

# **Production and Deployment of Metallurgical Biocarbon in Sweden: Mapping the EU and National Policy landscape and Potential Challenges**

Erland Nylund, William Di Francesco, Tova Jarnerud Örell, XingQiang Song

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## Customer value

The project identifies key regulatory enablers and barriers for developing a sustainable metallurgical biocarbon value chain in Sweden. By analysing policies, stakeholders, and cross-sectoral interactions, the study clarifies market conditions, highlight critical obstacles and outlines a vision that is intended to support industry decision making and accelerate the development of biocarbon use in metallurgy. Several standards and regulations with potential impact on metallurgical biocarbon are currently under development. It is important that metal industry actors actively participate in these processes, to ensure that future standards are not defined solely around the needs of the bioenergy or agricultural sectors.

- The policy landscape for metallurgical biocarbon is characterized by lack of standards, regulatory gaps and fragmentation between industries
- Uncertainty in the regulatory environment is identified as a main barrier for investments towards further development and upscaling
- Notably, IMO 2025 transport restriction are the most direct regulatory obstacle to further development
- A shared vision for a sustainable metallurgical biocarbon value chain was developed to guide future engagement and prioritisation of policy related efforts

## **Abstract**

This report provides a mapping of the European Union (EU) and Swedish policies, regulations and certification schemes that can influence the production and the use of biocarbon for metallurgical applications in Sweden. The analysis is carried out within the framework of the project “Sustainable Biocarbon for Metallurgical Use (HåBiMet) – Policy Perspective”. The report also identifies cross-sectoral conflicts related to biomass access and the growing biocarbon market. Finally, the findings reveal that policy drivers are fragmented across several regimes.

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# 1 Introduction

## 1.1 Background

The global steel industry accounts for 7-9% of anthropogenic CO<sub>2</sub> emissions, with traditional blast furnace operations relying heavily on coking coal (World Steel Association, 2024).<sup>1</sup> There is an urgent need to decarbonize hard-to-abate sectors, including the metallurgical industry. Steelmaking and ferroalloy production remain among the most carbon-intensive industrial activities in Sweden, primarily due to their dependence on fossil-based reductants. The transition involves replacing these fossil-based reductants and energy sources with renewable and carbon-neutral alternatives.

Biocarbon materials produced from sustainable biomass can contribute to a more sustainable and circular economy by facilitating the shift from fossil coke to renewable carbon sources. The production and use of metallurgical biocarbon are increasingly recognized as promising strategies for decarbonizing the steel sector. Metallurgical biocarbon offers a renewable alternative to fossil carbon sources (such as fossil coke and coal) in various high-temperature processes. In iron, steel, and ferroalloy production, biocarbon can be used as a substitution for fossil coke, mainly serving as a reductant or alloying element in processes such as blast furnace (BF) ironmaking, electric arc furnace (EAF) charging, and submerged arc furnace (SAF) operations in ferroalloy production. In the transition towards a sustainable H<sub>2</sub>-DRI-EAF (Hydrogen – Direct Reduction of Iron – Electric Arc Furnace) route, the injection of biocarbon remains necessary in the EAF stage for carburization, thermal input, and slag foaming.

Large-scale production and deployment of metallurgical biocarbon still face numerous challenges. These include the economic viability of biocarbon production, competition for biomass with other sectors (e.g., chemical industries and bioenergy), the lack of harmonized technical standards, and insufficient policy support. While scientific studies have evaluated the technical performance of biocarbon in metallurgical furnaces<sup>2</sup>, few have systematically analysed the role of governance framework in enabling (or hindering) its adoption in the metal sector. Policies and regulations can play a crucial role in developing biocarbon supply chain and promoting its use in metallurgy.

In Europe, a variety of climate, energy, and innovation policies and regulations influence the development of biocarbon value chains in the iron and steel sector, potentially leading to cross-sectoral competition for access to biomass resources and biocarbon supply. Moreover, industrial-scale use of biocarbon in metallurgy requires alignment with multiple EU and Swedish policies and regulations, many of which were originally designed for other sectors such as agriculture, forestry, and energy, rather than heavy

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<sup>1</sup> (World Steel Association, 2025)

<sup>2</sup> (Ibitoye *et al.*, 2024) [doi.org/10.1186/s40643-024-00779-z](https://doi.org/10.1186/s40643-024-00779-z), (Sarker, Ethen and Nanda, 2024) [doi.org/10.1002/ceat.202400217](https://doi.org/10.1002/ceat.202400217)

industry. More broadly, alternative technologies to decarbonize the EU steel industry<sup>3</sup>, such as hydrogen-based DRI, CCS & CCU, and iron ore electrolysis, may also affect the deployment of biocarbon in metallurgy. Therefore, both producers and users of metallurgical biocarbon need a better understanding of the policy-related challenges and opportunities to establish a well-functioning metallurgical biocarbon value chain.

This report presents the results of the research project “Sustainable biocarbon for metallurgical use (HåBiMet) – Policy perspective”, which addresses the policy dimensions related to the production and use of metallurgical biocarbon with a focus on the Swedish context. This report has been prepared in close collaboration with the research committee listed in the beginning of this report.

The project received funding from Impact Innovation, a joint initiative between Swedish agencies; the Swedish Energy Agency (Energimyndigheten), Sweden's Innovation Agency (Vinnova) and the Swedish government research council for sustainable development (Formas), as part of the research program “Swedish metals and minerals”, and the Social, Policy and Technical projects have cofunding from the Swerim Research committee for Metallurgy. Swerim coordinated the project, additional partners were:

- SLU, Swedish University of Agricultural Sciences
- LTU, Luleå University of Technology
- Energiforsk
- Envigas
- Vargön Alloys
- Höganäs
- Albaeco

## 1.2 Sister projects

In total, three funding applications were submitted and granted in separate calls within Swedish Metals and Minerals. The resulting three projects all seek to investigate the potential and barriers for sustainable metallurgical biocarbon in Sweden, but from different perspectives – Technical, Social, and Policy. The Technical and Social projects were pre-studies that finished in June 2025. As policy and stakeholder analysis requires an understanding of the socio-technical context of the industries and markets being regulated, the synergies between the HåBiMet projects were invaluable. The aims, key findings, and conclusions of the two sister-projects are summarized below.

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<sup>3</sup> For instance, (Somers, 2022)

### 1.2.1 Technical perspective

The HåBiMet – Technical perspective project combined literature study and expert interviews to identify technological barriers and enablers for a sustainable metallurgical biocarbon industry. Focus was on different metallurgical uses of biocarbon, but the scope also included other uses for biocarbon, in particular agricultural applications, and how their requirements differ from those for metallurgical uses. The main findings from the Technical project are summarised below.

- Biocarbon substitution in most major processes is feasible and ready to be deployed – supply of quality biocarbon is a constraint, but not technical feasibility.
- So far, quality requirements for metallurgical biocarbon are very high. Desired properties are high fixed carbon, low ash and low phosphorous content. The phosphorus content is a major barrier for certain applications and for expanding production to cheaper woody residues.
- Currently, the high cost of metallurgical biocarbon is the main obstacle to increased use.
- Regulatory uncertainty and policy gaps hinder investment and large-scale deployment.
- Swedish biomass resources are substantial and could supply the estimated metallurgical biocarbon demand through coproducts and residues such as sawdust or tops and branches. However, these coproducts are attractive to several other industries, the largest share seeming to go to heat and power generation.
- Valorisation of heat, oil and gases from pyrolysis is key to both biocarbon profitability and cost reduction.
- Cooperation with energy companies with established supply chains for woody residues can both ensure efficient coproduct valorisation and secure reliable feedstock supplies.
- The requirements on biocarbon used for soil and agricultural applications are to a large extent different and complementary to the requirements on metallurgical biocarbon. These qualities are linked to choice of biomass, and therefore agricultural biocarbon uses do not seem to directly compete with metallurgical biocarbon for supply.
- The biocarbon market is not very mature, still developing, and suffers from a lack of formal standards.

### 1.2.2 Social perspective

HåBiMet – Social perspective was a pre-study investigating to what extent particular social barriers inhibit the development of a metallurgical biocarbon market. Semi-structured interviews guided by a Technological Innovation System framework combined with workshops and seminars were used. Innovation system maturity, social acceptance, skill supply and employer attractiveness perspectives were in focus.

The following is directly quoted from the conclusion section of the project report:

- **Social acceptance is currently sufficient, but fragile.** There is no widespread opposition to metallurgical biocarbon, especially when its role as a chemical reagent rather than a fuel is clarified. However, misconceptions persist – such as the belief that hydrogen-based steelmaking eliminates the need for carbon entirely. Without clear communication and engagement, social acceptance could erode, especially in the face of biomass competition or environmental concerns.
- **Skill supply as adequate but need strategic development.** The current workforce is managing the transition well, but cross-sectorial knowledge and new competences will be essential. Upskilling in areas such as fire safety, process optimization, and biocarbon quality standards will be critical across forestry, energy, and metallurgical sectors.
- **Knowledge sharing and coordination are crucial.** A lack of standardization and fragmented communication between actors hinders progress. Better transparency, shared standards, and collaborative platforms are needed to build trust, align expectations, and accelerate innovation.
- **Safety and handling require immediate focus.** Fire safety, dust control, and health risks associated with biocarbon handling are top concerns among stakeholders.
- **Regional development.** Biocarbon production has real potential to boost local economies – especially in forest-rich areas like Västerbotten and Norrbotten. Co-utilization with district heating and other industries could enhance profitability and social value, improving public support and trust.
- **Further research is needed.** Life cycle assessments (LCA), social impact evaluations, and comparative studies of biocarbon versus other biomass uses are necessary to guide policy and investment. Understanding the full spectrum of environmental, economic, and social impacts will support more informed decision making

### 1.3 Aim and objectives

This project aims to enable the sustainable production of biocarbon (or “biochar”) for metallurgical use by identifying potential enabler and barriers in regulations and policy instruments, as a basis for improving the conditions for both the production and use of metallurgical biocarbon.

The main objectives are:

- To summarize relevant policies, regulations, and certification frameworks at both the EU and Swedish national level.
- To analyze their potential impacts on the production and use of metallurgical biocarbon, including allocation of woody biomass.
- To identify cross-sectoral conflicts and competing policy setting
- To co-create a vision for a sustainable value chain of metallurgical biocarbon

This project addresses existing EU policies, regulations and certifications up to November 2025. Further developments in EU policies and regulations are not included in the current version of the report.

## 1.4 Report structure

Section 1 presents the background, aim and objectives of the project. Section 2 presents research method and project activities. Section 3 presents results in two main subsections – stakeholder inventory and an overview of policy analysis. Section 4 provides an analysis of the current state, challenges and paths forward when it comes to stakeholder engagement, conflicts of interest and overall regulatory and policy landscape for metallurgical biocarbon.

## 2 Method and project activities

The HåBiMet sister projects explored social and technical aspects of the developing metallurgical biocarbon industry in Sweden. Findings in those projects confirmed the initial assessment that the regulatory environment and complexities stemming from the domain-crossing nature of the industry were important obstacles to understand better. In order to increase clarity and develop a clearer understanding of the policy landscape there was a need to create an overview of policies and regulations impacting biocarbon at different value chain stages. There was also a need to catalogue the actual actors and stakeholders influencing and being influenced by these policies.

Among the resources available to the HåBiMet policy project, the most important one was a growing network including most of the key actors with practical experience of metallurgical biocarbon in Sweden. Therefore, methods chosen making use of this resource – a combination of mainly qualitative and discursive methods, using the expertise of project members and informants to identify key policy instruments and topics.

This project employs a qualitative research approach to investigate the EU governance framework, including strategies, policies, regulations, and certifications, which may affect the production and use of metallurgical biocarbon in Sweden. The analysis draws on multiple sources and methods to ensure a comprehensive understanding of the current state of the art. These include:

- Desk research to map relevant policies and legal instruments, to review voluntary certification schemes relevant to biocarbon sustainability and quality assurance
- Workshops with stakeholder groups, such as biocarbon manufacturers, steel producers, and research institutes, to gather practical perspectives and sector-specific knowledge
- Exploratory and semi-structured interviews with stakeholders such as, biocarbon manufacturers, steel producers, technology providers, research institutes and forestry, to gather sector specific knowledge.
- Cross-sectoral policy analysis aiming to identify potentially conflicting incentives, regulatory gaps, and make improvement suggestions.

The specific activities conducted in the project are detailed in the following sections.

### 2.1 Project activity overview

This section provides an overview of key activities carried out within the project. It outlines the main phases of work, including information gathering and stakeholder engagement, and clarifies how these contributed to the project goals. It is important to note that while some activities were not specifically designed to contribute to the policy landscape analysis, they still produced results relevant to the project goals.

## 2.1.1 Workshops and seminars

Workshops and seminars were conducted throughout the project to support knowledge sharing, stakeholder engagement and the identification of key aspects related to the current policy landscape. Each of these were designed to build on the outcomes of the previous one, allowing discussions and insights to progressively deepened as the project progressed. The activities are summarised in Table 1.

*Table 1: Project workshop and seminar activities*

Activity	Date	Purpose
<b>WS - Policy inventorying</b>	2024-12-09	To initiate the project, an inventory of relevant policies and expertise within the consortium was compiled through a dedicated workshop. The results were used to initiate the literature research.
<b>Crash course</b>	2025-01-21 and 2025-01-23	To ensure a basis of understanding in regard to relevant metallurgical processes that incorporates the use of biocarbon, educational material was produced and presented to project stakeholders.
<b>Orientation seminar</b>	2025-01-23	To orient project stakeholders within the subject included in the HåBiMet as well as to disseminate stakeholder perspectives and operations, a seminar with a concluding workshop was conducted. This ensured equal level of understanding among projects participants.
<b>Webinar Energy sector</b>	2025-02-19	To further increase the awareness of the HåBiMet projects and discuss the symbiosis potential between biocarbon production and energy/heat production, a webinar was conducted with stakeholders from the energy sector.
<b>WS – conflicts of interest</b>	2025-03-10	To identify and discuss potential areas where conflicts of interests may occur, a workshop was held with consortium members and external participators. While the subject of policies was not specifically included in the prepared material, the results could be used to derive stakeholder perception and experiences of the policy landscape
<b>WS – Competence development</b>	2025-03-19	To identify and discuss competence needs and development for the continued development of metallurgical biocarbon, a workshop was held with consortium members and external participators. Just as with the previous workshop, the results were used to gain further insights into stakeholder perspectives on the current policy landscape.
<b>Sustainability compass</b>	2025-04-09	To reflect on how the value chain for metallurgical biocarbon influence each of the 17 UN Sustainable Development Goals, a workshop was held at Jernkontoret in Stockholm. The results identified key

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		environmental risks and leverage points in the value chain, helping guide sustainable considerations during the policy analysis.
<b>WS – “Good policy”</b>	2025-09-23	To identify what stakeholders considers a “good policy” and initiate discussions about what is needed to facilitate future policy initiatives, a workshop was held with consortium members. The results confirmed previously established conclusions and showcased which central uncertainties was considered the main barriers for the continuations of policy work.
<b>Concluding seminar</b>	2025-11-25	Included a presentation of the main results and conclusions. Following this, a draft of the vision for the future policy landscape for metallurgical biocarbon was introduced. Participants were then divided into smaller groups to discuss the vision and provide feedback. The results of this seminar were used to finalize the formulation of the vision.

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### **2.1.2 Semi structured interviews – First round**

During February and April 2025, as a part of the HåBiMet – Social perspective project, six exploratory and 21 semi-structured interviews were conducted with stakeholders from different parts of the metallurgical biocarbon value chain. Although the primary purpose was to pinpoint aspects related to the social project, these interviews included questions related to policies. The insights gained from the interview results have been used as complementary input in this project, strengthening the analysis with grounded stakeholder perspectives and experiences. These were especially valuable as respondents included actors representing sectors not represented in other information gathering activities conducted within the project. Represented stakeholder groups included biocarbon producers, metal producers, research institutes, technology providers, forestry, trade associations as well as actors from the energy sector.

### **2.1.3 Exploratory interviews – Second round**

Building on insights from previous information gathering, a second round of interviews was initiated. This round was conducted to develop a deeper understanding of the points of interaction between industry actors and public institutions and authorities in relation to policy development, permitting processes and related governance practices. As well as to identify priorities among actors from the energy sector. The interviews were held with representatives from the Swedish trade association Svebio as well as authorities such as Naturvårdsverket and the Swedish Transport Agency (Transportstyrelsen).

## 2.2 Coverage of policy instruments

Regarding the EU policy landscape, this project focuses on strategies, policies and secondary laws. Table 2 provides a brief introduction to the EU terminology. Besides, the work includes voluntary certification schemes, such as the European Biochar Certificate (EBC), which can play an influential role in shaping policy discussions and aligning with EU initiatives like the EU Land Use, Land-Use Change and Forestry (LULUCF) Regulation and the Carbon Removal Certification Framework (CRCF).

Table 2: Terminology of EU strategy, policy and law<sup>4</sup>

Type	Definition/Function
<b>Strategy</b>	<ul style="list-style-type: none"> <li>• Provide the EU's direction and goals for a 5-year period in the EU Strategic Agenda</li> <li>• Embed future insights into its policy-making, strategic planning, and preparedness</li> <li>• Guide the development of policies and legislative agendas.</li> </ul>
<b>Policy</b>	<ul style="list-style-type: none"> <li>• Guidelines or principles developed to achieve specific strategic goals</li> <li>• Propose laws, help implement EU legislation, ensure compliance of EU law, etc.</li> </ul>
<b>Primary law</b>	
<b>EU treaties</b>	<ul style="list-style-type: none"> <li>• Binding agreements between EU member states</li> <li>• Starting point for EU law</li> </ul>
<b>Secondary law</b>	
<b>Regulations</b>	<ul style="list-style-type: none"> <li>• Binding on their date of application</li> <li>• Must be applied in its entirety across the EU; without needing to be transposed into national law</li> </ul>
<b>Directives</b>	<ul style="list-style-type: none"> <li>• Binding objectives upon EU member states to achieve a certain result</li> <li>• Require transposition into national law</li> <li>• Individual countries can devise their own laws on how to reach these goals</li> </ul>

<sup>4</sup> Based on [https://commission.europa.eu/strategy-and-policy\\_en](https://commission.europa.eu/strategy-and-policy_en); [https://european-union.europa.eu/institutions-law-budget/law/types-legislation\\_en](https://european-union.europa.eu/institutions-law-budget/law/types-legislation_en); [https://commission.europa.eu/law/law-making-process/types-eu-law\\_en](https://commission.europa.eu/law/law-making-process/types-eu-law_en)

<b>Decisions</b>	<ul style="list-style-type: none"> <li>• Binding on those to whom it is addressed; directly applicable on their date of application</li> </ul>
<b>Recommendations</b>	<ul style="list-style-type: none"> <li>• Non-binding</li> <li>• Allow the institutions to express views or suggest actions</li> </ul>
<b>Opinions</b>	<ul style="list-style-type: none"> <li>• Non-binding</li> <li>• Allow the institutions to make a statement</li> </ul>

Criteria used for selection of EU legal and voluntary policy instruments:

- Inclusion of formal strategies, policies, regulations, and directives, including economic incentives and funding mechanisms
- Focus on applicable and upcoming legislation
- Coverage of certification schemes, both official and non-official
- Relevant to biocarbon production and use in metallurgy
- Connection to cross-sectoral competition for woody biomass
- Directly or indirectly affect the environmental permit requirements

To map every instrument that may influence the current and future development and use of metallurgical biocarbon is a task that exceeds the means of this project. Thus, the selection of policy instruments is, to a large degree, focused on challenges and concerns expressed by stakeholders during knowledge gathering activities and recent literature. The chosen analysed policies are listed in Table 3.

*Table 3: List of selected policies grouped by origin. The right column notes whether the main discussion of the policy is in the main report or an appendix.*

<b>Policies grouped by origin</b>	<b>Discussed in</b>
<b>EU policies</b>	
EU Emissions Trading System (EU ETS1)	Report
EU ETS2	Report
Industrial Emissions Directive (IED 2.0)	Report
Renewable Energy Directive (RED III)	Report
Carbon Removal Certification Framework (RFCF)	Report
Land use, land-use change and forestry (LULUCF) Regulation	Report
Regulation on Deforestation-free Products (EUDR)	Report
Carbon Removals and Carbon Farming (CRCF)	Report
EU Fertilising Products Regulation	Appendix
ReFuelEU Aviation	Appendix
FuelEU Maritime Regulation	Appendix
EU Taxonomy	Appendix

Ecodesign for Sustainable Products Regulation (ESPR)	Appendix
<b>European Biochar Certificate (EBC)</b>	
Guidelines of EBC	Report
Certification of Biochar Based Carbon Sinks	Report
<b>International Maritime Organisation (IMO)</b>	
IMSBC	Report
IMDG	Report
<b>Swedish policies</b>	
Industrial Leap, Climate Leap	Report
Carbon Border Adjustment Mechanism	Report
Miljöbalken	Report
ADR-S	Report
Arbetsmiljölagen (ALM)	Report
Lag om skydd mot olyckor (LSO)	Report

## 2.3 Method reliability, validity and limitations

As a project with a broad and ambitious scope, but limited time and budget, a research approach was chosen that combined available resources and made particular use of the existing experience and expertise in consortium members and partners. Policy and literature review has been far from comprehensive, as the body of text and research which could be strongly or tangentially linked to the subject matter is very large. Rather, prioritisation of which policy instruments to focus on, and their estimated impact relied significantly on the knowledge and expressed concerns of project participants and respondents.

Thus, the result validity is dependent on the ability to correctly identify subject matter experts and key actors in the metallurgical biocarbon environment. The method does not include the deep and meticulous policy analysis that would be required to reliably identify policy loopholes or unintended impacts that have not already been studied or identified by other experts.

One of the main conclusions is that further research is needed to fully understand the complex regulatory environment – and as such the authors do not claim to have achieved a comprehensive or flawless analysis. However, the breadth of respondents and sources is rich enough that it can be expected to capture the broad overview and characterise the main dynamics of intersection policies and regulations impacting metallurgical biocarbon.

When it comes to the stakeholder inventory and identification of key actors, such efforts can be very challenging in a disorganized and low-maturity field where many

stakeholders have yet to declare or identify their own interests. To some extent this seem to be the case when it comes to civil society, for whom metallurgical biocarbon is still largely unknown. However, when it comes to research and industry, the last few years have seen a number of initiatives working to consolidate biocarbon actors both within the agricultural and energy sectors (that dominate biocarbon discourse) and actors interested in industrial uses such as metallurgy. Insight gained from attendance at national and international biomass and biocarbon conferences combined with responses to queries and participation in open workshops makes it possible to identify both which actors have a high profile, and those actors that may be influential but are not present in the discourse.

The study does not attempt to make any strong predictions or descriptions of future conditions or the policy situation outside of Sweden (which is impacted by EU legislation). Respondents and project participants cover such a large fraction of the key actors in the field of metallurgical biocarbon in Sweden that the studies relevance and reliability for understanding conditions in Sweden in 2025 are very strong. Nevertheless, one of the main findings is that the current policy landscape is still characterised by uncertainty and a need for greater clarity in some key areas.

Thus, the method overall is limited to a strong focus on the Swedish context, even though insights from other areas (in particular the wider EU) have been included. The subject matter is shifting and not well understood, small policy changes may have considerable impact on the overall landscape, so findings may not remain relevant for long. There is little current research to fall back on, so the findings should be seen as a first landscape overview – useful for guiding further research and policy development.

## 3 Findings

Here, the findings from project activities are presented. These are not presented as activity-by-activity inventory of opinions and facts but rather seeks to present a situation overview resulting from the analysis of the multitude of investigative activities performed. The challenge of the policy landscape for metallurgical biocarbon is its complexity and unspecificity – therefore this report strives to synthesize an overview and provide clarity where possible.

The discursive methods used in the projects have been iterative – seeking to test analyses and syntheses on the knowledgeable informants and project participants that have been interviewed and attended workshops and seminars. We welcome new facts and perspectives that might disprove or provide nuance to the following analyses, but they are our best outlook based on current information.

Section 3.1 will paint an overview of the stakeholders and actors shaping the metallurgical biocarbon regulatory landscape. Section 3.2 will present an overview of the main existing and upcoming policies pertinent to metallurgical biocarbon, and some sense of what the impact is.

Particularly EU policies were analysed and described more in-depth, to better map their correlations and interactions. These more in-depth analyses and descriptions are presented in Appendix 10.1.

### 3.1 Stakeholder inventory and key actors

This section will present an overview of stakeholders in different domains, sectors and geographies that have an impact on the development of a Swedish metallurgical biocarbon sector. The compilation is intended as an aid to understand the policy and stakeholder landscape further discussed in coming sections, but also as an aid in future efforts to develop policy and raise awareness about metallurgical biocarbon. It is based on interviews, workshops, networking during academic conferences, literature reviews and online research. However, the “Biocarbon sector” is not yet a clearly defined or cohesive sector, and the list is unlikely to be comprehensive. Nevertheless, it should serve to illustrate the key features of a complex landscape with many actors, agendas and sectors, and relatively few platforms for coordination and exchange. Metallurgical biocarbon crosses many traditional sector boundaries, and as a result the number of stakeholders and impactful actors is great.

As a way to organise the stakeholder inventory, they will be categorised by domain and geography. *Domain* in this case is not rigorously defined but is intended to reflect why different actors have an interest in biocarbon. Metallurgical uses is just one of these domains, but three others are included, as they are dominant in shaping conditions for biocarbon markets. For the purposes of this report, these interests are categorised into four domains:

- Life science: Forestry/forest industry and agriculture

- Metal production: Dominated by steel industry, but also for instance ferroalloy production, interested in metallurgical biocarbon.
- Energy: District heating, fuel gases, and the wider biofuel sector
- Environment: Environmental regulators, environmental protection organisations in civil society

For each domain, the overall landscape and dominant actors are described. At the end of each sub-section, a table lists the main actor categories, with as comprehensive a list of individual actors as possible for each category. The categorisation varies from domain to domain.

### 3.1.1 Domain overview

“Biochar” discourse is dominated by soil uses – **agriculture**, carbon sequestration and to a lesser extent filling material in **construction**.

**Forestry** is relevant mainly as a potential source of biomass – particularly in Sweden. However, there have been instances of biocarbon or ash use for soil conditioning in forestry settings as well. Forestry and forest industry sectors are subject to considerable regulation on both EU and Swedish national level.

The **metal industry** discourse has long been focused on the technical feasibility and quality aspects of metallurgical biocarbon. This has linked to research regarding pyrolysis methods, biomass sources and the wider supply chain. However, the direct interfacing of metal actors with biomass sectors seem to be more recent, as metallurgical uses for biocarbon seem to only recently have gained wider attention in biocarbon-oriented conferences and organisations.

Solid carbon is a byproduct of fluidized bed boilers that are often used in Combined Heat and Power (CHP) plants, regular boilers or pyrolysis plants supplying heating grids. Historically, **energy companies** have shown an interest and participated in research projects to valorise this biocarbon in the metal sector and other sectors. In Sweden, there is a growing interest in this form of co-production, as it could also be a way to increase profitability of heat-producing units that may be inactive for large parts of the year when heat demand is low.

All the above sectors are regulated by laws, standards and other forms of policies, governed by a diverse set of **regulating political bodies and agencies**. These range from local municipalities and government agencies, through EU institutions up to global organizations such as the UN and ISO.

**Research actors** are recurring across these sectors, and there are more examples of cross-sector cooperation and investigation in the scientific realm. The research community can still be divided into a number of groups with different focus and interests, and there are a few highly relevant cross-domain platforms and consortia that can have a great influence on the development of the metallurgical biocarbon market.

Finally, there are actors in **civil society** and the NGO sphere particularly on the side of environmental protection and climate action.

### 3.1.2 Agriculture

Today, a lot of the interest for biocarbon resides within the agricultural sector. In particular smaller, ecologically minded farmers show a large interest in methods for producing biocarbon themselves at small scales, and using them for soil improvement and carbon sequestration. However, there are also larger agricultural actors considering deploying biocarbon additions to crop fields or as part of livestock feed. So far, there does not seem to be a large industrial base for the production of biocarbon for use in agriculture, and what exists in Sweden focuses on using local agricultural, urban or forestry byproducts as feedstock.

The utility and effect of carbon additions to soil can vary greatly between different climates and cropping systems. There is a global community of agricultural biocarbon users, though again the production seems to be mostly local and small-scale.

There has been some research interest into biocarbon production from fast-growing broadleaves that can be planted on marginal farmland<sup>5,6</sup>. This could be a complementary source of biomass but does not seem to be the focus for most actors planning to produce metallurgical biocarbon, possibly for cost reasons. Rather, most actors seem to be focused on utilising byproduct from forestry and forest industries, to avoid creating additional extraction pressures on land ecosystems.

Swedish farming is rather decentralised in the sense that there is a large number of farmers cultivating their own or leased land. These farmers are supported by larger institutions such as cooperatives, agricultural financiers, farming institutes and producers of machinery and feedstocks. Agricultural practices can be heavily impacted by regulations and incentive programmes such as EU agricultural subsidies. Therefore, the regulating bodies creating agricultural policy and funding subsidy programs are key actors in the sector.

Most national and international organisations focusing on biocarbon, such as Biokol Sverige, European Biochar and IBTC originate within the sphere of agriculture and soil improvement, although many of them have come to encompass broader perspectives and multiple use cases – such as metallurgical biocarbon or use in the construction sector. This growing interest for metallurgical and other heavy industries seems to be relatively recent in arenas like the European Biomass Conference and Exhibition, which is dominated by agriculture and bioenergy perspectives.

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<sup>5</sup> (Olofsson and Börjesson, 2016), available at [www.f3centre.se](http://www.f3centre.se).

<sup>6</sup> [Trees For Me Project 12](#)

### 3.1.3 Forestry and forest industries

Sweden is the EU country with the largest area of wooded land, followed by Finland<sup>7</sup>, and the second largest harvester of lumber after Germany<sup>8</sup>. About half of Swedish forests are privately owned by individuals, a quarter is owned by privately owned limited companies. The largest single owner of forests in Sweden is the state-owned company Sveaskog, owning ca 13% of all forests – 3.1 million hectares<sup>9</sup>. Many private forest owners coordinate forest management and biomass refining through owner cooperatives – Södra Skogsägarna<sup>10</sup>, Norra Skogsägarna<sup>11</sup> and Mellanskog<sup>12</sup>. Although they do not own it directly, these cooperatives have a considerable impact on the actual forestry activities carried out all over Sweden, and own some downstream forest industries like pulp mills and sawmills.

Forest industry actors and forest owners have a great vested interest in policies regulating or limiting biomass extraction and forestry practices. Large forestry concerns in Sweden like Sveaskog and Södra Skogsägarna are active in developing new forestry-based products and markets. Metallurgical biocarbon is one such potential future market, which could potentially provide higher-value valorisation of coproducts. So far metallurgical biocarbon does not seem to be widely discussed or explored in this sector, although discussions in the course of this project indicate that this might be changing. Forest industry actors could play a key role in developing metallurgical biocarbon markets, as biomass access and quality is a central concern to expanding biocarbon supply chains. Through partnerships and ownership of processing industries, these actors could facilitate supply both of primary materials and of woody byproducts suitable for biocarbon production.

There is a global market for many wood-based products, so supply from other countries complements domestic supply. In fact, Sweden has had a net import of woody biofuels of around 2-6 TWh in 2015-2023<sup>13</sup>. These imports are mainly from neighbouring countries – Norway, Latvia, UK, Germany and the Baltics. Before 2022, Russia was one of the largest suppliers, but since the start of the Ukraine war, imports have ceased completely. Imports from outside of Europe are small, but in periods both Brazil and Canada have exported substantial volumes of wood fuels to Sweden. Russia, Brazil and Canada together represented ca 9% of all Swedish wood fuel imports 1995-2024<sup>14</sup>. This shows that global biofuel markets cannot be fully ignored, but the regional supply and demand has a more direct impact.

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<sup>7</sup> (Eurostat, 2021a)

<sup>8</sup> (Eurostat, 2021b)

<sup>9</sup> (Skogsstyrelsen, 2025)

<sup>10</sup> (Sodra.com, 2025)

<sup>11</sup> (Norraskog.se, 2025)

<sup>12</sup> (Mellanskog.se, 2025)

<sup>13</sup> (Energimyndigheten, 2026a), " Import och export av sönderdelade oförädlade trädbränslen, GWh, 2013- " EN0122\_4

<sup>14</sup> Statistiska Centrabyrån Statistikdatabasen, " Varuimport från samtliga länder efter varugrupp KN 2,4,6,8-nivå och handelspartner, sekretessrensad, ej bortfallsjusterat. År 1995 – 2024"

### 3.1.4 Construction and green infrastructure

The use of biocarbon in the construction sector is also garnering attention. Biocarbon can be added to concrete as a partial replacement for some of the usual aggregates – reducing concrete weight and providing an inherent carbon sink, offsetting some of the climate footprint of ordinary Portland cement.

Biocarbon can also be used as a component in filling materials in green infrastructure in urban settings. The material can improve permeability and drainage in plant- and rain beds, while also providing long-term structural stability. There are some actors marketing construction products with biocarbon additives, but so far this seems to be a niche use case. A driving force for these applications in Sweden seems to be municipal energy producers with facilities that coproduce solid biocarbon (e.g. Stockholm, Norra Skåne) looking for ways to valorise it. These applications have not been in focus for the HåBiMet project, and few actors in this sector have been mentioned as key stakeholders in workshops and interviews.

### 3.1.5 Metal industry

Metal producers in Sweden, Europe and across the globe are under pressure to defossilise and decarbonise their value chains. Actors with a large current carbon footprint are looking for cost-effective and credible ways to reduce their climate impact, but most are also active in a competitive commodity marketplace, where price is key for competitiveness. Sweden has a large mining sector, but most fossil fuel consumption relates to the production of refined metals. The steel sector dominates both in Sweden<sup>15</sup> and globally<sup>16</sup>, being the second largest industrial emitter of CO<sub>2</sub>, but Sweden also has production of copper, ferrochromium, and aluminium. Other metals produced in Sweden are mainly coproducts to copper production, and the biocarbon demand for their refining can be grouped with copper production. Steel and ferrochromium producers are the largest consumers of coal and coke, and represent the largest expected demand for metallurgical biocarbon.

Considerable research has been devoted to developing and evaluating metallurgical biocarbon, supported and coordinated by industrial organisations such as Jernkontoret or EUROFER, research funds at national and EU level, and performed by research institutes and universities. There are also a small number of biocarbon producers whose main focus is metallurgical biocarbon production (e.g. Envigas, Vow Green metals, Arctic Heat).

Actors like Höganäs (metal powders), Outokumpu (stainless steel) and Vargön (ferrochromium) are early adopters of metallurgical biocarbon, and key actors in shaping the market and quality demands. The largest steel producer SSAB already sells fossil-free steel grades produced with biocarbon and biomethane in Electric Arc Furnace (EAF) plants in the US and are expected to use considerable amounts of

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<sup>15</sup> (Naturvårdsverket, 2025)

<sup>16</sup> (World Steel Association, 2025)

biocarbon in the two EAF facilities being built in Oxelösund and Luleå. The green steel startup Stegra are also expected to be a potential large consumer of metallurgical biocarbon. Even though the specific carbon demand per tonne of product is lower for EAF steel than for instance ferrochromium, the sheer capacities of Stegra and SSAB steel plants means they would dominate metallurgical biocarbon demand in Sweden if they fully transitioned away from fossil materials.

In other parts of Europe and the world, there is interest in biocarbon as a partial replacement for fossil carbon in blast furnaces, which could represent an enormous potential demand. Furthermore, production of base metals such as chromium, nickel, manganese and silicon do not have mature technologies to replace carbon as a reducing agent with hydrogen, and have a very high specific need of carbon per tonne produced metal or alloy. Therefore, the Swedish market may be impacted both on the supply and demand side by neighbours like Norway and Finland, that have modest steel sectors but considerable production of other metals. In particular Norway with heavily carbon-dependent industries like Elkem or Fesil but may have a total demand comparable to Sweden's, but with considerably smaller forestry output.

### 3.1.6 Energy

From some of the earliest investigations into the use of biogenic carbon in modern steelmaking, residue biocarbon from CHP gasification boilers have been discussed as a possible source of supply. Today, the District Heating sector is among the largest Swedish purchasers of forestry biomass (generally in the form of byproducts such as tops and branches or sawdust pellets). In Europe, most woody biomass is eventually used for energy production<sup>17</sup>, though it may have gone through several uses as construction material or cellulose products first.

Some energy companies, such as Stockholm Exergi, with a large use of biomass in their boilers, are developing carbon capture technologies in order to become carbon negative. This include bioenergy production with carbon capture, but also pyrolysis to coproduce heat and biocarbon, which can be sequestered as a carbon sink. Some companies (e.g. Meva energy, Solör bioenergi) also investigate selling biocarbon for metallurgical purposes as a way to increase the economic viability by delivering energy to local industry. Technology providers such as Bioshare have developed methods to either construct gasifier units capable of shifting production toward heat, gas or solid biocarbon, or retrofitting existing boilers to this end.

Other parts of the energy sector seek to use biogenic CO<sub>2</sub> or bio-syngas to produce fossil-free fuels such as Sustainable Airplane Fuel (SAF), biomethane or e-diesel<sup>18,19</sup>. Such production could be integrated with pyrolysis or biomass gasification, to further extend the lifecycle of carbon atoms before returning to the atmosphere.

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<sup>17</sup> (European Environment Agency, 2023)

<sup>18</sup>(d'Amore *et al.*, 2023), [doi.org/10.1016/j.enconman.2023.117170](https://doi.org/10.1016/j.enconman.2023.117170)

<sup>19</sup>See also projects like: <https://project-circulair.eu/>

Overall, the Swedish energy sector has a large current supply of forestry biomass residues, and has a considerable interest in increasing the value-add from conversion of these materials. Metallurgical biocarbon and efficient valorisation of pyrolysis gases are promising options to achieve this.

Further, the broader regional and global energy landscape also impacts the conditions for Swedish metallurgical biocarbon. The Ukraine war has impacted energy prices<sup>20</sup> and biomass availability, and the years after the full scale invasion has seen a notable increase in Swedish wood fuel prices<sup>21</sup>. High and volatile fossil fuel prices can act as a driving force for increased local biofuel production. This in turn could enable an expansion of biocarbon production, but also cause a shortage of biomass – all depending on the choice of biomass and valorisation technology.

Since the production of forestry byproducts is determined by the demand for primary forestry products, the supply of byproducts is not very elastic. If demand for these materials increases rapidly, they may face a prize crunch – undermining the profitability of biocarbon production. Since biomass cost and supply security is crucial to producing cost-competitive metallurgical biocarbon of a reliable quality, choices made by energy actors with regard to biomass supply can have a large impact on the biocarbon industry.

Finally, national and European climate regulations also impact the strategic choices of energy actors with regard to the use of biomass. Allocation of free emission rights within the ETS, the classification of biogenic greenhouse gases, and the cost of emissions are part of the economic balance for steel actors, so regulatory bodies creating such policies and the appointed monitoring agencies have both direct and indirect impact on metallurgical biocarbon market formation.

### **3.1.7 Policy makers, regulators and agencies**

Section 3.2 will provide an overview of national and supranational policies with an impact on metallurgical biocarbon market development. This subsection is a brief introduction to the political entities that create or implement policies impacting metallurgical biocarbon.

#### **Global actors**

The fundamental driving force for the interest in utilising biocarbon in metallurgical processes stem from concerns about global warming, and treaties such as the Paris Agreement mandating a reduction in green house gas emissions. As such, the UNFCCC and the Conference of the Parties (COP) are key institutions, providing the framework for global climate cooperation.

Another global body which was recently made very relevant to biocarbon trade is the International Maritime Organization. It is a UN agency responsible to ensure security

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<sup>20</sup> (Sun *et al.*, 2024), [doi.org/10.1016/j.heliyon.2024.e34712](https://doi.org/10.1016/j.heliyon.2024.e34712)

<sup>21</sup> (Energimyndigheten, 2026b)

and safety of shipping, and prevention of marine pollution by ships. IMO creates requirements and limitations for the safe handling and transport of all kinds of goods, and recently limited the permissibility of bulk maritime transport of biocarbon materials.

Independent of the UN, the International Organization for Standardization (ISO) creates international standards for goods, services and processes. At ISO level there is an active technical committee (TC 238) developing standards for “Solid Biofuels and Pyrogenic Biocarbon”. The recent expansion to include pyrogenic biocarbon should mean that most or all metallurgical biocarbon materials could be covered by standards developed in the committee. Work within TC 238 includes developing general requirements for the product category, and a materials based classification, as well as standards for safe handling and storage. The TC is led by a Swedish secretariat, and there is a corresponding technical committee within the Swedish standards institute SIS – “SIS/TK 412 Fasta bränslen”.

#### **EU actors**

As an EU member, Swedish entities are subject to policies created by the European Commission, sometimes requiring approval by the EU parliament and/or the European Council. The European Commission has been promoting and implementing policies aimed at achieving climate neutrality by 2050, with policies such as the European Green Deal and Fit For 55. Bioenergy, carbon capture and carbon sequestration in forests and other land ecosystems are important components of this strategy, and there has been recurring criticism from the Commission aimed at Swedish forestry practices and levels of biomass extraction.

#### **Swedish actors**

The *Swedish parliament* is the primary legislator with power to levy taxes, create subsidies, and create environmental legislation that goes beyond EU law. Swedish government agencies such as *Skogsstyrelsen*, *Jordbruksverket*, *Energimyndigheten*, and *Transportstyrelsen* monitor the adherence to regulations in their respective domains (forestry, agriculture, energy, environment and transport), advice businesses within their fields on good practice, and compile relevant statistics. Energimyndigheten is also one of the Swedish state agencies tasked with allocating research funding.

*The county administrative boards (Länsstyrelserna)* are the government representative agencies in each Swedish county, and are responsible for many tasks related to environmental compliance, such as granting environmental permits for industrial projects.

### **3.1.8 Research initiatives**

Biocarbon research shows up in a number of different fields, but can generally be said to focus on biomass sourcing, conversion of the biomass, or utilisation of the conversion products (including solid biocarbon). Agricultural and land sciences has a key role in this landscape, as it can encompass all of these steps, though researchers in

this discipline often focus more on biomass sourcing or different utilisation cases. In Sweden, SLU is the central actor in both agricultural and forestry research.

Energy science and chemical engineering departments in institutions like SLU, KTH, LTU, Chalmers and others investigate conversion processes like pyrolysis. Some focus on optimising energetic yield by efficient coproduct valorisation or by adjusting process parameters<sup>22</sup>, others investigate how biocarbon properties are affected by process conditions, raw materials or secondary treatments like leaching<sup>23</sup>. These institutions have also performed research into the supply chain, life time environmental impact and energy system implications of biocarbon system.

Metallurgical research has primarily been focused on understanding how biocarbon properties such as fixed carbon and chemical composition affects performance in different metallurgical processes. There have also been trials performed from laboratory scale up to industrial scale to develop and evaluate biocarbon replacement for various fossil input materials. The above mentioned metal industry actors have been a very important part of this research, having conducted many of the large-scale trials. Swerim, RISE, LTU and KTH are the most prominent Swedish research institutions doing research on metallurgical use of biocarbon materials. Many of the practical challenges to using biocarbon in pyrometallurgy are related to the physical characteristics of the material, so considerable research has gone into agglomeration of biocarbon. This includes co-agglomeration of biocarbon and other input materials, for instance oxide byproducts that are recirculated for increased metal yield.

There are a few examples of research projects crossing sectors and looking at wider market conditions or supply chains, often related to energy system analysis. Some such projects are:

- HåBiMet<sup>24</sup>
  - As can be seen in section 1.2 and this project report.
- Innovationsklustret Gröna kolatomer<sup>25</sup>
  - A Swedish initiative (2023-2025), led by Energiforsk with support from the Swedish Energy Agency (Energimyndigheten), aims to build a circular and resource-efficient value chain for biogenic carbon atoms. It brings together companies, academia, authorities, and organisations to accelerate market solutions, strengthen cross-sector networks, and provide input for policy and regulatory frameworks to help Sweden reach net-zero emissions by 2045.
- Rest till Bäst<sup>26</sup>

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<sup>22</sup> E.g. [LTU](#), [Chalmers](#), [RISE](#), [KTH](#)

<sup>23</sup> E.g. (Vattaparambil Sudharsan *et al.*, 2026), (Phounglamcheik *et al.*, 2020), (Yang *et al.*, 2022), (LTU, 2025)

<sup>24</sup> [HåBiMet | Swerim](#)

<sup>25</sup> [Innovationsklustret Gröna kolatomer | Energiforsk](#)

<sup>26</sup> [Rest till Bäst](#)

- A project partly financed by Vinnova (2017-2023) with the purpose of finding solutions for managing society's organic waste products (park and garden waste, sludge, algae and seaweed) as well as, create a sought-after useful product (biocarbon) while minimizing environmental impact and establishing a carbon sink.
- Trees For Me <sup>27</sup>
  - A Swedish interdisciplinary competence centre focused on fast-growing broadleaf trees to support sustainable forestry, materials, and energy systems in Sweden. It develops research and knowledge from seed to fuels, coordinating actors across forestry, energy and bioeconomy sectors.

### 3.1.9 Environmental interests and civil society

Perspectives of environmental and economic sustainability is recurring in biocarbon research in all domains. However, environmentalist organisations do not yet seem to be active participants in the discourse, or have any formulated position in support or opposition of the practice. On the other hand, there is a great deal of interest and engagement relating to sustainable forestry and agricultural practices, conservation and protection of forest biomes. Criticism of current forestry practices does not necessarily translate into scepticism for metallurgical biocarbon, but it is reasonable to think that some of it could be transferred if metallurgical biocarbon was more widely known, and comes to rely on forest biomass. For this reason, a brief outline of ongoing forestry discourse in Sweden is merited.

Sweden has long history of regulating its forestry. Since the early 1900s, there is a replanting requirement when forests are harvested. Since 1993 there is nominally an equal importance afforded to environmental and economic targets for forestry. However, the dominant harvesting practice is clear-felling, which has become controversial and received considerable criticism by environmental groups in the past decade or two. Many actors are advocating for alternative harvesting and planting practices, putting a greater emphasis on biodiversity and protecting old forests. The Church of Sweden, one of the country's largest private owners of forest land, has recently modified its forestry policy with the stated intention of putting a stronger priority on environmental and spiritual values.

The scale of harvested forests in Sweden has led to controversy in Europe and conflicts with the European Commission. Swedish forestry actors maintain that the greatest environmental benefit comes from continued harvesting for long-lifetime uses such as construction lumber, as carbon sequestration rates in wood plateaus and decreases after a certain age. Outdoor activities like hunting, hiking, foraging and skiing are very popular in Sweden, and the role of forests as recreational areas often intersect with the interests of forest industries, for instance some forestry practices seem to impact moose populations, and forest harvesting in popular recreational areas or areas with

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<sup>27</sup> [Forskningsprojekt - Trees For Me](#)

high natural values meets outrage. There are several civil society organisations that include direct actions such as occupations and blockages in their toolbox for protecting natural forests.

Forest preservation efforts has also come to align with political actions by Sweden's indigenous peoples – the Sámi, and their recognised traditional homeland Sápmi, including most of northern Sweden. Many remaining old forests with high natural values facing harvesting are located in Sápmi, and Sámi communities have on multiple occasions objected to logging on grounds of cultural significance, impact to traditional reindeer herding, as well as biodiversity and environmental impacts. Environmental groups and indigenous groups have often collaborated in direct actions against clear-felling, although not always when it comes to specific policy agendas for forestry reform.

## 3.2 Policy overview

This section will provide an overview of relevant policy areas that currently influence or have the potential to influence the development of the Swedish metallurgical biocarbon sector. Since there are virtually no policy instruments that references metallurgical biocarbon specifically, the overview instead maps those affecting the broader conditions for industrial decarbonization, biomass utilization and technological innovation in the metallurgical biocarbon industry. The intention of this overview is to clarify how existing policy frameworks affect the conditions under which the sector operates in order to provide a foundation/basis for continued policy related work. It is based on interviews, workshops, networking during conferences, literature reviews and online research.

To simplify the summary, the chosen policy instruments were grouped into categories based on patterns that were identified in the previously mentioned knowledge gathering activities. In other words, the categories were chosen based on uncertainties expressed by stakeholders from different parts of the metallurgical biocarbon value chain. These are the four categories:

- Carbon/GHG costing policies
  - Policies that put a price on greenhouse gas emissions, such as carbon taxes or emissions trading system
- Transport/storage safety
  - Policies regulating or supporting the movement, handling and storage of biomass or biocarbon throughout the value chain.
- Environmental regulation and permits
  - Regulations governing permitting, land use, resource management, and environmental impact relevant to biocarbon production and use
- Standardisation and certification
  - Technical definitions and quality requirements that determine how biocarbon is classified, measured and integrated.

### 3.2.1 Carbon/GHG costing policies

A range of policy instruments introduce explicit pricing on greenhouse gas emissions with the objective of creating financial incentives for emission reduction across industrial processes. These mechanisms influence the relative cost structures of carbon sources and can increase the competitiveness of low emission alternatives such as biocarbon.

Within the EU, the primary regulatory instrument affecting carbon pricing is the EU Emissions Trading System (EU ETS)<sup>28</sup>. These regulations apply an emission cap to energy intensive sectors and enable trading of emission allowances. As the free allocation of allowances is gradually reduced and allowance prices are increased overtime, the cost of continued use of fossil carbon in metallurgical processes has increased correspondingly. This dynamic has been expressed by industry actors as a key driver of interest in biogenic carbon substitution.

The EU ETS 2 is being established as a complementary system to EU ETS, covering fuel combustion in buildings, road transport as well as additional sectors related to small industry not covered by the EU ETS<sup>29</sup>. While its core design mirrors the existing system, the EU ETS 2 places the responsibility of monitoring, reporting and compliance on fuel suppliers. Although metallurgical biocarbon is not directly regulated under this scheme, its value chain may be indirectly affected through increased costs associated with fuel use in biomass and biocarbon transport. The full implementation of EU ETS 2 was recently postponed from 2027 to 2028.

The Carbon Border Adjustment Mechanism (CBAM) introduces a carbon cost to imported goods based on their embedded emissions<sup>30</sup>. CBAM aims to reduce carbon leakage risk by requiring importers of emission intensive goods to purchase CBAM certificates at prices linked to EU ETS allowance prices. This creates more comparable carbon cost conditions between European and non-European producers. In practice, CBAM may support domestic deployment of metallurgical biocarbon as imported metal products with lower production costs, but higher imbedded emissions become subject to equivalent carbon pricing. On October 8<sup>th</sup>, 2025, the regulation was amended<sup>31</sup> with deadlines for full implementation being postponed to 2027.

The Carbon Removal Certification Framework (CRCF)<sup>32</sup> is an EU framework that sets common rules for certifying carbon removal activities. It covers carbon farming, carbon storage in products, and permanent removals like biocarbon or Direct Air Carbon Capture and Storage (DACCS). Certification is based on strict quality criteria: qualification, additionality, long-term storage, and sustainability. The regulation introduces standardized monitoring, reporting, and verification (MRV), third-party audits, and an EU registry for transparency. Adopted in late 2024, CRCF aims to boost

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<sup>28</sup> [Directive 2023/87/EC - EUR-Lex](#)

<sup>29</sup> [ETS2: buildings, road transport and additional sectors](#)

<sup>30</sup> [Regulation - 2023/956 - EUR-Lex](#)

<sup>31</sup> [Regulation - EU - 2025/2083 - EN - EUR-Lex](#)

<sup>32</sup> [Regulation - EU - 2024/3012 - EN - EUR-Lex](#)

credible carbon markets, support climate goals, and create new revenue streams for farmers and innovators. For the further development of metallurgical biocarbon, the framework may have an accelerating effect through the support of a certified carbon credit market. Making its use financially attractive and driving investments in pyrolysis technology and industrial integration.

Swedish carbon tax applies to fossil emissions from sectors outside the scope of EU ETS<sup>33</sup>. Since its introduction in 1991, the tax has undergone repeated adjustments in rate and coverage to remain aligned with the broader European regulatory framework. Because the tax explicitly excludes activities regulated by EU ETS, its relevance to metallurgical biocarbon lies primarily in upstream processes and certain auxiliary operations. The upcoming full implementation of EU ETS 2 can be expected to influence the boundaries of the Swedish carbon tax to avoid overlap in taxation of fossil fuels, though the exact adjustments remain to be determined.

### **3.2.2 Transport/storage safety**

Transport and storage safety considerations play a significant role in shaping both the feasibility and cost structure of emerging biocarbon value chains. The self-heating properties of biocarbon have repeatedly been highlighted by industry actors as a critical barrier to large scale deployment.

For maritime transport, global rules are established by the International Maritime Organisation (IMO) through the International Maritime Solid Bulk Cargoes (IMSBC) and the International Maritime Dangerous Goods (IMDG) codes<sup>34</sup>. IMSBC governs the safe carriage of unpackaged solid cargoes and IMDG regulates the safe transport of packaged dangerous goods. For a material to be allowed to be shipped in bulk it needs to be included in the IMSBC system. Under the IMDG code, charcoal is classified as Class 4.2 (substance liable to spontaneous combustion) and is not allowed to be shipped in bulk unless specific conditions are met. As of 1 January 2025, an amendment to the IMDG code (amendment 42-24) entered into effect regarding charcoal of animal and vegetable origin. The amendment requires all charcoal materials to be classified as Dangerous Goods under designation UN 1361 CARBON<sup>35</sup> and forbids bulk transport. This updated regulation introduces Special Provision 978 which follows a phased implementation, ending with mandatory compliance 1 January 2026, and includes the following requirements:

- Materials must be weathered for 14 days or packed under inert gas and stored for 24 hours after pyrolysis
- Packing is only allowed if the material temperature is below 40°C on the day of packing
- Unpackaged bulk transport in containers is prohibited
- Cargo transport units require at least 30 cm of head space

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<sup>33</sup> [Sweden's carbon tax - Government.se](#)

<sup>34</sup> [International Maritime Organization](#)

<sup>35</sup> [Biochar Europe](#)

- Dangerous Goods Declaration must include.
  - Production date
  - Packaging date
  - Material temperature on the day of packing

This represents one of the most significant direct barriers to continued large-scale implementation of metallurgical biocarbon. The Swedish Transport Agency (Transportstyrelsen) enforces the IMDG and IMSBC codes for sea transport in Sweden and is thus responsible for translations of future codes incorporating metallurgical biocarbon products.

In the European Union, Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) framework regulates the placing of chemical substances on the market<sup>36</sup>. In Sweden, it is enforced by the Swedish Chemicals Agency (Kemikalieinspektionen)<sup>37</sup>. REACH requires manufacturers or importers of substances exceeding 1 tonne per year to register the substance with the European Chemical Agency (ECHA) and provide data on properties and uses for safety evaluation. ECHA has accepted that biocarbon can be registered within the charcoal dossier – EC No. 240-383-3<sup>38</sup> but uncertainties still remain regarding whether metallurgical biocarbon consistently falls under this classification. Variations in feedstock composition and intended industrial uses create interpretative challenges that continue to affect Swedish biocarbon producers, particularly in relation to compliance.

#### **Swedish laws governing handling, storage and work environment**

In addition to EU-level regulations, several national laws influence the handling and storage of metallurgical biocarbon.

The Fire Safety Act (Lagen om skydd mot olyckor, LSO), regulates responsibilities and requirements for preventing and managing risks.<sup>39</sup> Facilities and operations involving an elevated fire risk are required to conduct systematic fire safety work, including documented risks assessments, preventative routines, installation of appropriate equipment and regular inspections.

The Work Environment Act (Arbetsmiljöbalken, AML) complements LSO by regulating risks to employees during handling and processing of combustible or dust-forming materials<sup>40</sup>. Under AML employers must ensure to minimize exposure to fire hazards, airborne particulates and other health risks.

The domestic regulation ADR-S governs the transport of dangerous goods by road within Sweden and is harmonized with the European Agreement concerning the International

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<sup>36</sup> [REACH Regulation - Environment - European Commission](#)

<sup>37</sup> [Reach-förordningen - Kemikalieinspektionen](#)

<sup>38</sup> [Biochar Europe](#)

<sup>39</sup> [Lag \(2003:778\) om skydd mot olyckor | Sveriges riksdag](#)

<sup>40</sup> [Arbetsmiljölagen \(1977:1160\) | Sveriges riksdag](#)

Carriage of Dangerous Goods by Road (ADR)<sup>41</sup>. Myndigheten för Samhällskydd och Beredskap (MSB) is the competent authority in Sweden responsible for issuing and maintaining these regulations. If biocarbon is classified as Dangerous goods (as in the IMO codes), ADR-S may apply to national road transport. This can introduce additional requirements for packaging, labelling, documentation and vehicle safety standards during inland transport.

Together, LSO, AML and ADR-S form the core national regulatory framework that governs safe storage handling and transport of metallurgical biocarbon within Sweden. Just as ADR has been adapted to harmonize with the EU-level ADR, most Swedish regulations can come to be adapted in a similar fashion.

### 3.2.3 Environmental regulation

Environmental regulations form the foundation for the policy landscape that governs how metallurgical biocarbon can be produced, handled and integrated into Swedish industrial value chains. These regulations define the conditions for emissions, land use, waste management and permitting procedures. They influence both operational design of facilities and the feasibility of scaling production capacity.

The updated Industrial Emission Directive (IED 2.0) establishes EU level requirements for controlling emissions from industrial installations with significant environmental impact. The revised directive strengthens emission limit values, expands the scope of regulated activities and increase expectations for resource efficiency and circular use of materials. IED 2.0 also places greater emphasis on monitoring and reporting obligations while broadening the requirements for use of Best Available Techniques (BAT), defined on EU level in BAT Reference Documents (BREFs). This latest reform of IED is required to be transposed into national law by 1 July 2026<sup>42</sup>, which probably will entail revisions to regulatory frameworks such as Miljöbalken and associated ordinances. The final interpretation of which biocarbon related activities fall within the directives scope will depend on how Swedish authorities classify biocarbon in different stages of the value chain. This transposition process means that some Swedish regulatory details remain in flux, but it is clear that IED 2.0 will set more stringent environmental performance expectations.

The Renewable Energy Directive (RED III) establishes EU-wide sustainability criteria for biomass, land management and greenhouse gas performance. While metallurgical biocarbon is not used directly as an energy carrier, RED III influences forest biomass markets by defining which feedstocks qualify as sustainable within EU legislation. An important element of the updated directive is the cascading use principle, which prioritizes higher value material uses of biomass before energy use.<sup>43</sup> Although the principle is not legally binding in all sectors, it guides national interpretations of

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<sup>41</sup> [Föreskrifter om transport av farligt gods på väg och i terräng \(ADR-S\) | MSB](#)

<sup>42</sup> [Ändringar i IED](#)

<sup>43</sup> [Directive - EU - 2023/2413 - EN - Renewable Energy Directive - EUR-Lex](#)

sustainable biomass allocation and may influence the availability of certain forest byproducts for biocarbon producers.

The EU Deforestation Regulation (EUDR) introduces due diligence requirements for operators placing wood and wood-derived products on the EU market. Compliance requires geolocation data for harvest plots, documentation of deforestation free origin and risk assessment procedures.<sup>44</sup> For biocarbon producers, EUDR may influence feedstock procurement practices by adding new traceability and documentation requirements, particularly when sourcing residues or byproducts that fall within the scope of the regulation.

The EU Land Use, Land-Use Change and Forestry (LULUCF) Regulation governs how greenhouse gas emissions and removals from land and forests are measured, reported, and accounted for in achieving EU climate targets. The regulation sets binding accounting rules for different land types and harvested wood products. Up until 2025, the regulation only required member states to ensure that emissions did not exceed removals, called the “no debit” rule. From 2026 and onwards the regulation will enter a planned “period 2”, in which they must actively increase net removals instead, leading to stricter environmental requirements. For metallurgical biocarbon this could entail an increase in difficulties when sourcing biomass. As European countries aim to boost carbon sinks, more biomass may be retained in forests or directed towards more long-lived products.

#### **Swedish national law, permits and environmental grants**

The Swedish Environmental Code (Miljöbalken) is the central legal framework for environmental protection and sustainable development in Sweden. It consolidates 15 previous acts into one comprehensive law, covering everything from land and water use to waste, chemicals and noise regulations. Its purpose is to ensure that economic activities are conducted in a way that promotes sustainable development as well as protects human health and ecosystems. Miljöbalken is continually adapted to incorporate new EU regulations and directives.<sup>45</sup>

A central part of Miljöbalken is the permits and “notification” system where industrial activities which may cause significant environmental impacts needs to be reviewed. Depending on how the activity is classified different authorities are involved in the permitting or notification process. Those with significant impact (A-Activities) are reviewed by the Land and Environment court (Mark och miljödomstolen), activities with moderate impact (B-Activities) are reviewed by the respective Countys Administrative Board (Länstyrelser), and minor activities (C-Activities) require only municipal notification. The process includes an Environmental Impact Assessment. In the context of metallurgical biocarbon, the permit process might be slower due to the lack of

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<sup>44</sup> [Regulation on Deforestation-free products - Environment](#)

<sup>45</sup> [Miljöbalk \(1998:808\) | Sveriges riksdag](#)

existing standards and widespread knowledge regarding the value chain of the material.<sup>46</sup>

The same lack of knowledge is also apparent in national funding programs such as Industrikivet and Klimatkivet, where latter have funded a large amount of established biocarbon production in Sweden. Since there are no experts on metallurgical biocarbon in these organizations, applications for funding requires applicants to provide stronger decision support than in cases where inherent knowledge exists.

### 3.2.4 Standardisation and certification

At present, there is no widely recognised international standards for biocarbon materials. There are a number of ISO standards covering solid biofuels such as wood pellets, wood chips or solid biogenic waste from industry or municipalities. Standards include terminology, testing methods and product categorisation criteria. These standards are managed by the previously mentioned TC238 “Solid biofuels and pyrogenic biocarbon”. The inclusion of “Pyrogenic biocarbon” in this TC is recent, decided at the end of 2024<sup>47</sup>, and the work on standards explicitly including biocarbon are “Under development”, or ISO stage 20.00, meaning considerable work remains before a standard is published.

Biocarbon-related standards under development include general requirements and material-based classification of biocarbon materials. TC 238 Working Group 7 “Safety of solid biofuels” should be highly relevant for the work of establishing safety standards for biocarbon, but it is unclear whether such a standard is currently being prepared. The standard with working draft no. 20023, “*Solid biofuels and pyrogenic biocarbon — Safety of solid biofuel pellets — Safe handling and storage of wood pellets in residential and other small-scale applications*” covers safe handling of wood pellets for small-scale applications throughout the value chain. This particular standard does not seem to include pyrogenic biocarbon, but such activities may be forthcoming.

#### Certifications

Beside the ISO standardisation process, there are a few other organisations that have developed biochar certifications. The Ithaka institute, an “international network for carbon strategies”<sup>48</sup>, has developed the European Biochar Certificate (EBC).

The EBC was developed to minimize the risks associated with biochar production and use, and to support both producers and users of biochar in preventing or at least reducing potential hazards to human health and the environment. This is done through tolerance limits for heavy metals and other elements, and emissions and energy efficiency during production. Currently, the EBC is a voluntary industry standard in Europe, while it is obligatory for all biochar sold for agricultural use in Switzerland.<sup>49</sup> The

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<sup>46</sup> [Miljöbalk \(1998:808\) | Sveriges riksdag](#)

<sup>47</sup> [SIS Biokol nytt arbetsområde](#)

<sup>48</sup> [ithaka-institut.org](http://ithaka-institut.org)

<sup>49</sup> [European Biochar](#)

EBC has published several key documents to guide certification process for biochar and carbon sink (C-sink), including (i) Guidelines of the European Biochar Certificate, (ii) EBC Guidelines for the Certification of Biochar-Based Carbon Sinks, and (iii) Positive list of biomass feedstock.<sup>50</sup>

The EBC is monitored and awarded by Carbon Standards International, a Switzerland-based company belonging to the EASY-CERT group.

A more in-depth description of EBC is presented in Appendix 10.1.7.

Swedish certification organisation Sigill offers a carbon credit for carbon sinks achieved through biocarbon soil additions<sup>51</sup>. The certification seems to focus on carbon stability and long-term sequestration potential. It has no direct application for metallurgical biocarbon, but rather represents an alternative use for biocarbon materials.

No formal or informal standards for metallurgical biocarbon have been identified, and as shown in the *HåBiMet – Technical perspective* project, different metal actors are not consistent in their specifications or demands for biocarbon quality. Thus, both locally and internationally, certifications and industrial standards for biocarbon are more developed for land use purposes than for metallurgical use.

## **4 Analysis – Potential impacts on production and use of metallurgical biocarbon**

The overall regulatory situation for metallurgical biocarbon is that there is a considerable uncertainty – either as it relates to how the products should be categorised, and when it comes to the degree of impact different policy instruments might have. Industrial development for metallurgical biocarbon is harmed by this uncertainty, and by the few instruments directly limiting biocarbon handling specifically the 2025 IMO code amendment. As the overall challenges are scaling up, managing costs, and ensuring steady supply of a reliable quality, the uncertainties can be prohibitive by themselves, blocking long-term investment. However, frameworks such as ETS and other carbon costing regulation, environmental regulations and forestry directives do shape the conditions under which this industry is developing. The following sections contains more careful analysis of how the current landscape impacts access to woody biomass, the establishing and operation of biocarbon production facilities, and use of biocarbon in metallurgical industries. Section 4.2 discuss existing concerns about environmental risks of metallurgical biocarbon use and production, and how regulation relate to those risks. Finally, Section 4.5 summarises the key policy challenges and needs for the metallurgical biocarbon industry.

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<sup>50</sup> [European Biochar - EBC and WBC Guidelines](#)

<sup>51</sup> [Sigill carbon credits](#)

## 4.1 EU regulation impact on biomass supply

### 4.1.1 EU regulation and biomass supply

Swedish metallurgical carbon production often relies on forestry residues, waste wood, and industrial side streams. The availability of woody biomass for metallurgical biocarbon production in Sweden is affected by a complex interplay of EU and national regulations. Under the EU RED II/III, forest biomass must meet stringent sustainability and greenhouse gas (GHG) saving criteria to qualify as a renewable energy source.

The RED III mandates that Member States shall implement the “cascading use” principle in their support schemes (Article 3(3)), prioritizing its highest economic and environmental added value. According to RED III, the following order of priority for using woody biomass shall follow: (i) wood-based products, (ii) extending the service life of wood-based products, (iii) reuse, (iv) recycling, (v) bioenergy, and (vi) disposal. As an example of discouraged practices, the regulation specifies that “Member States should not grant direct financial support for the use of saw logs, veneer logs, industrial grade roundwood, **stumps and roots** to produce energy (Art. 3(3c)). Since metallurgical biocarbon would not be considered energy carriers, the materials exact relation within the current hierarchy is uncertain.

Woody biomass resources are increasingly in demand from several Swedish sectors, such as district heating, CHP plants, construction, agriculture, and transport fuels. Forest residues and by-products, such as sawdust and bark, are often considered as lower-tier biomass, though they are critical feedstocks such as for both biocarbon production and bioenergy generation. This competition may be intensified by the full implementation of ETS2 in 2027, which raises the cost of fossil fuels for heating in buildings and small industries, resulting in a shift toward biomass sources. Based on the RED II/III, the cascading use principle does not prohibit the use of forest residues for energy production, although the regulation requires that Member States to follow the “cascading use” principle and favour higher-value uses of woody biomass. By far, however, there is a lack of published research results to compare the value of woody biomass used for metallurgical biocarbon and bioenergy, serving as a basis for decision-making on biomass allocation in the context of RED III.

The increasing demand for sustainable transport fuels, especially in aviation, shipping, and heavy-duty road transport, is expected to intensify competition for wood biomass in the long term, including the residues and by-products used in metallurgical biocarbon production. For instance, ReFuelEU Aviation and FuelEU Maritime regulations (described in Appendix 10.1.11-12) drive long-term demand for sustainable fuels and impose stricter GHG intensity limits, potentially diverting biomass toward bio-oil and advanced fuel production rather than solid bio-carbon applications.

While Sweden’s abundant forest resources could help buffer pressures of woody biomass supply, EU-wide policies may still influence biomass resources availability in Sweden. In particular, the LULUCF Regulation (EU) 2023/839 sets a collective EU target of approximately 310 Mt CO<sub>2</sub>e net removals by 2030 and assigns Swedish national

goals, which may affect forest harvesting practices. Meanwhile, the Regulation on deforestation-free products (EUDR), amended by Regulation (EU) 2024/3234, introduces geolocation-based due diligence requirements starting December 2025 for large operators and June 2026 for SMEs, potentially increasing compliance costs for imported wood but enhancing trust in certified Swedish biomass. As implicated by the RED III, biocarbon production from woody biomass may be affected if feedstock is classified as primary biomass. In 2022, the Swedish Bioenergy Association (“Svebio”) points out that restrictions on primary woody biomass under RED III could possibly halt the expansion of forest biomass use, threatening Sweden’s ability to meet climate targets and increasing competition among sectors for residues and by-products, as well as impeding development of biocarbon production for industrial applications.<sup>52</sup>

Market incentives also shape wood biomass feedstock flows among different sectors. For example, the EU Fertilising Products Regulation (EU) 2019/1009, through Delegated Regulation (EU) 2021/2088, created a market for biocarbon as a fertiliser component under CMC 14. This has raised demand for clean woody biocarbon. The Carbon Removals and Carbon Farming regulation (EU/20240/3012) is expected to further increase the demand for biocarbon for permanent carbon storage from 2026. However, as the HåBiMet technical project observed, the qualities that make biocarbon most suitable for soil uses overlaps significantly with those properties making it less useful for metallurgy. Many of those properties correlate with choice feedstock, so it is not obvious that an increased demand for soil amendment biocarbon will significantly reduce the availability of biomass suitable for metallurgical biocarbon.

Financial frameworks also influence investment decisions: the EU Taxonomy Regulation (EU) 2020/852 and its Climate Delegated Regulation (EU) 2021/2139 affect capital costs for forestry and bioenergy projects. National funding programs like Industriklivet and Klimatklivet support biocarbon and biomass initiatives that meet sustainability criteria. Locally, Stockholm Biochar Project<sup>53</sup> has created a competing market for turning the city’s part and garden waste into renewable energy for heating while sequestering carbon by using biocarbon in soil, which may further tighten production of biocarbon for industrial applications.

In sum, RED III (Article 29 criteria and Article 3(3) cascading principle), the EUDR’s due-diligence regime, LULUCF targets, transport fuel mandates, and the fertilizer/biocarbon product market together define both the eligible pool of woody inputs and the cross-sectoral competition for woody biomass feedstocks in Sweden. Previous HåBiMet projects indicate that the physically available woody biomass in Sweden could support the projected demand for metallurgical biocarbon. However, if many actors are funneled to focus on specific biomass fractions (such as pellets from tops and branches), prices may spike and supply may not meet demand in an efficient way.

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<sup>52</sup> [Svebio Primary woody biomass impact assessment](#)

<sup>53</sup> [C40.org - Stockholm worlds first urban carbon sink with biochar](#)

## 4.2 Environmental concerns

The main motivation for using biocarbon instead of fossil carbon products in metallurgical processes is reducing environmental impact. Biogenic carbon does not require mining and does not inject carbon from the Earth's crust into the atmosphere. However, forestry, biomass extraction and processing are not without environmental impacts. This section will discuss the environmental impacts of metallurgical biocarbon, and how policies impact can contribute to minimizing or exacerbating them.

### 4.2.1 Increased lumber extraction as a result of biocarbon production

As has been outlined in Section 3.1.9, any initiative that could lead to an increased harvest of lumber may be controversial, and there is controversy surrounding what volumes and means of lumber harvesting that can be considered sustainable. Values that should be protected are both cultural, recreational and relating to biodiversity and environmental impact. There is not, however, a categorical opposition to forestry and lumber harvesting, and there is not yet a public awareness for the concept of metallurgical biocarbon. Thus, we should consider to what extent metallurgical biocarbon industry could be expected to increase extraction pressures and lead to greater forest harvesting, and to what extent policies affect this connection.

First, stating the obvious, if metallurgical biocarbon is produced from primary wood harvested or grown specifically for that purpose, an increased use of the material will increase lumber harvests. However, most Swedish actors (both in metallurgy and biocarbon production) are focused on using different woody residues rather than stemwood, as this both reduces costs and strengthens environmental benefit.

These residues could either be pure co-products such as bark, sawdust or wood chips made from damaged wood, tops or branches, or they could be secondary harvested wood not suitable for the main commercial markets such as pulp or lumber. These secondary harvests would typically be hardwoods like aspen or birch, that are harvested along with the softwood main crops of pine or spruce in the clearfelling harvesting practice. Those hardwoods that meet the product requirements for pulp wood or lumber can achieve a higher price in those markets, some fraction is however sold as fuel wood. Carbon pricing policies could increase the demand for biomass to fossil-dominated industries such as transportation and the chemical industry. However, they should also favour an increased use of lumber in the construction sector, both as a way of reducing carbon-intensive steel and concrete, but also potentially as a carbon-removal method if the building lifespan is long enough.

From another perspective, an industry reliant on the byproducts from a separate industry can be quite sensitive to price-crunches, if demand for those byproducts increases rapidly. As the supply is not determined independently, but rather is an effect of the demand for other products (pulp and lumber in this case), an increase in demand cannot be met with an organic increase in supply. This leads to a rapid price increase.

When it comes to the wood products labelled as “fuel wood”, Sweden had a net import of ca 2.7 million tonnes in 2024<sup>54</sup>. Most of this import comes from North European countries – notably Latvia, Estonia, Norway, the UK, Finland and Germany.

Overall, both policy intentions and current market dynamics favour the use of wood for products rather than as fuel, but there is a considerable volume of byproducts already being used in Sweden. The HåBiMet project estimation of biocarbon need is that Swedish metal industry needs between 280 and 420 kton of biocarbon, which could be covered either by an increased extraction of tops or branches in Northern Sweden (ca 15% of estimated sustainable unused harvesting potential). In energy units, this is 2.3-3.5 TWh of woody biomass, which can be compared to the total Swedish bioenergy consumption of ca 135 TW<sup>55</sup>. Most likely scenarios for large-scale production of metallurgical biocarbon will entail an efficient valorisation of all energy co-products: gas, oil and heat. About half the energy content of woody biomass remains in the solid biocarbon product, the rest will be found in said co-products which can be valorised in district heating. Although 3 TWh is a considerable volume, it is dwarfed by the current size of Swedish bioenergy markets, making it unlikely that it would be a major driver of increased wood harvesting. However, the impact on specific product categories such as fuel wood chips, sawdust and sawdust pellets should be investigated more closely – as these may be subject to price spikes due to low supply elasticity if other sectors focus on the same raw materials for defossilisation.

#### **4.2.2 Competing uses for biomass and biocarbon**

Swedish electricity is already largely independent from fossil fuels, and Sweden’s path toward carbon neutrality revolves around defossilising heavy industries like the steel sector, low-emission transportation as well as continued carbon sequestration in forests. Many sectors can achieve de-carbonisation through electrification, but a few sectors require carbon inputs, or are already reliant on bioenergy. In the first category are mainly metal industries and the petrochemical industry. In the second category are many district heating providers, to some extent the vehicle fuel industry which has been using partial substitution with biofuels to reduce emissions, and pulp and paper industries.

Out of these, district heating could feasibly be supplied from many other sources than bioenergy, but the current infrastructure and grid designs are often optimised for high-temperature transmission and CHP plants burning energetic fuels with some share of biomass, sometimes relying fully on woodchips or wood pellets as fuel.

The chemical industry has signalled a very large potential need for biomass inputs, which some estimations put as high as 25 TWh/year<sup>56</sup>. In this industry, the primary need

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<sup>54</sup> SCB Statistikdatabasen 2025, ”Varuexport till bestämmelseland. Ej bortfallsjusterat, ton efter varugrupp enligt KN, handelspartner och år”

<sup>55</sup> Energimyndighetens Statistikdatabas 2025. Total energitillförsel per energivara fr.o.m. 1970, TWh. PxWeb.

<sup>56</sup>(Fossilfritt Sverige, 2021)

seems to be for hydrocarbon precursors which can be turned into commercial chemicals, but also for sugars, starches and similar organic compounds already present in many biomass categories. Woody biomass might be attractive as there is already large production and supply, including some refined sidestreams from the paper and pulp industries such as lignin or hemicellulose. However, many other biomass categories such as municipal solid waste, biogas and agricultural waste should also be possible ways of fulfilling this demand<sup>57</sup>. Still, until the chemical industries begin introducing biogenic feedstocks at a large scale and make clear what kind of raw materials they view as their supply base, it is difficult to gauge if they will directly compete for resources with a metallurgical biocarbon industry.

The aviation industry has several ongoing projects looking to produce e-fuels from biogenic CO and CO<sub>2</sub> streams, which could be a competing use of biomass, but could also be an opportunity for synergies, for instance by valorising pyrolysis gases or oil.

On the whole, there is both current and possible future competition for biomass – but metallurgical biocarbon production could be a more high-value application both from a cascading use perspective, and when it comes to product price. Nevertheless, supply security and price stability outlooks contain a high degree of uncertainty, due to the expected but so far unspecific biomass demands by other industrial sectors.

#### **4.2.3 Increased water use as a result of biocarbon production**

Large scale biocarbon production may require and increased local water withdrawals, which can put pressure on freshwater resources in certain regions. In addition, several stages along the value chain, from biomass handling to pyrolysis residues, carry potential for leachate formation, nutrient runoff and accidental releases. Such contamination risks could adversely affect both freshwater systems and marine environments if not adequately managed.

While biocarbon can provide positive water-quality benefits when used in filtration applications or produced from sewage biosludge, these benefits do not eliminate the need for robust water protection measures at production sites.

#### **4.2.4 Air quality, dust emissions and fire-related hazards**

Biocarbon production also introduces environmental concerns linked to air quality, dust emissions, and fire safety hazards. Since biocarbon is prone to generating fine particulate dust, which can disperse beyond industrial sites and negatively affect local air quality. Furthermore, the materials well known self-heating properties poses as an additional environmental obstacle. Although thorough care to workplace safety, standardized handling protocols, and enhanced fire-prevention systems, in line with

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<sup>57</sup> See (Nylund *et al.*, 2025)[doi.org/10.5071/33rdEUBCE2025-IBO.3.2](https://doi.org/10.5071/33rdEUBCE2025-IBO.3.2)

ALM and LSO, can significantly reduce these hazards they remain critical environmental considerations as production grows.

### 4.3 Production of metallurgical biocarbon

Two key regulations could be crucial for future biocarbon production in Sweden: the IED 2.0 environmental permit and alternative revenue streams. In terms of environmental permitting, Annex 1 of the IED 2.0 outlines categories of activities covered, including “Gasification, liquefaction or pyrolysis of coal and other fuels (in installations with a total rated thermal input of 20 MW or more”. Small scale biocarbon producers are likely not large enough to be covered, but production at a scale suitable to supply metal industries would likely exceed the 20MW threshold. Current BREFs (e.g. Waste Treatment, Energy Efficiency) do not adequately address pyrolysis-specific issues, such as emissions, feedstock variability, and operational factors. According to Article 70i of IED 2.0, the European Commission shall adopt an implementing act by 1 September 2026 “to establish uniform conditions for operating rules for each of the activities referred to in Annex Ia.” This implies that Swedish pyrolysis plants falling under the scope of by IED 2.0 will be subject to stricter environmental permitting requirements and enhanced information reporting obligations. Probably the IED 2.0 environmental requirements will increase the CAPEX (capital expenditure) and OPEX (operating expenditure) of biocarbon production to some extent.

#### 4.3.1 Financing and carbon credits

The Swedish biocarbon production has the possibility to receive some funding from the Industrial Leap (“Industriklivet”) to reduce CAPEX for early-stage pyrolysis plants, though the application process is often competitive.

For EU- and Sweden-based biocarbon producers, alternative revenue streams have been anchored in regulations, certification schemes, and market signals, which can potentially affect production investment viability and even metallurgical biocarbon market price. Firstly, biocarbon producers can monetise carbon dioxide removal (CDR) on the voluntary market and prospectively under the EU’s new certification regime. Examples of the voluntary market are (i) the EBC “C-sink” scheme, which certifies the long-term storage potential of biocarbon embedded in soils and products, and (ii) Puro.earth CORCs (CO<sub>2</sub> Removal Certificates), issued for biocarbon applications that meet specific criteria for durable carbon sequestration.

In Sweden, IP Kolkrediter was launched on 1 July 2024 by HS Certifiering, enabling landowners and biocarbon users to certify and sell Sweden-based credits. In parallel, the official and EU-wide currently voluntary Carbon Removal Certification Framework (CRCF) aims to create a trusted certification system for permanent carbon removals, carbon farming, and carbon storage in long-lasting products. EBC and CRCF push higher-value long-duration applications for some biocarbon output (e.g., in materials), indirectly affecting price and availability for metallurgical biocarbon. Importantly, these additional carbon revenues apply only for storage-oriented (C-sink) biocarbon, e.g. with a benchmark of 100-year permanence in both CRCF and EBC. Acting as a reducing

agent, carburizer, or slag conditioner, however, the carbon in metallurgical biocarbon is re-emitted at high temperature in steelmaking and the production of ferrochrome, which cannot be certified as a durable carbon removal under the existing certification schemes. Even in metallurgical applications, some carbon will remain in the metals, but there is no clear path to certifying this as a carbon sink. If such metal carbon sinks are ever to be certified in a similar way, a better understanding of the expected life cycle of biogenic carbon stored in metals may be needed.

Thus, agricultural biocarbon use that creates carbon sinks can access some direct financial advantages by selling carbon removal certificates, but this is not currently an option for metallurgical biocarbon.

#### **4.3.2 Swedish regulations impacting biocarbon production**

Substituting fossil coke with biocarbon in such processes may typically trigger a variation in the environmental permit, which must demonstrate compliance with BAT-AELs (Best Available Techniques – Associated Emission Levels) and show how the change supports the installation’s transformation plan. Even in the best-case scenarios, the process of updating permits will be a cost in time and money, which would not normally be incurred when switching between two sources of fossil fuels.

Another factor that may influence the industry-scale deployment of metallurgical biocarbon is the tightening of environmental permit requirements following the transposed IED 2.0 at the national level. Annex 1 of the IED 2.0 outlines the categories of activities subject to the regulation, including “Production and processing of metals”, such as “production of pig iron or steel (primary or secondary fusion) including continuous casting, with a capacity exceeding 2.5 tons per hour”.

As mentioned, the current situation with the IMSBC and IMDG codes from IMO represents a major challenge to the increased implementation of metallurgical biocarbon. While not specifically a Swedish regulation, all IMO codes and rules are translated and nationally implemented through Transportstyrelsen. Updating these codes is typically a two-year IMO-process, meaning that if new scientific evidence supports safer classification, regulatory relief will not be immediate. A similar challenge may exist for road transport, where biocarbon fall under ADR-S.

In general, with upcoming EU level regulatory changes and implementations, such as EU ETS 2, existing Swedish laws, frameworks and policy instruments will need to be revised to ensure alignment with new requirements. This means that both the current and future regulatory landscape in Sweden is in a state of transition, creating additional uncertainty for all parts of the metallurgical biocarbon value chain. These uncertainties span from biomass sourcing to carbon related taxation.

## **4.4 Use and adoption of metallurgical biocarbon**

The deployment of metallurgical biocarbon in Sweden’s iron and metal sector is shaped by a complex interplay of EU and national policies, regulations, certification schemes,

and market dynamics. These factors influence the technical acceptability, cost competitiveness, profitability, and scalability of biocarbon as a decarbonization tool in the sector.

As mentioned above, most of the carbon in metallurgical biocarbon cannot be certified as C-sink with tradable carbon credits in all the current certification schemes. Under the circumstances, one of the main drivers is CBAM that gradually prices the carbon emissions of imported iron and steel, increases the relative market value of Swedish steel with lower process emissions, and strengthens incentives to substitute fossil reductants with biocarbon where technically feasible and cost-effective. Another strong driver is the EU ETS1 where biogenic CO<sub>2</sub> emission from biocarbon can be zero-rated (i.e., emission factor = 0), given that the biocarbon meets sustainability and GHG saving criteria specified in RED II/III. In fact, there is an urgent need for the iron and metal companies to reduce the fossil carbon emissions, since free allocation of ETS allowances to companies has been gradually scaled down. The free allocation of allowance is determined partly using EU-level product benchmarks that are set in advance.<sup>58</sup> Table 4 shows examples of the benchmark value change between 2013-2020 and 2021-2025. To achieve the tighter goal of ETS cap reduction by 62% by 2030 compared to 2005 levels, the EU-wide annual reduction factor has been increased to 4.3% during the period 2024-2027 and to 4.4% from 2028.<sup>59</sup>

The pace and scale of metallurgical biocarbon deployment will also largely depend on its cost competitiveness relative to fossil-based coke. At present, the price of biocarbon is much higher than fossil coke, for instance, four times based on an interview (Örell & Nylund, 2025)<sup>60</sup>. In this context, the EU ETS serves as a key influencing factor. On 1 September 2025, the EUA price was around €74 per tonne of CO<sub>2</sub> (Figure 1), which can substantially increase the effective cost of using fossil coke in EAFs, SAF, and other carbon-intensive processes.

Table 4: Changes of the product benchmarks related to the metal sector

Product benchmark	Benchmark value for 2013-2020 (kg CO <sub>2</sub> e/t product) <sup>61</sup>	Benchmark value for 2021-2025 (kg CO <sub>2</sub> e/t product) <sup>62</sup>
Coke	286	217
Sintered ore	171	157

<sup>58</sup> [https://climate.ec.europa.eu/document/download/a4c0cb40-35f9-4705-882d-b55382d03e9a\\_en?filename=2\\_gd2\\_allocation\\_methodologies\\_en.pdf](https://climate.ec.europa.eu/document/download/a4c0cb40-35f9-4705-882d-b55382d03e9a_en?filename=2_gd2_allocation_methodologies_en.pdf)

<sup>59</sup> [https://climate.ec.europa.eu/eu-action/carbon-markets/eu-emissions-trading-system-eu-ets/eu-ets-emissions-cap\\_en](https://climate.ec.europa.eu/eu-action/carbon-markets/eu-emissions-trading-system-eu-ets/eu-ets-emissions-cap_en); [https://climate.ec.europa.eu/document/download/d5276f6c-4355-438a-a0ef-0c03a9b34a39\\_en?filename=1\\_gd1\\_general\\_guidance\\_en.pdf](https://climate.ec.europa.eu/document/download/d5276f6c-4355-438a-a0ef-0c03a9b34a39_en?filename=1_gd1_general_guidance_en.pdf)

<sup>60</sup> Final report HåBiMet – Technical Perspective (Draft).

<sup>61</sup> [Eurofer joint statement](#)

<sup>62</sup> [Official Journal of the European Union 2021-03-15](#)

<b>Hot metal</b>	1328	1288
<b>EAF carbon steel</b>	283	215
<b>EAF high alloy steel</b>	352	268

In contrast, certified sustainable biogenic carbon from biochar is zero-rated under ETS monitoring and reporting rules, meaning it does not incur CO<sub>2</sub>-related compliance costs. If the carbon price rise or remain elevated, the cost savings from avoided EUA purchases enhance the economic viability of biocarbon on a per-tonne-of-fixed-carbon basis. Conversely, a sustained decline in EUA prices would reduce this advantage and extend the payback period for biocarbon investments. According to “The Enerdata Carbon Price Forecast 2030–2050” published on 24 November 2023, for instance, the ETS carbon price is expected to remain stable at €70-75/t CO<sub>2</sub>, and is likely to increase up to around €130/t CO<sub>2</sub> by 2040.<sup>63</sup>



Figure 1: EU carbon permit's price (€/ton CO<sub>2</sub>) in the past 10 years<sup>64</sup>

The growing market demand for low-carbon steel products is emerging as a strong long-run driver for the adoption of metallurgical biocarbon. As product-level carbon reporting becomes more widespread, e.g., in the forms of Environmental Product Declarations (EPDs) and forthcoming digital product pass (DPP), replacing fossil-based coke with biocarbon presents a promising and certifiable method for reducing cradle-to-gate CO<sub>2</sub> emissions in steel and FeCr production. Nevertheless, the fundamental economic question remains: how do the costs of biocarbon compare to conventional alternatives, and what procurement incentives or support mechanisms are available to enable its industrial-scale use over the long term?

From a broader perspective, the steel decarbonization pathway will be significantly shaped by EU strategies, policies and regulation, including the EU Hydrogen Strategy<sup>65</sup>

<sup>63</sup> [Enerdata.net - Carbon price projections EU ETS](#)

<sup>64</sup> [Tradingeconomics.com - Carbon](#)

<sup>65</sup> [COM/2020/301 - EUR-Lex](#)

and the associated rules for Renewable Fuels of Non-Biological Origin (RFNBOs), and the Industrial Carbon Management (ICM) Strategy<sup>66</sup>. These frameworks promote, for example, hydrogen-based direct reduction of iron (H<sub>2</sub>-DRI) followed by EAF operation, which is expected to reduce long-term demand for solid biocarbon in primary ironmaking, while also supporting the deployment of CCUS technologies. Despite this shift, biocarbon will continue to play a role in the metal sector in both the short and long term. In the near term, biocarbon remains viable for several metallurgical applications, including as a substitute in pulverized coal injection (PCI), a carburising agent in furnaces, and a binder in iron ore pelletization. Over the long term, biocarbon can also contribute to decarbonization in the metal sector. Furthermore, biogenic carbon-enriched off-gases from biocarbon based EAFs or SAFs could be integrated with CCUS technologies, potentially enabling both alternative revenue streams and certified carbon removals under the CRCF Regulation.

#### 4.5 Challenges and needs for the metallurgical biocarbon industry

- Metallurgical biocarbon would most likely be benefited by increased EUA prices
- High prices for carbon removal certificates could aid the overall development of biocarbon production, but does not presently provide any direct benefit for metallurgical biocarbon
- Production facilities are likely to be covered by ETS1 or ETS2, unless very small scale. Since metallurgical needs are large and concentrated, they are more likely to use the large facilities covered by these frameworks than those aiming to sell to agricultural actors. However, since biogenic emissions are factor 0, the main impact will be one of being better than fossil alternatives.
- Clarity is needed in how to understand biocarbon in relation to cascading use principles.
- Standardisation will help reduce confusion and enable better use and trade across sectors.
- In particular, best practices and evidence-based standards for safe management and transport of biocarbon is crucial

## 5 Vision for a sustainable value chain of metallurgical biocarbon

Part of the project aim was to formulate a vision for a policy environment enabling a sustainable value chain for metallurgical biocarbon This intention is to describe what a constructive framework should achieve, and to a certain extent avoid it, rather than be a complete framework or set of policies. The purpose of a vision is to be forward-looking and aspirational; a vision should not be a concrete roadmap, but rather a tool to determine whether development is going in the right direction. The following proposed

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<sup>66</sup> [EU Industrial Carbon Management Strategy](#)

vision is intended as a starting point for further discussion, both within the value chain of metallurgy, as well as with actors outside this value chain. Given the global ambitions to move away from fossil fuel dependence, there is a growing demand for biobased resources. The projected demands are greater than what the global primary production can deliver, thus, there will be priorities and trade-offs to manage. This project focuses on metallurgical biocarbon creating benefit and minimizing harm, yet adopts a society-wide approach to consider other sectors' needs. The vision should be a baseline for shared priorities among all or most key stakeholders in the metallurgical biocarbon value chain. The work of evaluating or developing policies, will be supported by this vision.

This does not mean that the vision aims to be as bland and uncontroversial as possible, but rather it should be as strong and forward-looking as possible while still fulfilling the criteria of being acceptable to most or all key stakeholders.

Whether the proposed vision is actually acceptable to all relevant stakeholders is not yet established, and can't be fully verified as part of this project. However, final dissemination activities and project reporting will pay extra attention to feedback regarding the proposed vision, and incorporate these in the final project report.

After gathering feedback from consortium members and external participants from the final project seminar, the vision was finalized. During discussions it became apparent that the vision would benefit from being adapted to ease dissemination activities. Thus, the project group produced the vision in three different lengths: The original vision, a shortened vision and finally three headers representing the three respective sections of the vision.

## 5.1 Vision for a sustainable value chain for metallurgical biocarbon

### Long version

*The policy landscape for metallurgical biocarbon promotes safe and efficient use of biomass, a resilient supply chain, an efficient market for biocarbon and limitation of environmental impact to sustainable levels. To achieve this, metallurgical biocarbon should primarily be produced from biomass coproducts and side streams, in the long run completely avoiding biomass harvested solely for biocarbon, in line with the cascading principle, upholding adequate qualities.*

*Metallurgical biocarbon is used to de-fossilise hard-to-abate metallurgical processes, and there are incentives to use it where the climate impact reduction is greatest. Regulations and incentives are stable, communicated and transparent. Regulations and classifications of biocarbon are clear and harmonised across sectors, and take into account the multiple uses possible for biocarbon materials making sure it is used where the societal gain is highest.*

*Policies support the creation of value chains where local environmental and socio-economic damage is minimised, and where the local communities providing value chain components are always benefited.*

### **Short version**

*The policy landscape for metallurgical biocarbon promotes safe and efficient use of biomass, a resilient supply chain of required qualities of biocarbon, an efficient market and limitation of environmental impact to sustainable levels. \**

*Regulations and incentives consider the multiple uses for biocarbon, prioritizing uses where the societal gain is highest. Regulations and classifications of biocarbon are clear, stable, transparent and harmonised across sectors.*

*Policies support the creation of value chains that limit environmental and socio-economic harm and ensure that local communities contributing to these chains directly benefit.*

*\*Sustainable use:*

- *Biomass from forest is primarily from coproducts and side streams, in the long run completely avoiding forest cut solely for biocarbon, in line with the cascading principle*
- *Excess biomass from other streams: agricultural residues not used for soil enhancement, invasive species*
- *New sources of biomass are evaluated from a systems perspective to ensure equitable and environmentally best use*

### **Section headers**

- *Efficient and sustainable supply chain*
- *Transparency across sectors*
- *Minimum harm and local benefits*

## 6 Conclusions

The study sought to better understand the challenges and opportunities for metallurgical biocarbon in Sweden by focusing on policy environment, stakeholder analysis and identifying possible conflicts of interest.

Landscape overviews of stakeholders, key actors and policy environment were created and presented. A vision for a sustainable metallurgical biocarbon value chain policy environment was developed and should be useful in further stakeholder engagement and in prioritising technical projects related to metallurgical biocarbon.

Lessons learned regarding policy environment and the key actors and interests impacting metallurgical biocarbon in Sweden can be summarised with the following points:

- There are not formal standards for metallurgical biocarbon, but standardisation efforts within ISO have recently included pyrogenic biocarbon which includes metallurgical use in its scope.
- Metallurgical use is still a marginal segment for biocarbon, but there is a growing awareness and interest for these applications.
- The market formation of metallurgical biocarbon is affected by a remarkably large number of policy frameworks and incentives, that are in fact aimed at different sectors including energy, forestry, agriculture, and of course climate legislation. At the same time, biocarbon (and particularly its metallurgical uses) are almost never explicitly mentioned, leaving some ambiguity and room for interpretation that has not been fully explored.
- Friction and uncertainty is the overall effect of the complex range of policies and unclear application to biocarbon production and use is one of friction and uncertainty. Even though few of the identified policies are categorical obstacles to metallurgical biocarbon, the combined uncertainty inhibits investment and entrepreneurial risk-taking.
- The degree of clarity for regulations can be explained as a scale going from biomass production (relatively high clarity) to biocarbon production (reasonable clarity) to the use of biocarbon (still some things to be clarified for agricultural uses, very little clarity for metallurgical uses).
- Particularly one policy (or gap in regulation) do act as direct obstacles to development of metallurgical biocarbon.
  - In 2025, IMO instituted a measure, severely restricting the options for marine transport of biocarbon, essentially prohibiting bulk transportation.
- Environmental concerns could be assumed to be a main conflict area. However, it does not currently seem to be a roadblock for
  - Environmental objections can be construed in two main categories– an added environmental pressure from extra extraction from biomass, or a reduction in carbon sequestration potential by using biocarbon in metallurgical processes where they ultimately form CO<sub>2</sub>.

- Both of these oppositions have been encountered in the project, but neither of them seem to be deep-set or insurmountable among key stakeholders and actors.
- Among those familiar with biocarbon, it is accepted that using woody waste streams such as sawdust pellets or chips from tops and branches can avoid increasing the burdens associated with increased biomass extraction.
- Those actors seeking to produce or purchase metallurgical biocarbon are fully focused on these kinds of byproducts – motivated by both cost and environmental impact.
- The question of competing uses is more salient. There is no clear academic consensus on the comparative environmental benefit of biocarbon used for carbon sequestration in soil and metallurgical biocarbon. However, technical analysis has shown that quality requirements on biocarbon for the two applications may be different enough that they are best met with different biomass – reducing or negating the risk of this conflict of interest.

## 7 Suggested Continued Work

- Practical as well as theoretical studies to better understand workplace safety and fire hazards related to biocarbon handling and storage.
- Investigation into how permitting processes and transport safety regulations impact the expansion of metallurgical biocarbon industries.
- Environmental impact studies that can help compare the relative benefit of biocarbon use in metallurgical applications and competing applications such as carbon sequestration in soil or construction materials.
- Technical analyses of carbon stock in steel products, and to what extent and on what timescale it can be viewed as a carbon sink.

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## 10 Appendices

### 10.1 EU policies and law

#### 10.1.1 EU Emissions Trading System (EU ETS)

Launched in 2005, the EU ETS is both a regulatory market and a cornerstone of Europe's decarbonization strategy. Its legal basis is Directive 2003/87/EC<sup>67</sup>, most recently amended by Directive (EU) 2024/795 on 1 March 2024.<sup>68</sup> Under Directive 2003/87/EC, a delegated act is Regulation (EU) 2018/2066, last updated on 1 January 2025<sup>69</sup>, which governs the monitoring and reporting of GHG emissions for activities listed in Annex I and III of Directive 2003/87/EC.

The ETS system is based on a “cap and trade” principle. The overall emissions cap is divided into tradable units called EU Allowances (EUAs). Below are some clarifications drawn from the latest consolidated version of Directive 2003/87/EC on 1 March 2024:

- Emissions: “The release of greenhouse gases from sources in an installation or the release from an aircraft performing an aviation activity listed in Annex I or from ships performing a maritime transport activity listed in Annex I of the gases specified in respect of that activity, or the release of greenhouse gases corresponding to the activity referred to in Annex III” (Art. 3(b))
- Allowance: “An allowance to emit one tonne of carbon dioxide equivalent during a specified period” (Art. 3(a))
- Installation: A stationary technical unit where one or more activities listed in Annex I are carried out and any other directly associated activities which have a technical connection with the activities carried out on that site and which could have an effect on emissions and pollution (Art. 3(e))
- Categories of activities to which this directive applies (Annex I), such as
  - Combustion of fuels in installations with a total rated thermal input exceeding 20 MW (except in installations for the incineration of hazardous or municipal waste)
  - Production of coke
  - Metal ore (including sulphide ore) roasting or sintering, including pelletization
  - Production of iron or steel (primary or secondary fusion) including continuous casting, with a capacity exceeding 2,5 tonnes per hour
  - Production or processing of ferrous metals (including ferro-alloys) where combustion units with a total rated thermal input exceeding 20 MW are operated. Processing includes, inter alia, rolling mills, re-heaters, annealing furnaces, smitheries, foundries, coating and pickling

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<sup>67</sup> [Directive - 2003/87 - EN - EUR-Lex](#)

<sup>68</sup> [EUR-Lex - 02003L0087-20240301 - EN - EUR-Lex](#)

<sup>69</sup> [EUR-Lex - 02018R2066-20250101 - EN - EUR-Lex](#)

- Production or processing of non-ferrous metals, including production of alloys, refining, foundry casting, etc., where combustion units with a total rated thermal input (including fuels used as reducing agents) exceeding 20 MW are operated.

Companies can acquire EUAs through three main channels: (i) receive them for free<sup>70</sup>, (ii) buy them at auction organized by the European Energy Exchange, and (iii) buy them on the open (or so-called secondary) market (LIFE ETX, 2024). Regulation 2024/873 provides the basis for determining free allocations and ETS benchmark values. Two examples are: (i) free allocation for specific sectors and products are determined using performance benchmarks that represent the average emissions intensity the 10% most efficient facilities within each sector, and (ii) benchmarks follow a "one product, one benchmark" approach, meaning that they are consistent regardless of the production technology, fuel type, installation size, or geographic location".<sup>71</sup>

Commission Implementing Regulation (EU) 2018/2066 (consolidated as of 01.01.2025) specifies the conditions under which emissions can be considered zero. According to the regulation, "the emission factor for biomass that complies with the sustainability criteria and greenhouse gas emission-saving criteria for the use of biomass established by Directive (EU) 2018/2001<sup>72</sup>, with any necessary adjustments for application under this Directive, as set out in the implementing acts referred to in Article 14 of this Directive, shall be zero." Otherwise, the carbon content of biomass used shall be considered as fossil carbon (Art. 38(5)).

- 02003L0087 – EN – 01.03.2024 – 016.001, Annex IV: "The emission factor for biomass that complies with the sustainability criteria and greenhouse gas emission-saving criteria for the use of biomass established by Directive (EU) 2018/2001, with any necessary adjustments for application under this Directive, as set out in the implementing acts referred to in Article 14 of this Directive, shall be zero."
- 02018R2066 – EN – 01.01.2025 – 006.001, Article 38(5): Biofuels, bioliquids and biomass fuels shall fulfil the sustainability and the greenhouse gas emissions saving criteria laid down in paragraphs 2 to 7 and 10 of Article 29 of Directive (EU) 2018/2001, in order to be counted towards the zero-rated biomass fraction of a source stream. The sustainability and the greenhouse gas emissions saving criteria laid down in paragraphs 2 to 7 and 10 shall apply irrespective of the geographical origin of the biomass. Where the biomass used does not comply with this paragraph, its carbon content shall be considered as fossil carbon.

Below is a summary of key changes introduced in the 2023 revision of the ETS Directive:

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<sup>70</sup> [EU ETS emissions cap - European Commission](#)

<sup>71</sup> [Free allocation - European Commission](#)

<sup>72</sup> [EUR-Lex - 02018L2001-20240716 - EN - EUR-Lex](#)

<sup>73</sup> [https://climate.ec.europa.eu/eu-action/carbon-markets/eu-emissions-trading-system-eu-ets/about-eu-ets\\_en#our-climate-ambition-for-2030](https://climate.ec.europa.eu/eu-action/carbon-markets/eu-emissions-trading-system-eu-ets/about-eu-ets_en#our-climate-ambition-for-2030)

- The emission cap has been tightened to achieve a 62% reduction in CO<sub>2</sub> emissions by 2030, compared to 2005 levels. This includes emissions from maritime transport, which have been covered in the EU ETS since 2024.
- Free allocation of allowances to companies has been reduced, in line with the stricter cap, and is now conditional on companies' decarbonisation efforts. For the aviation sector, free allocation will be phased out by 2026.
- The Market Stability Reserve has been revised to promote balance in the reformed EU carbon market.
- Additional resources have been mobilized to support people and businesses in the green transition. Member States have committed to using all EU ETS revenues (or their financial equivalent) to support climate action and a green transition. The budgets of Innovation Fund and Modernisation Fund have been increased accordingly.
- A new emissions trading system, ETS2, has been established to cover emissions from buildings, road transport and additional sectors. ETS2 will become operational in 2027 and will complement other European Green Deal policies targeting these sectors.
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### 10.1.2 EU ETS2

The new EU carbon trading scheme, ETS2, was established in 2023, as part of the revision of the ETS Directive (EU) 2023/959.<sup>74</sup> Separate from the EU ETS (ETS1), ETS2 has its own emission cap and allowance system. It covers carbon dioxide emissions from the combustion of fuels from road transport, buildings, and additional sectors (mainly small industry not included in EU ETS1).

The Implementing Regulation (EU) 2023/2122, adopted on 17 October 2023, updates and expands the EU's greenhouse gas monitoring and reporting framework under the EU ETS. It includes provisions on monitoring methodology (Article 75f), applicable tiers for released fuel amounts, calculation factors (Article 75h), etc.<sup>75</sup>

ETS2 will become fully operational in 2027 and will complement other European Green Deal policies targeting these sectors.<sup>76</sup> While emissions trading under ETS2 begins in 2027, permits for GHG emissions will be required starting 1 January 2025, and emissions will be monitored and reported from that date. To support a fair transition to climate neutrality, the Social Climate Fund (SCF) was established alongside ETS2, with the primary goal of alleviating the social and economic impacts arising from the implementation of ETS2.<sup>77</sup>

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<sup>74</sup> [https://climate.ec.europa.eu/eu-action/carbon-markets/ets2-buildings-road-transport-and-additional-sectors\\_en#guidance-and-support](https://climate.ec.europa.eu/eu-action/carbon-markets/ets2-buildings-road-transport-and-additional-sectors_en#guidance-and-support)

<sup>75</sup> [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L\\_202302122](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202302122)

<sup>76</sup> [https://climate.ec.europa.eu/eu-action/carbon-markets/eu-emissions-trading-system-eu-ets/about-eu-ets\\_en#our-climate-ambition-for-2030](https://climate.ec.europa.eu/eu-action/carbon-markets/eu-emissions-trading-system-eu-ets/about-eu-ets_en#our-climate-ambition-for-2030)

<sup>77</sup> [https://climate.ec.europa.eu/eu-action/carbon-markets/eu-emissions-trading-system-eu-ets/social-climate-fund\\_en](https://climate.ec.europa.eu/eu-action/carbon-markets/eu-emissions-trading-system-eu-ets/social-climate-fund_en)

EU ETS2 is a new cap-and-trade system with a strict EU-wide emissions cap and an auctioning scheme. As specified in the legal framework, allowances for buildings and road transport “*should only be allocated via auctioning, without there being any free allocation*”. For the aviation sector, free allocation will be removed as of 2026. Moreover, ETS2 is designed as an upstream system, meaning that responsibilities and obligations mainly lie with producers and suppliers rather than individual fuel users.

In Sweden, the Swedish Environmental Protection Agency (“*Naturvårdsverket*”, SEPA) is the National Competent Authority for ETS2. It is responsible for implementing and administering the system, including the permitting of regulated entities and overseeing their Monitoring, Reporting and Verification (MRV) obligations. Starting from 1 January 2025, operators covered under ETS 2 must apply for a permit from the SEPA.<sup>78</sup>

Fuels covered by the ETS2 are primarily defined in Article 2(1) of Directive 2003/96/EC (Energy Taxation Directive, ETD)<sup>79</sup>. Below outlines the inclusion and exclusion of fuels under ETS2:<sup>80</sup>

- Included types of fuels:
  - fuels listed in Tables A and C in Annex I of the ETD: leaded petrol, unleaded petrol, LPG, natural gas, gas oil, kerosene, heavy fuel oil, coal and coke;
  - any other product intended for use, offered for sale or used as motor fuel or heating fuel as specified in Article 2(3) of the ETD. This includes any fuel additives used as motor fuel, certain bio-based fuels, and any other hydrocarbons for heating purposes, except for peat.
- Excluded types of fuels:
  - Peat;
  - Waste used as fuels (hazardous or municipal waste used as fuel, as explicitly excluded from the ETS2 scope in Annex III of the Directive);
  - Waste-derived fuels (mostly used in ETS1 installations);
  - Solid biomass (e.g. wood-based fuels);
  - Charcoal from wood.

### 10.1.3 Industrial and Livestock Rearing Emissions Directive (IED 2.0)

The revised Industrial and Livestock Rearing Emissions Directive (IED 2.0), formally Directive 2010/75/EU as amended by Directive 2024/1785<sup>81</sup>, is the main EU instrument for reducing emissions to air, water and land, and for preventing waste generation from large industrial installations and intensive livestock farms. By 2050, the implementation of IED 2.0 is expected to reduce emissions of key air pollutants (PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub>, and

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<sup>78</sup> <https://www.naturvardsverket.se/vagledning-och-stod/ets2-utslappshandelssystem-for-vagtransporter-byggnader-och-ytterligare-sektorer/>

<sup>79</sup> <https://eur-lex.europa.eu/eli/dir/2003/96/oj/eng>

<sup>80</sup> [https://climate.ec.europa.eu/document/download/b5ccad58-6909-4a32-8a72-c73ab8d2a165\\_en?filename=policy\\_ets\\_ets2\\_gd\\_regulated\\_entities\\_en.pdf](https://climate.ec.europa.eu/document/download/b5ccad58-6909-4a32-8a72-c73ab8d2a165_en?filename=policy_ets_ets2_gd_regulated_entities_en.pdf)

<sup>81</sup> <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:02010L0075-20240804%20>

non-methane volatile organic compounds (NMVOCs)) by up to 40% compared to 2020 levels.<sup>82</sup>

IED 2.0 entered into force on 4 August 2024 and must be transposed into national law by 1 July 2026.<sup>83</sup> The first implementation phase, running from 2024 to 2030, focuses on developing and implementing a new regulatory environment to support industrial transformation. This includes identifying BAT requirements for newly covered activities, such as the mining of metals, landfills, and battery gigafactories.

The latest rules in the directive aim to help promote innovation in emerging technologies and foster material efficiency and decarbonization by encouraging greener industrial practices.<sup>84</sup> Key objectives include:<sup>85</sup>

- Promoting innovation and transformation through the most effective viable emissions reduction techniques.
- Tightening emission reduction rules by introducing stricter emissions limit values (ELVs) and more stringent conditions for granting derogations.
- Streamline permitting processes via the Industrial Emissions Portal Regulation (EU) 2024/1244 (IEPR)<sup>86</sup>, which also enhances public access to environmental data. Thresholds for pollutant releases to air, water and land are specified in Annex II of the IEPR. The regulation entered into force on 22 May 2024 and will apply from 1 January 2028. Plant-level data emission data will be reported to the European Industrial Emissions Portal<sup>87</sup> starting in 2028.
- Expanding coverage to additional activities to reduce previously unregulated emissions, such as metal mining, battery manufacturing, and waste landfills.

The IED regulates emissions from industrial activities, including those in the steel sector. Emission limit values are based on Best Available Techniques (BAT), defined at the EU level in BAT Reference Documents (BREFs). BAT techniques represent the most environmentally effective and economically and technically viable methods for preventing and controlling emissions. BAT Conclusions (BATCs) are implementing decisions adopted by the European Commission and serve as the basis for drafting permit conditions by Member States' national permitting authorities. The BATC for iron and steel production was published in March 2012 and covers sinter plants, pelletization plants, coke oven plants, blast furnaces, basic oxygen steelmaking and

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<sup>82</sup> [https://environment.ec.europa.eu/news/revised-industrial-emissions-directive-comes-effect-2024-08-02\\_en?utm\\_source=chatgpt.com](https://environment.ec.europa.eu/news/revised-industrial-emissions-directive-comes-effect-2024-08-02_en?utm_source=chatgpt.com)

<sup>83</sup> [https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-the-industrial-emissions-directive-\(refit\)?sid=8701](https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-the-industrial-emissions-directive-(refit)?sid=8701)

<sup>84</sup> [https://environment.ec.europa.eu/topics/industrial-emissions-and-safety/industrial-and-livestock-rearing-emissions-directive-ied-20\\_en](https://environment.ec.europa.eu/topics/industrial-emissions-and-safety/industrial-and-livestock-rearing-emissions-directive-ied-20_en)

<sup>85</sup> [https://environment.ec.europa.eu/topics/industrial-emissions-and-safety/industrial-and-livestock-rearing-emissions-directive-ied-20\\_en](https://environment.ec.europa.eu/topics/industrial-emissions-and-safety/industrial-and-livestock-rearing-emissions-directive-ied-20_en)

<sup>86</sup> [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L\\_202401244](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202401244)

<sup>87</sup> <https://industry.eea.europa.eu/>

casting, and electric arc furnace steelmaking and casting.<sup>88</sup> A review of the current BAT-BREF for the production of iron and steel is tentatively scheduled for 2026.<sup>89</sup>

Annex 1 of the IED 2.0 specifies the categories of activities covered, including (i) Gasification, liquefaction or pyrolysis of coal and other fuels (in installations with a total rated thermal input of 20 MW or more), and (ii) Production and processing of metals, such as “production of pig iron or steel (primary or secondary fusion) including continuous casting, with a capacity exceeding 2.5 tons per hour”.

In Sweden, the IED is implemented through the Environmental Code (“Miljöbalken”), which classifies activities into A/B/C/U categories. Licensing is handled by Mark- och miljödomstolen for A-class activities, and by Miljöprövningsdelegationerna under County Administrative Boards for B-class activities. Typical first-instance processing time ranges from 6 to 18 months, depending on the complexity of the case.<sup>90</sup>

#### 10.1.4 Renewable Energy Directive (RED III)

To accelerate the EU’s clean energy transition, the Renewable Energy Directive EU/2018/2001 (RED II) was revised in 2023. The updated Directive EU/2023/2413 (RED III)<sup>91</sup> entered into force on 20 November 2023. It emphasizes increased renewable energy use across four key sectors: industry, transport, buildings (heating & cooling), and electricity. Below are examples of the sectoral targets:

- Industry: Member States must ensure an indicative annual average increase of at least 1.6% in the share of renewable energy used for final energy and non-energy purposes between 2021–2025 and 2026–2030 (Art. 22a). At least 42% of the hydrogen used for final energy and non-energy purposes in industry must come from renewable fuels of non-biological origin (RFNBOs) (Art. 22a).
- Transport: By 2030, the share of renewable energy in final energy consumption must reach at least 29%, with a minimum 14.5% reduction in GHG intensity (Art. 25(1)). Member States must also establish a mechanism allowing fuel suppliers in their territory to exchange **credits** for supplying renewable energy to the transport sector (Art. 25(4)).
- Heating & cooling: A binding annual average increase of 0.8 percentage points between 2021–2025 and 1.1 percentage points between 2026–2030 applies to all Member States. Additional indicative increases are calculated per Member State to reach an EU-wide average increase of 1.8 percentage points

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<sup>88</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012D0135>

<sup>89</sup>

[https://accioclimatica.bibliotecadigital.gencat.cat/bitstream/handle/20.500.14343/766/2025\\_UC\\_The\\_Industrial\\_Emissions\\_Directive.pdf?isAllowed=y&sequence=4](https://accioclimatica.bibliotecadigital.gencat.cat/bitstream/handle/20.500.14343/766/2025_UC_The_Industrial_Emissions_Directive.pdf?isAllowed=y&sequence=4)

<sup>90</sup> <https://www.business->

<sweden.com/498c72/contentassets/41249a64a04e4309b7637b00c526eef8/environmental-permitting-process-2025.pdf>

<sup>91</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023L2413&qid=1699364355105>

For the first time, RED III makes the **cascading use principle** legally binding at EU level (Article 3(3)). This principle establishes a clear priority order for the use of woody biomass, influencing feedstock eligibility and the design of support scheme for energy derived from biofuels, bioliquids and biomass fuels across Member States. To ensure that woody biomass is used in accordance with its highest economic and environmental added value, the following order of priorities should be followed: (i) wood-based products, (ii) extending the service life of wood-based products, (iii) re-use, (iv) recycling, (v) bioenergy, and (vi) disposal.

Article 3(3d) further specifies that “Member States shall not grant new support or renew any support for the production of electricity from forest biomass in electricity-only installations, unless such electricity meets at least one of the following conditions”: (i) produced in a region identified in a territorial just transition plan, (ii) produced with biomass CO<sub>2</sub> capture and storage (BECCS), and (iii) produced in an outermost region as referred to in Article 349 TFEU (Treaty on the Functioning of the European Union).

Under Article 22a of RED III, Member States are required to ensure that RFNBOs account for a minimum of 42 % of the hydrogen used for final energy and non-energy purposes in industry by 2030, increasing to 60 % by 2035” (Art. 22a). In addition, Member States are encouraged to promote voluntary labelling schemes for industrial products that claim to be produced using renewable energy and RFNBOs. These voluntary labelling schemes should transparently indicate the percentage of renewable energy or RFNBOs used across various stages of the product lifecycle, including raw material acquisition, pre-processing, manufacturing, and distribution (Art. 22a). The calculation of these percentages should be based on the methodologies outlined in either Commission Recommendation (EU) 2021/2279 or ISO 14067:2018, ensuring consistency and credibility in environmental claims.

RED III sets an EU-wide binding target of at least 42.5% renewable energy in gross final energy consumption by 2030, with an aspiration target of 45% (for comparison, the share of renewables in EU energy consumption was 24.5% in 2023). Notably, RED III does not allocate binding national targets to individual Member States. According to preliminary estimates from the Swedish Energy Agency, Sweden is expected to reach around 76% renewable energy by 2030, compared to a total share of 63% in 2021.<sup>92</sup> This reflects Sweden’s strong position and continued commitment to renewable energy deployment.

### **10.1.5 Ecodesign for Sustainable Products Regulation (ESPR)**

The Ecodesign for Sustainable Products Regulation (EU) 2024/1781 entered into force on 18 July 2024, replacing the Ecodesign Directive 2009/125/EC.<sup>93</sup> The ESPR aims to significantly enhance the sustainability of products placed on the EU market by

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<sup>92</sup> <https://www.klimatpolitiskaradet.se/wp-content/uploads/2024/06/reportoftheswedishclimatepolicycouncil2024.pdf>

<sup>93</sup> <https://eur-lex.europa.eu/eli/reg/2024/1781/oj/eng>

improving their circularity, energy performance, recyclability, and durability.<sup>94</sup> As an EU-level framework regulation, the ESPR establishes overarching ecodesign requirements that serve as the basis for Member States to develop specific implementing measures.

“Ecodesign” is defined in Article 2 as “the integration of environmental sustainability considerations into the characteristics of a product and the processes taking place throughout the product’s value chain”. The directive addresses several key ecodesign requirements, such as (i) energy use and energy efficiency, (ii) water use and water efficiency, (iii) resource use and resource efficiency, (iv) recyclability, and (v) environmental impacts, including carbon footprint and environmental footprint. A central feature of the ESPR is the Digital Product Passport (DPP), which serves as a digital record providing comprehensive information about a product and its entire value chain.

As a key step in implementing the ESPR, the European Commission adopted the 2025-2030 working plan for the Ecodesign for Sustainable Products and Energy Labelling on 16 April 2025.<sup>95</sup> This plan prioritizes the following five product groups: iron & steel, aluminium, textiles/apparel, furniture, tyres, and mattresses.

#### **10.1.6 Carbon Removal Certification Framework (CRCF)**

The Carbon Removals and Carbon Farming (CRCF) Regulation (EU/2024/3012) was published on 6 December 2024, establishing the first EU-wide voluntary certification framework for permanent carbon removals, carbon farming, and carbon storage in products.<sup>96</sup> This framework sets certification rules for the following categories:<sup>97</sup>

- Carbon farming, including practices such as forest and soil restoration, emission avoidance from soils, peatland rewetting, more efficient use of fertilizers, and other innovative agricultural methods.
- Industrial carbon removals, such as bioenergy with carbon capture and storage (BECCS), and direct air carbon capture and storage (DACCS).
- Carbon storage in long-lasting products, including wood-based construction materials and biochar.

A variety of terms are defined in Article 2 of the regulation, including:

- “Carbon removal”: The anthropogenic removal of carbon from the atmosphere and its durable storage in geological, terrestrial or ocean reservoirs, or in long-lasting products.

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<sup>94</sup> [https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/ecodesign-sustainable-products-regulation\\_en](https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/ecodesign-sustainable-products-regulation_en)

<sup>95</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52025SC0112>

<sup>96</sup> [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L\\_202403012](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202403012)

<sup>97</sup> [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_24\\_885](https://ec.europa.eu/commission/presscorner/detail/en/ip_24_885)

- “Permanent carbon removal”: Any practice or process that, under normal circumstances and using appropriate management practices, captures and stores atmospheric or biogenic carbon for several centuries, including permanently chemically bound carbon in products, and which is not combined with enhanced hydrocarbon recovery.
- “Carbon farming”: Any practice or process carried out over an activity period of at least five years, related to the management of a terrestrial or coastal environment and resulting in the capture and temporary storage of atmospheric or biogenic carbon in biogenic carbon pools, or in the reduction of soil emissions.
- “Carbon storage in products”: Any practice or process that captures and stores atmospheric or biogenic carbon for at least 35 years in long-lasting products, allows on-site monitoring of the carbon stored and is certified throughout the monitoring period.

The CRCF introduces certified carbon removals as a foundation for new economic opportunities. These certified removals can be monetized through private schemes, public sector support, and commercial advantages, particularly among consumers who seek to reward environmentally responsible practices. Carbon farming is expected to enable innovative business models for farmers and foresters, while also delivering significant biodiversity benefits. The regulation further promotes the use of long-lasting bio-based building materials, such as wood and biochar, to store carbon over several decades or longer, thereby encouraging the adoption of sustainable construction techniques. Regarding financial support, the regulation facilitates access to innovative financing mechanisms, including impact finance and results-based public support. Under this framework, carbon removers and carbon farmers can be rewarded based on certified removals and verified emissions reductions, enhancing the credibility and scalability of carbon removal initiatives.<sup>98</sup>

The European Commission has developed a draft delegated regulation (Ref. Ares(2025)5828622 - 17/07/2025), currently undergoing “public consultations and feedback” from 17 July 2025 to 22 September 2025.<sup>99</sup> This delegated act introduces the methodologies for carbon removal activities through (i) DACCS, (ii) Biogenic Emissions Capture with Carbon storage (BioCCS), and (iii) Biochar Carbon Removal (BCR). Two biochar-related definitions are provided in Article 1 of the draft regulation:

- “Biochar”: A carbonaceous material that is produced by thermal treatment of biomass.
- “BCR activity”: An activity resulting in the production and permanent storage of biochar by its application to soils or by its incorporation into materials.

For BCR activities, specific eligibility criteria are defined in Annex 1.1.2, as follows:

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<sup>98</sup> [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_24\\_885](https://ec.europa.eu/commission/presscorner/detail/en/ip_24_885)

<sup>99</sup> [https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/14573-Carbon-removals-and-carbon-farming-methodologies-for-certifying-permanent-carbon-removals\\_en](https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/14573-Carbon-removals-and-carbon-farming-methodologies-for-certifying-permanent-carbon-removals_en)

### 1.1.2. Biochar carbon removal activity

A BCR activity shall consist of biochar production at one or more biochar production facilities that are owned by the same legal entity and that apply the same biochar production technology as each other. Biochar produced at different locations may never be assigned to the same production batch (see Section 2.2.5.1) even if the feedstock and production conditions are similar. Biochar from a single activity may be applied in soils or incorporated in products at several sites.

#### 1.1.2.1. Eligibility criteria for the production

The biochar production process shall:

- (a) involve heating biomass to temperatures of at least 350 °C;
- (b) be designed with the intention of fully capturing or destroying any methane produced with the biochar;
- (c) utilise the co-produced heat for biomass drying or to satisfy another economically justifiable demand for heat, for heating or cooling purposes.

#### 1.1.2.2. Eligible forms of biochar applications

##### a) Biochar applied in soils

Biochar application shall be eligible for certification if it has been, either directly without first intermixing it with any other product, or after intermixing with a matrix consisting of soil or one or more additional soil amendment products in compliance with Article 5 of Regulation (EU) 2019/1009 of the European Parliament and of the Council<sup>1</sup>, or after feeding to animals and recovery as manure:

- i. applied to agricultural soils;
- ii. applied to forest soils;
- iii. used in landscaping, for daily cover at landfill sites or for filling holes, including disused mines and oil wells;
- iv. applied to urban soils, including planting media used in flowerbeds or for urban tree planting and in public parks and public or private gardens, or in soil in greenhouses.

Operators of activities that produce biochar that is used for landscaping, landfill or hole filling shall intermix the biochar with at least one other material prior to application and shall ensure that the intermixture cannot self-sustain combustion.

Operators of activities where biochar is applied to soils shall ensure that there is no significant risk that the net climate benefit of the BCR is offset by heat absorption due to albedo decreases.

Total application of biochar to soil shall be limited to 50 tonnes per hectare [t/ha].

b) Biochar incorporated in products

Only BCR activities that incorporate biochar in cement, concrete or asphalt shall be eligible for certification.

### 10.1.7 European Biochar Certificate (EBC) guidelines

The EBC was developed to minimize the risks associated with biochar production and use, and to support both producers and users of biochar in preventing or at least reducing potential hazards to human health and the environment. Currently, the EBC is a voluntary industry standard in Europe, while it is obligatory for all biochar sold for agricultural use in Switzerland.<sup>100</sup> The EBC has published several key documents to guide certification process for biochar and carbon sink (C-sink), including (i) Guidelines of the European Biochar Certificate, (ii) EBC Guidelines for the Certification of Biochar-Based Carbon Sinks, and (iii) Positive list of biomass feedstock.<sup>101</sup>

#### Guidelines of EBC

In the current version of the Guidelines of EBC (v10.4), biochar is defined as “a porous, carbonaceous material that is produced by pyrolysis of biomass and is applied in such a way that the contained carbon remains stored as a long-term C sink or replaces fossil carbon in industrial manufacturing. It is not made to be burnt for energy generation.”

The EBC covers seven application classes of biochar: (i) EBC-FeedPlus, (ii) EBC-Feed, (iii) EBC-AgroOrganic, (iv) EBC-Agro, (v) EBC-Urban, (vi) EBCConsumerMaterials, and (vii) EBC-BasicMaterials. For all application classes, biochar must be analyzed at least according to the EBC Basic Analysis Package. The table below outlines the key analytical parameters required for EBC-certified biochar.

Table A8: overview of the most important analytical parameters for EBC biochar (EBC, 2024)

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<sup>100</sup> <https://www.european-biochar.org/en/home>

<sup>101</sup> <https://www.european-biochar.org/en/ct/2-EBC-and-WBC-guidelines-documents>

EBC-Certification Class		EBC-FeedPlus	EBC-Feed	EBC-AgroOrganic	EBC-Agro	EBC-Urban	EBC-ConsumerMaterials	EBC-BasicMaterials
Elemental analysis	Declaration of Ctot, Corg, H, N, O, S, ash							
	H / Corg	< 0.4			< 0.7			
Physical parameters	Water content, dry matter (as received and @ < 3mm particle size), bulk density (DM), WHC, pH, salt content, electrical conductivity of the solid biochar							
TGA	Needs to be presented for the first production batch of a pyrolysis unit							
Nutrients	Declaration of N, P, K, Mg, Ca, Fe							
Heavy metals	Pb	10 g t <sup>-1</sup> (88%DM)	10 g t <sup>-1</sup> (88%DM)	45 g t <sup>-1</sup> DM	120 g t <sup>-1</sup> DM	120 g t <sup>-1</sup> DM	120 g t <sup>-1</sup> DM	declaration, no limit values for certification
	Cd	0.8 g t <sup>-1</sup> (88% DM)	0.8 g t <sup>-1</sup> (88% DM)	0.7 g t <sup>-1</sup> DM	1.5 g t <sup>-1</sup> DM	1.5 g t <sup>-1</sup> DM	1.5 g t <sup>-1</sup> DM	
	Cu	70 g t <sup>-1</sup> DM	70 g t <sup>-1</sup> DM	70 g t <sup>-1</sup> DM	100 g t <sup>-1</sup> DM	100 g t <sup>-1</sup> DM	100 g t <sup>-1</sup> DM	
	Ni	25 g t <sup>-1</sup> DM	25 g t <sup>-1</sup> DM	25 g t <sup>-1</sup> DM	50 g t <sup>-1</sup> DM	50 g t <sup>-1</sup> DM	50 g t <sup>-1</sup> DM	
	Hg	0.1 g t <sup>-1</sup> (88% DM)	0.1 g t <sup>-1</sup> (88% DM)	0.4 g t <sup>-1</sup> DM	1 g t <sup>-1</sup> DM	1 g t <sup>-1</sup> DM	1 g t <sup>-1</sup> DM	
	Zn	200 g t <sup>-1</sup> DM	200 g t <sup>-1</sup> DM	200 g t <sup>-1</sup> DM	400 g t <sup>-1</sup> DM	400 g t <sup>-1</sup> DM	400 g t <sup>-1</sup> DM	
	Cr	70 g t <sup>-1</sup> DM	70 g t <sup>-1</sup> DM	70 g t <sup>-1</sup> DM	90 g t <sup>-1</sup> DM	90 g t <sup>-1</sup> DM	90 g t <sup>-1</sup> DM	
	As	2 g t <sup>-1</sup> (88% DM)	2 g t <sup>-1</sup> (88% DM)	13 g t <sup>-1</sup> DM	13 g t <sup>-1</sup> DM	13 g t <sup>-1</sup> DM	13 g t <sup>-1</sup> DM	
Organic contaminants	16 EPA PAH	6±2.4 g t <sup>-1</sup> DM	CSI-declaration	6±2.4 g t <sup>-1</sup> DM	6.0+2.4 g t <sup>-1</sup> DM	CSI-declaration	CSI-declaration	CSI-declaration
	8 EFSA PAH	1.0 g t <sup>-1</sup> DM						4 g t <sup>-1</sup> DM
	benzo[e]pyrene benzo[j]fluoranthene	< 1.0 g t <sup>-1</sup> DM for each of both substances						
	PCB, PCDD/F	See chapter 10		Once per pyrolysis unit for the first production batch. For PCB: 0.2 mg kg <sup>-1</sup> DM, for PCDD/F: 20 ng kg <sup>-1</sup> (I-TEQ OMS), respectively				

\* medical and health care products are not included

The certification classes, EBC-ConsumerMaterials and EBC-BasicMaterials, cover all necessary environmental requirements for applications, excluding the application areas of soil, agriculture, and feed additive. The EBC-BasicMaterials class defines what qualifies as “biochar” for use as a sustainable raw material. Only biomass (no fossil carbon) may be used to produce EBC-certified biochar. With the exception of preheating the pyrolysis reactor, the use of fossil fuels for heating during pyrolysis is strictly prohibited. Biomass pyrolysis must be conducted in an energy-efficient manner (see Chap. 8 of the EBC Guideline). Accordingly, pyrolysis gases must be either recovered or burned, and they must not be released into the atmosphere.

Feedstocks not listed in the EBC Positive List, such as industrial waste or fossil carbon sources like lignite, do not qualify as biochar and must not be traded under the EBC label.

The EBC Positive List specifies which types of biomasses are permissible for each application class. For instance, in version 10.3 of the Positive List (dated 6 June 2025), forestry and wood feedstocks are defined as “Natural bark and wood, untreated or mechanically treated, from forestry operations, sawmills or similar operations”. Moreover, EBC-certified biochar may only be produced from forest wood if sustainable forest management can be demonstrated through certification by PEFC (Programme for the Endorsement of Forest Certification), FSC (Forest Stewardship Council), or equivalent regional standards or legislation.

According to the EBC Guidelines (2024, p. 8), biochar has a wide range of applications:

- Agricultural uses include soil conditioners, composting additives, and carriers for fertilizers to manure treatment and stable bedding, silage additives, and feed additives.
- Industrial uses are particularly relevant in the construction, plastics, paper, and textile sectors.

When sold to end-user (B2C), all biochar and biochar-based products must be labelled according to the EBC certification class under which they are traded. When sold to other businesses (B2B) that process or trade biochar, the biochar products may be labeled with multiple certification classes, depending on the intended applications. Further details can be found in Chapter 3 of the Guidelines of EBC.

#### **Certification of Biochar Based Carbon Sinks**

EBC has also developed a guideline titled “Certification of Biochar Based Carbon Sinks” (version 2.1 from 1st February 2021).<sup>102</sup> In this guideline, the C-sink potential of a unit of biochar is defined as “the amount of carbon it contains minus the carbon expenditure of its production, i.e., all GHG emissions caused by its production. It thus includes the complete carbon footprint of the biochar at the factory gate, i.e., when it leaves the production site”. The EBC C-sink potential reflects the total carbon footprint of biochar, covering every stage from the initial biomass source to the point at which the biochar exits the site of the EBC-certified pyrolysis facility. It represents the fraction of biochar (by dry weight) that can be sequestered as a stable, long-term carbon sink.

Regarding approved biomasses and carbon expenditures for the production of biochar, six biomass categories are defined in the EBC C-sink (Chap. 2), including (i) agricultural biomasses, (ii) organic residues from food processing, (iii) wood from landscape conservation, short rotation plantations, arable forestry, forest gardens, field margins, and urban areas, (iv) biomass from forest management, (v) wood waste, and (vi) other biogenic residues. For example, under “biomass from forest management”, the following sustainability criteria apply: (i) “A maximum of 80% of the harvested biomass may be removed from the forest to maintain nutrient cycle and forest biodiversity”, and (ii) the degree of canopy cover must not fall below 75% as a result of the timber harvest” (Chap. 2.4). Chapter 2.5 provides examples of carbon-neutral inputs for C-sink certificate, such as : (i) all wood from forests whose re-growth demonstrably exceeding the removal, independent of its size and structure, and (ii) wood waste from forestry (e.g., bark, crowns, branches, roots), wood processing (e.g., sawdust, offcuts), and recycled construction and service wood (e.g., lumber, pallets, furniture).

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<sup>102</sup> [https://www.european-biochar.org/media/doc/2/c\\_en\\_sink-value\\_2-1.pdf](https://www.european-biochar.org/media/doc/2/c_en_sink-value_2-1.pdf)

The EBC calculates the C-sink potential of biochar only up to the factory gate (Chap. 8). To ensure transparency and accountability beyond this point, an EBC-accredited tracking system is required to document all carbon losses from the factory gate to the point of end-use. This tracking system can be implemented by C-sink brokers, trading platforms, or biochar manufacturers. For instance, if biochar is later burned (e.g., as charcoal or as a reducing agent in steel production), a significant portion of the stored carbon would be released, thereby reducing the certified C-sink potential.

### **10.1.8 Land use, land-use change and forestry (LULUCF) Regulation**

The initial regulatory framework for the LULUCF sector, as laid down in Regulation (EU) 2018/841<sup>103</sup>, was adopted in 2018. It covers CO<sub>2</sub> emissions and removals, as well as GHG emissions of CH<sub>4</sub> and N<sub>2</sub>O resulting from the management of land, forests and biomass. A key rationale behind the regulation is that land can act either as a carbon sink or source, depending on how it's managed. For instance, afforestation and the use of durable wood products contribute to long-term carbon storage.<sup>104</sup>

On 11 May 2023, the revised LULUCF regulation<sup>105</sup> was published, aiming to enhance governance, promote transparency, and strengthen the link between climate mitigation and environmental protection measures. Key features of the revised regulation include:

- The 2030 Union target for net greenhouse gas removals shall be 310 million tonnes of CO<sub>2</sub> equivalent as a sum of the values of the greenhouse gas net emissions and removals by Member States in 2030 set out in Annex IIa (Article 4(2)).
- By 2030, Sweden must reach about 47321 kt of CO<sub>2</sub>e net LULUCF removals, meaning 3955 kt of CO<sub>2</sub>e additional removals as compared to the average of 43366 kt of CO<sub>2</sub>e during the period 2016-2018 (Annex IIa).

According to Article 5(4) of the revised regulation, Member States must account for any changes in the carbon stock of the carbon pools within each land accounting category. The regulation defines “carbon pool” as “the whole or part of a biogeochemical feature or system within the territory of a Member State and within which carbon, any precursor to a greenhouse gas containing carbon, or any greenhouse gas containing carbon is stored”, and (4) ‘carbon stock’ means “the mass of carbon stored in a carbon pool”.

The regulation covers the following land reporting categories or sectors: (i) forest land, (ii) cropland, (iii) grassland, (iv) wetlands, (v) settlements, (vi) other land, (vii) harvested wood products, (viii) other, (ix) atmospheric deposition, (x) nitrogen leaching and run-off (Article 2(2)). For land accounting categories of afforested land and managed forest land, the relevant carbon pools include: (i) living biomass, (ii) litter, (iii) deadwood, (iv)

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<sup>103</sup> <https://eur-lex.europa.eu/eli/reg/2018/841/oj/eng>

<sup>104</sup> [https://climate.ec.europa.eu/eu-action/land-use-sector\\_en](https://climate.ec.europa.eu/eu-action/land-use-sector_en)

<sup>105</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02018R0841-20230511>

dead organic matter, (v) mineral soils, (vi) organic soils, (vii) harvested wood products (Annex I(B)). “Harvested wood products” refers to (i) paper, (ii) wood panels, and (iii) sawn wood (Article 9)

*Sweden's climate action strategy: “The final updated NECP indicates that the country would fall short of its 2030 LULUCF obligation by between 7 million tonnes and 19 million tonnes under different scenarios. The 2030 Secretariat presents increased forest growth or reduced logging as options to boost carbon storage”*

### 10.1.9 Regulation on Deforestation-free Products (EUDR)

The EU Deforestation Regulation 2023/1115 (EUDR)<sup>106</sup> entered into force on 29 June 2023 and shall be implemented on 30 December 2024. The EUDR repeals the EU Timber Regulation (EUTR), which applies for timber products and other products produced after entry into force of the EUDR. On 19 December 2024, Regulation (EU) 2024/3234<sup>107</sup> was published to amend the EU 2023/1115 as regards provisions relating to the date of application. The amended regulation makes the law applicable on 30 December 2025 for large and medium companies and 30 June 2026 for micro and small enterprises.

The aim of EUDR is to “lay down obligations concerning relevant commodities and relevant products in order to effectively combat deforestation and forest degradation, and to promote deforestation-free supply chains”. The main reason is that deforestation and forest degradation are taking place at an alarming rate, which contribute to the global climate crisis in multiple ways. As defined in the regulation,

- “Deforestation” means “the conversion of forest to agricultural use, whether human-induced or not”.
- “Deforestation-free” means:
  - “The relevant products contain, have been fed with or have been made using, relevant commodities that were produced on land that has not been subject to deforestation after 31 December 2020”, and
  - “In the case of relevant products that contain or have been made using wood, the wood has been harvested from the forest without inducing forest degradation after 31 December 2020”.

According to Article 3 of the regulation, relevant commodities and relevant products, which are placed or made available on the market or exported, shall fulfill all the following three conditions: (i) they are deforestation-free, (ii) they have been produced in accordance with the relevant legislation of the country of production, and (iii) they are covered by a due diligence statement. The due diligence (Article 8) shall include (i) the collection of information, data and documents needed to fulfil the requirements set out in Article 9, (ii) (b) risk assessment measures as referred to in Article 10, and (iii) risk mitigation measures as referred to in Article 11.

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<sup>106</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R1115>

<sup>107</sup> <https://eur-lex.europa.eu/eli/reg/2024/3234/oj>

The regulation applies to seven “relevant commodities” (cattle, cocoa, coffee, oil palm, rubber, soy, wood) and to listed products in Annex I (Art. 1). For example, 21 types of relevant products included the commodity group “wood”, such as sawdust and wood waste and scrap (4401) and wood charcoal (4402). In Annex I, it is also noted that this Regulation does not apply to goods if they have completed their lifecycle and are formally classified as waste as defined in Article 3(1) of Waste Framework Directive 2008/98/EC.

#### **10.1.10 EU Fertilising Products Regulation**

The Fertilizing Products Regulation (EU) 2019/1009, entered into force on 16 July 2022, lays down rules on the making available on the market of EU fertilising products.<sup>108</sup> On 7 July 2021, Commission Delegated Regulation (EU) 2021/2088 was adopted, amending Annexes II, III and IV to Regulation (EU) 2019/1009 for the purpose of adding pyrolysis and gasification materials as a component material category (CMC 14) in EU fertilising products.<sup>109</sup>

The Regulation (EU) 2021/2088 became applicable from 16 July 2022. The main features of CMC 14 (pyrolysis and gasification materials) specified in Annex I of the regulation, such as

- The thermochemical conversion process shall take place under oxygen-limiting conditions in such a way that a temperature of at least 180 °C for at least two seconds is reached in the reactor (Annex I(2)).
- The pyrolysis and gasification materials shall have a molar ratio of hydrogen (H) to organic carbon (H/Corg) of less than 0.7, with testing to be performed in the dry and ash-free fraction for materials that have an organic carbon (Corg) content of less than 50 % (Annex I(3)).
- The pyrolysis and gasification material shall have been registered pursuant to REACH Regulation (EC) No 1907/2006 (Annex I(7)).

#### **10.1.11 ReFuelEU Aviation**

On 18 October 2023, the Regulation (EU) 2023/2405 was published on “ensuring a level playing field for sustainable air transport (ReFuelEU Aviation)”.<sup>110</sup> It is part of the “Fit for 55” package to meet the EU emissions reduction target of 55% by 2030. The regulation lays down harmonized rules on the uptake and supply of sustainable aviation fuels (SAF). In Article 3 of the regulation, SAF means:

- Synthetic aviation fuels: “renewable fuels of non-biological origin” (defined in Article 2(36) of RED Directive (EU) 2018/2001 and limited to liquid drop-in fuels).

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<sup>108</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R1009>

<sup>109</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R2088>

<sup>110</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023R2405>

- Biofuels: as defined in Article 2(33) of RED, produced from the feedstock listed in Part B of Annex IX, such as used cooking oil and animal fats.
- Advanced biofuels: as defined in Article 2(34) of RED, produced from the feedstock listed in Part A of Annex IX in RED, such as “biomass fraction of wastes and residues from forestry and forest-based industries”.
- Recycled carbon aviation fuels: as defined in Article 2(35) of RED, which comply with the lifecycle emissions savings threshold referred to in Article 29a(2) of RED and are certified in compliance with Article 30 of RED.

Annex I of the ReFuelEU regulation sets requirements for aviation fuel suppliers to gradually increase the share of SAF blended into the conventional aviation fuel supplied at EU airports. Aviation fuel suppliers may also decide to comply with the minimum shares by using (i) “renewable hydrogen for aviation” as defined in Article 3(16) of ReFuelEU, (ii) “synthetic low-carbon aviation fuels” (defined in Article 3(13)), and (iii) “low-carbon hydrogen for aviation” (defined in Article 3(15)).<sup>111</sup> Figure A1 illustrates the EU’s binding target on the share of SAF, starting with 2% SAF in 2025 and rising to 70% by 2050.<sup>112</sup>

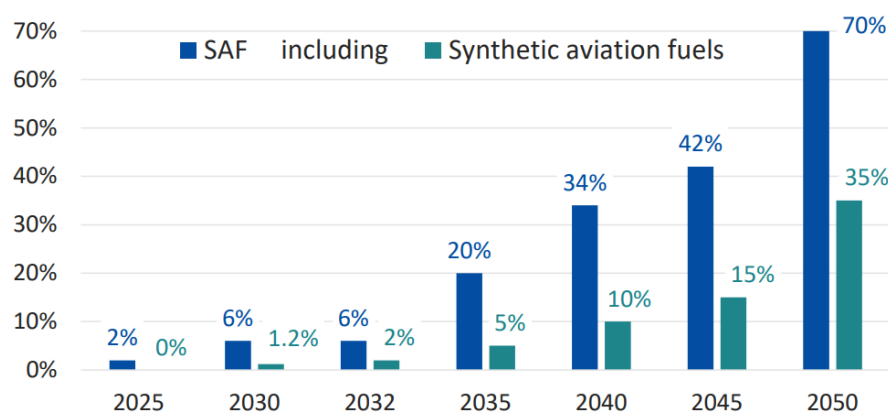


Figure A1: actors and stakeholders in the Energy domain

To speed up the use of SAF, the Commission adopted a Delegated Regulation (Document C/2025/618)<sup>113</sup> on 6 February 2025, which sets out the EU rules for the support system established and financed by the EU ETS. To incentivize early uptake of SAF, 20 million EU ETS allowances, estimated at around €1.6 billion (based on carbon price of €80/tCO<sub>2</sub>) for aircraft operators, are set to cover the price gap between fossil fuel and cleaner fuels (2024-2030).<sup>114</sup>

<sup>111</sup> [https://transport.ec.europa.eu/transport-modes/air/environment/refueleu-aviation\\_en](https://transport.ec.europa.eu/transport-modes/air/environment/refueleu-aviation_en)

<sup>112</sup> [https://www.wto.org/english/tratop\\_e/tessd\\_e/15042024\\_e/05\\_Subsidies-EuropeanUnion.pdf](https://www.wto.org/english/tratop_e/tessd_e/15042024_e/05_Subsidies-EuropeanUnion.pdf).

<sup>113</sup> [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI\\_COM:C\(2025\)681](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI_COM:C(2025)681)

<sup>114</sup> [https://climate.ec.europa.eu/news-your-voice/news/adoption-eu-rules-ets-support-system-accelerate-use-sustainable-aviation-fuels-2025-02-06\\_en](https://climate.ec.europa.eu/news-your-voice/news/adoption-eu-rules-ets-support-system-accelerate-use-sustainable-aviation-fuels-2025-02-06_en)

### 10.1.12 FuelEU Maritime Regulation

On 13 September 2023, Regulation (EU) 2023/1805 on the use of renewable and low-carbon fuels in maritime transport was published. The FuelEU Maritime regulation was published as a part of the “Fit for 55” package to meet the EU emission targets. The regulation establishes harmonized rules for reducing the GHG intensity of energy used onboard ships calling at EU ports. The regulation applies to commercial vessels exceeding 5000 gross tonnes (GT), regardless of flag. It covers 100% of fuel use on intra-EU/EEA voyages and 50% on voyages to or from non-EU or outermost region ports. A “well-to-wake” lifecycle assessment is utilized to evaluate emissions, accounting for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from fuel production through combustion.<sup>115</sup>

The core of the regulation is a series of binding GHG intensity reduction targets relative to a 2020 baseline of gCO<sub>2</sub>eq/MJ. These targets increase over time:<sup>116</sup>

- 2025: 2%
- 2030: 6%
- 2035: 14,5%
- 2040: 30%
- 2045: 62%
- 2050: 80%

To further decarbonize port operations, it will be mandatory to utilize onshore power supply (OPS) or equivalent zero-emission systems for container and passenger ships berthing in major EU ports from 1 January 2030, and all EU ports equipped with OPS by 1 January 2035.<sup>117</sup>

FuelEU also introduce banking, borrowing, and pooling of GHG-intensity credits to incentivize innovation and operational flexibility. Additional benefits are awarded to early adopters and users of renewable fuels of non-biological origin or other alternative propulsion methods such as wind propulsion, which can generate credits for broader fleet compliance.

Enforcing mechanisms include verified annual reporting of fuel consumption and lifecycle emissions, compliance balance calculations during verification periods and a FuelEU Document of Compliance. Ships falling short of their GHG intensity targets face financial penalties, and non-compliance can lead to restrictions on port calls.

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<sup>115</sup> [Decarbonising maritime transport – FuelEU Maritime - Mobility and Transport](#)

<sup>116</sup> [The FuelEU Maritime Regulation: Emission Reduction of Fuels in Shipping | carboneer](#)

<sup>117</sup> [Regulation - 2023/1805 - EN - EUR-Lex](#)

### 10.1.13 EU Taxonomy

The EU taxonomy is the EU's official classification system that defines which economic activities can be considered environmentally friendly<sup>118</sup>. Meant to assist investors, companies and policymakers in directing capital towards projects that support the EU Green Deal and the 2050 climate-neutrality targets. The Taxonomy Regulation entered into force on 12 July 2020 and sets four overarching conditions that an economic activity has to meet in order to qualify as environmentally sustainable.

- Substantially contribute to at least one of six environmental objectives
  - Climate change mitigation
  - Climate change adaptation
  - Sustainable use and protection of water and marine resources
  - Transition to a circular economy
  - Pollution prevention and control
  - Protection and restoration of biodiversity and ecosystems
- Do no significant harm (DNSH) to any of the other 5 objectives
- Comply with minimum safeguards
- Comply with the applicable technical screening criteria

On 4 July 2025, the EU Commission adopted changes to the EU Taxonomy in the form of a Delegated Act<sup>119</sup> originating in the Omnibus I package. Stakeholders have been allowed to provide feedback to the Delegated act and the scrutinized version is planned to be fully implemented on 1 January 2026, covering the 2025 financial year. However, organisations may apply the updated regulation for the 2026 financial year and onwards if deemed convenient.

### 10.1.14 Carbon Border Adjustment Mechanism (CBAM)

The Carbon Border Adjustment Mechanism (CBAM) is a “tool to put a fair price on carbon emitted during the production of carbon-intensive goods” imported from outside of the EU. It was established under Regulation (EU) 2023/956, as a part of the “fit for 55” legislative package, and adopted on 10 May 2023<sup>120</sup>. The GHG emissions subject to CBAM corresponds to emissions covered by Annex I to directive 2003/87/EC, similarly to EU ETS. The mechanism entered its transitional phase on 1 October 2023, with full implementation scheduled for 1 January 2026.

During the transitional period importers are required to submit quarterly reports detailing both direct and indirect emissions embedded in the imported goods but not yet obliged to purchase or surrender CBAM certificates. On 8 October 2025<sup>121</sup>,

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<sup>118</sup> [EU taxonomy for sustainable activities - Finance - European Commission](#)

<sup>119</sup> [Commission to cut EU taxonomy red tape for companies - Finance](#)

<sup>120</sup> [Regulation - 2023/956 - EN - cbam regulation - EUR-Lex](#)

<sup>121</sup> [Regulation - EU - 2025/2083 - EN - EUR-Lex](#)

Regulation (EU) 2025/2083 was adopted, amending Regulation (EU) 2023/965, simplifying CBAM based on data and information gathered since the beginning of the transitional period on 1 October 2023.

- De minimis threshold: The start of CBAM certificate sales is postponed to February 2027, covering verified emissions from 2026 imports
- Quarterly surrender: The required minimum quarterly surrender of certificates is lowered from 80% to 50% of embedded emissions.
- Emissions calculations: Broader use of default values is introduced for calculating embedded emissions where primary data is unavailable (supported by updated Commission methodologies)
- Reporting template: Harmonised formats simplifying reporting and ensuring consistent data collection during final transitional period.

Under article 4 of the regulation, importers of CBAM goods must be authorized by national competent authorities before placing goods on the EU market.

From 1 January 2026, authorised importers must utilize CBAM certificates corresponding to the embedded emissions of their imported goods. The price of certificates will be calculated weekly based on the average auction price of EU ETS allowances as well as follow compliance and enforcements procedures as defined in article 15-20.

- From 2027, authorised declarants shall submit an annual CBAM declaration by 30 September each year, covering the previous calendar year
- Emission data must be verified by an independent accredited verifier in accordance with the methodologies established by the European Commission
- Failure to surrender the required number of CBAM certificates results in a financial penalty comparable to those under EU ETS.

