

EnergyProSafe – Improving energy production and safety in biocarbon value chains



Newsletter 1-2025

Introduction

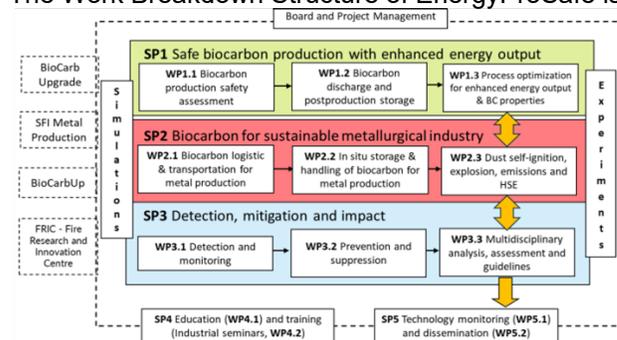
The overall objective of EnergyProSafe is improving and enhancing energy production and safety in biocarbon value chains.

The sub-objectives are:

- Optimization of biocarbon production processes to maximize energy output and produce biocarbon with minimised hazardous properties
- Identifying and evaluating safety-related vulnerabilities and risks during biocarbon production, transportation, handling and storage for metal production
- Increasing fundamental knowledge through experimental and simulation studies on the safety-related issues to identify and investigate root causes and influential factors under industrial relevant conditions
- Developing, testing and assessing the effectiveness of measures to predict, detect and prevent safety-related issues throughout the biocarbon value chains considering different conditions and scenarios
- Proposing and developing guidelines and recommendations for assessing and evaluating technical, HSE, economic and environmental consequences and impacts of the main safety issues identified
- Increasing expertise on safe production, logistics and storage throughout the biocarbon value chains from biocarbon production to metal production processes

- Education of highly skilled candidates and training of industrial partners
- Monitoring of activities and state-of-the-art within this area and dissemination of results to the industry partners, and other relevant parties when applicable

The Work Breakdown Structure of EnergyProSafe is:



EnergyProSafe management and work break down structure and information flow. Project links (biocarbon production, upgrading and application focused projects):

- [BioCarbUpgrade](#) (2023-26): Upgrading biocarbon for sustainable metallurgical industries,
- [BioCarbUp](#) (2019-22): Optimising the biocarbon value chain for sustainable metallurgical industry,
- [BioCarb+](#) (2013-17): Enabling the biocarbon value chain,
- [SFI Metal Production](#) (2015-22),
- [KPN Reduced CO₂](#) (2018-22) emissions from metal production.

EnergyProSafe will run for four years (2025-2028) and has a total cash budget of 16.8 million NOK. This is a [Collaborative and Knowledge-building Project](#) (KSP) funded by The Research Council of Norway and industry.

The EnergyProSafe consortium

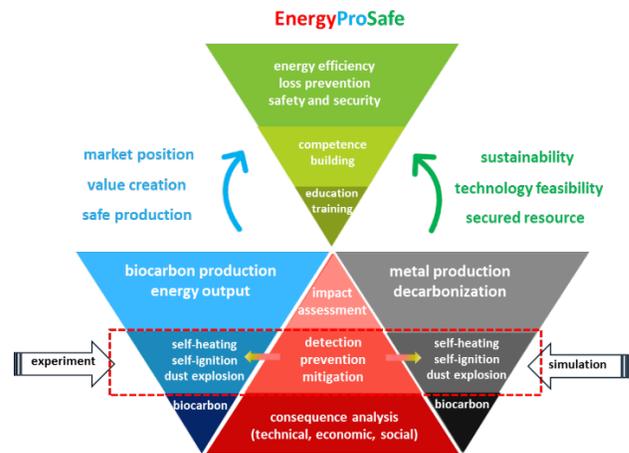
SINTEF Energy Research (SINTEF ER), with a solid BC and bioenergy track record, leads the project and focuses on BC production and process optimization, safety issues through BC value chains to metal production, and dissemination to industry, authorities and the public. Luleå University of Technology (LTU) in Sweden will share knowledge and a model for studying self-heating/ignition of BC.

Mälardalens University (MDU) in Sweden will contribute with strong knowledge and experience on process and system modelling and integration. RISE Fire Research (RFR) will contribute with comprehensive expertise and strong competence on fire research and safety engineering, testing and certification, and assessment and suppressing of fire incidents. The Department of Civil and Environmental Engineering, Norwegian University of Science and Technology (NTNU), will supervise the PhD and master candidates. The industry partners include large and central metallurgical industries in Norway (Elkem, Eramet Norway, Wacker, Finnjord, Hydro), BC production industry (WAI Environmental Solutions) and a vendor of detection technologies (Onsite Technologies). The industrial partners will contribute with their extensive industrial knowledge and experience on safety issues from BC production to end use for metal production.

Project background

Bioenergy is important in Norway, while the metallurgical industry in Norway seeks to substitute large amounts of biobased materials for fossil reductants and materials (packing coke and coal tar pitch) in their processes. An accelerated utilization of Norwegian biomass resources that would reduce the CO₂ footprint of the metallurgical industry is required.

To boost contributions to the reduction of greenhouse gas (GHG) emissions and decarbonization of industries, the biocarbon (BC) value chains must be improved and tuned to remove technical and economic constraints, secure safe and efficient production, satisfy quality and quantity demands and ensure predictable and controlled long term BC supplement. The EnergyProSafe project responds to the national strategies on transition into a low-carbon-emission society and goals of the metallurgical industry by improving energy production and safety in BC value chains, securing safe and sustainable supply of BC of needed quality and in sufficient quantity. In addition, this project addresses safe and responsible production by identifying vulnerabilities and risks, developing detection and prevention measures and providing guidelines and recommendations to prevent accidents. Outputs from the project are valuable for industries carrying out proactive and systematic work in relation to health, safety and the environment (HSE) and making the working environment and safety level appropriate and satisfactory, see project concept below.



BC production processes need to be improved for maximizing mass yields and energy output, which are critical for techno-economics and profitability of BC production. During BC production, a significant fraction of by-products (i.e., gases and volatiles) are generated, which have a high temperature and contain combustible constituents. There is generally limited understanding about compositions and properties of these by-products, especially from continuous pilot and/or industrial scale BC production processes. It hinders identification and implementation of efficient measures to release the energy potential of the by-products, and overall energy output and efficiency of the BC production process. BC production generally covers several stages, including generation of BC at high temperature, cooling down of the produced BC, and discharging of the BC to containers. The BC discharged and loaded in containers will be further stored for days or even months in confined spaces. During both production and storage, there are risks related to self-heating and self-ignition of the BCs as they experience changing surrounding conditions (i.e., ambient temperature, humidity and availability of oxygen). The investigation of the safety-related risks during production and postproduction storage of BC is still at a very early stage. Systematic studies are needed to obtain fundamental understanding of root causes and triggering factors to promote safety. In addition, for producing a large quantity of BC, non-conventional biomass sources will be exploited to produce BC having properties that promote occurrences of self-heating and self-ignition. Further investigations are required to assess propensity and understand detailed mechanisms of the safety risks during postproduction storage of the BC derived from such non-conventional biomasses.

Metal production demands substantial amounts of energy and materials, particularly carbon as reductants. Large quantities of BC must be available for continuous metal production. Before reaching the

furnace, the BC will experience short or long-distance transportation, unloading/reloading, and handling and storage at the metal production plants. Vulnerabilities and safety risks along this process must be identified and assessed. The mechanisms arising safety related risks during logistics are complex and are sensitive to material properties and surrounding conditions. The available knowledge is mainly derived from previous studies on solid fuels (i.e., coal and biomass). Nevertheless, the BC has significantly different physiochemical properties than these solid fuels. Detailed and systematic research and tests designed for BC should be conducted to obtain new understanding and insights into the root causes of safety related risks. Efficient strategies and measures are imperative to detect, prevent and mitigate the safety risks during transportation, storage and handling of BC for metal production, which are tailored to use BC for each specific metal production process. The effectiveness of these measures and impact on industrial operation and the surrounding environment should also be carefully evaluated. Furthermore, recommendations and guidelines for improving health and safety are needed.

Research, development and industrial practices aimed at production and utilization of BC have been addressed in the previous [BioCarbUp](#) and the ongoing [BioCarbUpgrade](#) project.

The EnergyProSafe project will fill the knowledge gap and build up knowledge and competence towards improving energy production and safety in BC value chains. Enhanced understanding and novel solutions to safety issues will improve adaptability and application of BC for metallurgical processes. For this to happen, research and development are needed across the span of the BC value chains through cooperation between R&D institutes and industries. The EnergyProSafe project consortium covers all key aspects, from production to end-use, and includes central industry players in the metallurgical and bioenergy areas in Norway.

Project overview

The project is divided into 5 subprojects (SP), each subproject is itself divided into several work packages (WP).

- Safe biocarbon production with enhanced energy output - SP1
- Biocarbon for sustainable metallurgical industry - SP2
- Detection, mitigation and impact - SP3
- Education and training - SP4
- Technology monitoring and dissemination - SP5

Safe biocarbon production with enhanced energy output - SP1

The main objective of SP1 is to identify risks related to smouldering, self-ignition, dust explosion and other HSE issues during production and postproduction of BC.

SP1 leader: Chief Scientist [Øyvind Skreiberg](#), SINTEF Energy Research

Biocarbon for sustainable metallurgical industry - SP2

The main objective of SP2 is to improve understanding of property change and self-ignition during logistics and transportation of biocarbon.

SP2 leader: Research Scientist [Liang Wang](#), SINTEF Energy Research, who also is the EnergyProSafe project leader

Detection, mitigation and impact - SP3

The main objective of SP3 is identification and development of detection and monitoring and measures for safe biocarbon value chains.

SP3 leader: [Reidar Stølen](#), RISE Fire Research

Education and training - SP4

The major objective of SP4 is education of highly skilled candidates and training of industrial partners.

SP4 leader: Professor [Anne Elise Steen-Hansen](#), NTNU

Technology monitoring and dissemination - SP5

The major objective of SP5 is monitoring of activities and state-of-the-art within this area and dissemination of results to the industry partners, and other relevant parties when applicable.

SP5 leader: Chief Scientist Øyvind Skreiberg, SINTEF Energy Research

Progress in 2025

In the first half of 2025 the focus has been on start-up of the project, studies connected to 1) risk identification during production and upgrading, logistics and storage of biocarbon, 2) influence of production conditions on energy output and BC properties, and recruitment of the PhD candidate and dissemination from the project.

EnergyProSafe kick-off meeting in Trondheim

The EnergyProSafe official kick-off meeting was arranged in Trondheim on 5 June 2025. In the meeting, the project and its activities were presented and discussed, and the project steering committee was established. Each year annual work plans will be proposed and agreed on, based on the project description while also taking into account industries'

needs along the path towards project completion in 2028.



Participants at the EnergyProSafe kick-off meeting in Trondheim

PhD work

The EnergyProSafe PhD position on improving safe handling and storage safety of biocarbon has been [announced](#). When the position has been filled, the candidate will start working at the department of Civil and Environmental Engineering, NTNU, with Professor Anne Elise Steen-Hansen as the supervisor.

EnergyProSafe website established

A SINTEF [website](#) has been established for the EnergyProSafe project, including a publications page which will be kept updated.

EnergyProSafe in EERA Bioenergy Newsletter

An article entitled "EnergyProSafe – Improving energy production and safety in biocarbon value chains, and BioCarbUpgrade" presents EnergyProSafe and also provides a small update from the BioCarbUpgrade project in the July 2025 EERA (European Energy Research Alliance) Bioenergy newsletter.

EnergyProSafe blog

A SINTEF blog presenting the EnergyProSafe project has been [published](#).

EnergyProSafe publications

Liang Wang, Øyvind Skreiberg. [Improving energy production and safety in biocarbon value chains](#). SINTEF blog 27 June 2025.

Liang Wang, Øyvind Skreiberg (2025). EnergyProSafe – Improving energy production and safety in biocarbon value chains, and BioCarbUpgrade. EERA Bioenergy News 23, July 2025, in press.

Other news

Historical agreement in Denmark

10 billion Danish kroner will towards 2045 be made available for global warming abatement efforts in the Danish agricultural sector, which includes a CO₂ tax from 2030 on greenhouse gas emissions from livestock and a significant focus on biocarbon production and the utilization of biocarbon for different global warming abatement purposes. Read more [here](#).

Carbon Removal Certification Framework (CRCF)

“On 10 April 2024, the European Parliament adopted the provisional agreement on the Carbon Removals and Carbon Farming (CRCF) Regulation, which created the first EU-wide voluntary framework for certifying carbon removals, carbon farming and carbon storage in products across Europe. By establishing EU quality criteria and laying down monitoring and reporting processes, the CRCF Regulation will facilitate investment in innovative carbon removal technologies, as well as sustainable carbon farming solutions, while addressing greenwashing.” Read more [here](#).

Norsk Biokullnettverk

The "Norwegian Biochar Network" was founded in 2019. Its purpose is to gather actors from the biochar value chains in Norway. The network aims to promote biochar as an important part of the circular economy, and works towards Norwegian leadership in value creation connected to production and utilization of biochar. SINTEF Energy Research is a member in the network, and Øyvind Skreiberg is a member of its board. Also the BioCarbUpgrade industry partners Elkem, Norsk Hydro and OBIO are members in the network. The network has attracted great interest and many members and has after being in operation as a project within the Norwegian Bioenergy Association (NoBio) for several years, now become a standalone organisation. As a part of the network activities, seminars, workshops and webinars have been arranged on different biochar topics and for different industries (e.g. the metallurgical industry), and the network is also active in making the biochar voice heard in the society and towards authorities. All in all, the foundation of the network has been a timely one, serving its purpose. For more info about the network, see [here](#), where you can find many interesting news from the biochar area, including regarding a new report on the possibilities for sustainable production and the markets for use of biochar in Norway.

Nordic Biochar Network

The Nordic Biochar Network was founded in 2019. It is a joint initiative of researchers in the Nordic countries to increase and spread knowledge about biochar. Research Scientist [Kathrin Weber](#) from SINTEF Energy Research was the main initiator of the Nordic Biochar Network. As a part of the network activities, conferences and webinars have been arranged, e.g. a Biochar Summit in 2024, which was arranged again 10-11 June 2025: [Biochar Summit](#), in collaboration with the Biochar Europe. For more info about the network: <https://www.nordicbiochar.org/>

International Biochar Initiative

In addition to the Norwegian Biochar Network and the Nordic Biochar Network, the [International Biochar Initiative](#) (IBI) is a source of extensive information connected to the biochar field. Its mission is to provide a platform for fostering stakeholder collaboration, good industry practices, and environmental and ethical standards to support biochar systems that are safe and economically viable. IBI news are available [here](#).

European Biochar Industry Consortium (EBI) has become Biochar Europe

[Biochar Europe](#) (the earlier EBI) is supporting the development of biochar applications and is a network of many industrial actors connected to biocarbon production and utilisation. Earlier Norsk Biokullnettverk had an active link to the International Biochar Initiative, but this changed to EBI (now Biochar Europe), i.e. with an increased industrial and European focus. A recent white paper on Biochar as the Key to a Climate-Neutral, Competitive & Resilient European Economy is available [here](#). Interesting resources/news are available [here](#).

Prosess21

Prosess21 is a forum established to strengthen the coordination between the competence environments in and connected to the process industry and the public actors. Prosess21 shall give strategic advices and recommendations on how to minimize emissions from the process industry while achieving sustainable growth. The metallurgical industry is a very important part of the Norwegian process industry. An interesting report, with respect to possible future use and priorities regarding biomass based materials in the Norwegian process industry is [Biobasert Prosessindustri](#), as well as [Ny prosesssteknologi med redusert karbonavtrykk inkl. CCU](#). The [Prosess21 main report](#), summarises the Prosess21 work. A new Prosess21 chapter has now started, with a new mandate and a new steering group, see [here](#). For more info about Prosess21: <https://www.prosess21.no/>

FME ZeMe

[FME ZeMe](#) (Zero Emissions Metal Production) is a Centre for Environment-friendly Energy Research (FME) targeted at the metallurgical industry, which received funding from the RCN in 2024. FME ZeMe has now been established and the kick-off meeting was arranged January 14. A recent conference co-organised by ZeMe, [Biocarbon in metallurgy](#), was arranged in Wisla in Poland 8-9 April, with the BioCarbUpgrade project as one of the contributors.

Recent events

Impacts of Fuel Quality 2024, 2-6 September 2024, Garmisch-Partenkirchen, Germany. <https://fuelqualityimpact.org/news>

Silicon for the chemical and solar industry XVII, Trondheim, 10-12 September 2024. <https://www.ntnu.edu/si-conference>

INFACON 2024, 18-22 September, Beijing, China. [Link](#)

Biochar IV, 18-23 May 2025, Santa Marta, Colombia. <https://engconf.us/conferences/materials-science-including-nanotechnology/bio-char-iv/>

EUBCE 2025, 9-12 June 2025, Valencia, Spain. <https://www.eubce.com/>

The Biochar Summit 2025, June 10-11, 2025, Brussels, Belgium. <https://www.biochareurope.eu/summit>

Upcoming events

ICHEAP17, 17th International Conference on Chemical and Process Engineering 29 June - 2 July 2025, Florence, Italy. <https://www.aidic.it/icheap17/>

COM 2025 & LightMAT 2025, July 7-10, 2025, Montreal, Quebec, Canada. <https://com.metsoc.org/>

E2DT, Palermo, Italy, 12-15 October, 2025. <https://www.aidic.it/e2dt2025/>

ICSOBA 2025, 26 - 31 October 2025, Nanning, Guangxi, China. <https://icsoba.org/2025/>

TMS 2026 Annual Meeting & Exhibition, 15-19 March 2025, San Diego, USA. <https://www.tms.org/TMS2026>

25th International Symposium on Analytical and Applied Pyrolysis, 7-11 June 2026, Pisa, Italy. <https://pyro26.dcci.unipi.it/>

EUBCE 2026, 19-22 May 2026, The Hague, The Netherlands. <https://www.eubce.com/>

Links (click on the links or logos to get there)

[BioCarbUpgrade](#)

[BioCarbUp](#)

[BioCarb+](#)

[KPN reduced CO₂](#)

[Prosess21](#)

[SKOG22](#)

[Energi21](#)

[Norsk Biokullnettverk](#)

[Nordic Biochar Network](#)



Ferrolegeringsindustriens
Forskningsforening

