construction materials and metal recovery.

- **Slag remains the most critical industrial symbiosis stream**

Slag accounts for approximately 90% of steel industry by-products by mass, making it the most important by-product for future industrial symbiosis. Changes in slag chemistry and formation mechanisms could have major implications for downstream users.

- **Stakeholders see industrial symbiosis as a key decarbonization enabler**

In the Symbio-Steel stakeholder survey, the most frequently identified drivers of decarbonization were:

Electrification (83%)

Circular Economy (69%)

Hydrogen as reducing agent (61%)

Industrial Symbiosis (57%)

## Research needs due to transformation

To maintain resource efficiency in a decarbonized steel industry, future research should focus on:

- Slag: composition changes, treatment methods and new valorization routes
- Dust and sludge: recovery, recycling and stabilization technologies
- Off-gases and energy streams: cross-sector energy integration
- Water and chemical flows: enhanced reuse and circularity
- Material input variability: effects of DRI, HBI and changing scrap mixes

## What's Next?

### Three complementary objectives for future industrial symbiosis research:

- Verify whether existing by-products remain suitable for established applications.
- Adapt treatment and conditioning methods when material properties change.
- Innovate new valorization pathways for emerging by-product streams.

Open access article: "Recent achievements of Industrial Symbiosis in the steel sector based on the Symbio-Steel project: a review"



## Stay tuned for updates

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AUTHOR:

Han Yu