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Metallurgical biocarbon as a decarbonization strategy: Policy drivers and industrial implications from a Swedish perspective

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In Sweden, the transition toward fossil-free metallurgy increasingly considers biocarbon produced from sustainable biomass as a substitute for fossil coal in high-temperature processes such as electric arc furnaces (EAF), tunnel kilns (TK), and submerged arc furnaces (SAF). This study, part of the HåBiMet –Policy Perspective project, examines how EU and Swedish policy frameworks shape the feasibility and competitiveness of metallurgical biocarbon deployment.

The analysis combines desk research with stakeholder workshops and interviews, mapping climate and energy policies (EU ETS, ETS2, CBAM), biomass governance (RED III, LULUCF, EUDR), and environmental regulations (IED 2.0, Miljöbalken i.e. the Swedish Environmental Code). Findings indicate that while there are economic incentives for substituting fossil carbon, such as by zero-rating biogenic CO2 emissions under the ETS and pricing direct emissions of imported iron and steel products under CBAM –other frameworks introduce constraints. RED III's cascading use principle prioritizes wood for material applications over energy, potentially limiting access to forestry residues critical for biocarbon production. IMO transport safety rules and REACH compliance add logistical complexity, while the absence of harmonized standards for metallurgical biocarbon creates uncertainty for procurement and quality assurance. Furthermore, biocarbon expands the intertwining of the metal industry with sectors such as forestry, agriculture and energy, contributing to further complexity.

From an industrial perspective, technical feasibility is established: biocarbon can replace fossil reductants in blast furnace (BF) injection, EAF carburization, and SAF operations. However, cost remains a major barrier –biocarbon is up to four times more expensive than fossil carbon carriers. Policy-driven carbon pricing partially offsets this gap; for example, ETS allowance prices (€70–75/t CO_2) significantly increase the effective cost of fossil coke. Yet, permitting under IED 2.0 and Miljöbalken may raise CAPEX/OPEX for pyrolysis plants, requiring strategic planning and early engagement with regulators.

The study concludes that metallurgical biocarbon will play a transitional role alongside hydrogen-based DRI and CCUS. Although, the surrounding policy landscape is characterized by a lack of clear standards and uncertainty regarding how imminent EU legislation will affect costs tied to different parts of the value chain. To accelerate adoption, industry needs predictable policy signals, clear sustainability criteria, and standards for metallurgical biocarbon quality that are recognized at the EU level. These would advantageously be pursued in collaboration with stakeholders from other sectors to mitigate future conflicts of interest.

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