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EERA BIOENERGY NEWSLETTER

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Joint Programme Coordinator's corner

Myrsini Christou
EERA Bioenergy Coordinator

Dear EERA Bioenergy members, dear eebionews readers,

Green gases, biomethane and biohydrogen, being renewable gases that can be injected into the natural gas grid, are expected to be key contributors towards the decarbonisation of the EU energy system and for reaching the ambitious REPowerEU target of 35 bcm biomethane produced in Europe per year by 2030. Biomethane can reduce reliance on natural gas imports and by being a versatile energy carrier. It can contribute to higher renewable energy shares in the tertiary sector (buildings and industry), for power generation and in the transport sector (by using bio-LNG in heavy road transport or shipping).

Biomethane in Europe is mainly produced by upgrading the biogas from anaerobic digestion, whereas thermal and hydrothermal gasification shows a growing interest as a way to produce biomethane at a larger scale.

Biomethane production volumes are rapidly growing; almost all EU Member States have in place gas infrastructure and storage, a natural gas infrastructure for transport and gas quality regulations; all being important prerequisites for biomethane deployment and growth. Nevertheless, the extent of that growth strongly depends on the market and policy environment, on societal acceptance and also on the research and innovation developments.

To understand the strengths and opportunities for the biomethane market, **EERA Bioenergy** was actively involved in the organisation of the workshop "Delivering on REPowerEU: bringing research and industry closer to accelerate innovation and uptake of biomethane", in the frame of the **SUPEERA** project (https://www.supeera.eu/), joint with the **GreenMeUp** project (https://www.greenmeup-project.eu/). The event was held on the 7th of June 2023, during the EUBCE conference in Bologna (see: https://www.eubce.com/hostedevents/delivering-on-repowereu/)

Eminent European scientists and leading industry were invited to discuss on:

1) How can R&I contribute to accelerating biomethane production and unlock the feedstock potential?
2) How to best standardize the integration of biomethane in the existing gas network?
3) Which policy framework could facilitate biomethane market development?
4) How to increase social acceptance and environmental impact of biomethane facilities and installations?

More than 80 participants joined the event physically and online.

The first session opened with a keynote speech by Maria Georgiadou from the European Commission, Directorate-General for Research and Innovation, and Biomethane Industrial Partnership Task Force 5 on the *Collaboration between Research and Industry for identifying R&I needs to accelerate biomethane production*. Marion Maheut from Engie and Luisa Brega from Prodeval presented the **R&I needs to accelerate biomethane production through gasification and anaerobic digestion upgrading from the industry perspective**. They were followed by Francisco Girio from LNEG who presented the **R&I for efficient and cost-effective production of biomethane through thermochemical technologies**, in the frame of the HYFUELUP project that was initiated within **EERA Bioenergy**, while I had the pleasure to present **R&I to unlock feedstock potential for biomethane production**.

The second session addressed cross-cutting issues: **Removing the technical barriers to biomethane standardisation"** by Erik Büthker from TotalEnergies and European standardisation committee for biomethane, CEN PC 408, **Sustainability in technical, economic, and environmental terms** by Marlies Hrad from the University of Natural Resources and Life Sciences Vienna (BOKU), **Policy framework to facilitate biomethane market development** by Giulia Cancian from European Biogas Association (EBA), and **Social acceptance in socio-political and community dimensions** by Myriam Röder from Aston University.

Berta Matas Güell from SUPEERA moderated the panel discussion and Q&A of the first session, and I moderated the panel discussion and Q&A of the second session as coordinator of the GreenMeUp.

More than 80 participants joined the event physically and online.

On the following day, the 8th of June, we held our EERA Bioenergy Joint Programme Steering Committee Meeting, restricted to our EERA Bioenergy members.

EERA Bioenergy activities are designed to add value to both, the scientific-technical and the industrial sides of the EU bioenergy and biofuels sector. You will be very welcome to this Joint Programme of Excellence to be involved in its activities at all levels!

Myrsini.

EERA Bioenergy news in brief

NEW MEMBERSHIP

We warmly welcome Cukurova University, from Turkey, and the Energy Agency of Plovdiv, from Bulgaria, to the EERA Bioenergy Joint Programme as associate members.

https://ziraat.cu.edu.tr/

https://www.eap-save.eu/

WEBINARS ON COLLABORATIVE PROJECT GENERATION

Between February and May 2023, EERA Bioenergy JP has brought together all its members in several webinars to promote collaboration between the five subprogrammes and, thereby, take full advantage of the possibilities that offers Horizon Europe, the research and innovation framework program of the European Union.

Scientists and researchers from the organization met in a total of seven webinars, restricted to EERA Bioenergy members, and unveiled excellent projects' ideas for the Cluster 5 "Climate, Energy and Mobility" of Horizon Europe 2023-2024 Work Programme.

All EERA Bioenergy members were invited to join the discussions on the following topics:

- HORIZON CL5-2023-D3-02-01: Development of near zero-emission biomass heat and/or CHP including carbon capture.
- HORIZON-CL5-2023-D3-02-07: Development of next generation advanced biofuel technologies.
- HORIZON-CL5-2023-D3-02-16: Accelerating the green transition and energy access in Africa.

These webinars had the objective to boost project collaboration among EERA Bioenergy members to promote key technologies and solutions that support European climate policies and the United Nation's Sustainable Development Goals.

STEERING COMMITTEE MEETINGS HELD IN GRAZ AND BOLOGNA

Steering Committee Meeting in the CEBC 2023 (Graz, Austria)

The first EERA Bioenergy Steering Committee meeting of the year took place in the framework in the framework of the 7th Central European Biomass Conference in Graz (Austria) on the 18th of January.

Relevant issues related to the Joint Programme structure and actions were addressed by the participants.

The European Commission representatives opened the meeting. Maria Georgiadou (DG-RTD) informed on the last updates of R&I policy in renewable fuels and bioenergy. Michael Hübner (CETP) explained the main aim of the Clean Energy Transition Partnership is, and what lies ahead and introduces its integrative Strategic Research and Innovation Agenda. In addition, Biljana Kulisic (DG ENER) showed a clear connection between policy and the Renewable Energies Directive, and the increase in the consumption of biomass and imports, concluding that regulation has a clear impact on the sector's growth.

The Subprogramme Coordinators presented the activities and planning for the 1st semester of 2023, and the EERA Bioenergy Secretariat summarized the main activities and goals achieved since the last Steering Committee meeting held on 16th June 2022.

Dina Bacovsky (ETIP Bioenergy) introduced the Technology and Innovation Platform and highlighted the main activities ongoing in ETIP Bioenergy in which EERA Bioenergy could play a role, followed by the introduction of the new associated member of EERA Bioenergy JP, Yildiz Technical University. Tunç Durmaz had the opportunity to present himself and his team and introduced the university to all the participants.

The three awarded researchers presented an overview of their Doctoral Thesis: Ph.D. Thesis award 'Production of xylooligosaccharides and bioethanol from barley straw by an enzymatic process. Study of its prebiotic activity' (Cristina Álvarez, CIEMAT); Ph.D. Thesis award 'Modelling new sustainable cropping systems for advanced biofuel production' (Andrea Parenti, UNIBO); Ph.D. Thesis award 'Design and test of a table-top facility for the thermochemical valorisation of agricultural residues through pyrolysis and gasification' (Marco Puglia, UNIMORE).

Lastly, Spyridon Pantelis (EERA asbl Secretariat) showed the financial information of EERA Bioenergy and brought updated information on work and activities that are being carried out by EERA asbl.

Steering Committee Meeting in the EUBCE 2023 (Bologna, Italy)

In the framework of the 31st European Biomass Conference & Exhibition in Bologna (Italy), EERA Bioenergy held its second Steering Committee meeting in 2023, on the 8th of June.

Maria Georgiadou (DG-RTD), as the only European Commission representative, opened the meeting. She showed the main provisional RED III targets agreed upon by the EU Parliament and Council on the field of bioenergy and biofuels and informed that new feedstocks had not been added yet to the Delegated Act to RED II. She gave an overview of REPowerEU Plan and highlighted the policy objectives of the Work Programme 2023-2024 of the HE Cluster 5. She finished her presentation by informing about the Integrated Biorefineries Mission of Mission Innovation 2.0 which was launched in April 2022.

Then the Subprogramme Coordinators took the floor and reviewed the goals achieved since January and presented the activities planned for the 2nd semester of 2023. Myrsini Christou, Joint Programme Coordinator, supported every idea and took the opportunity to encourage all the EERA Bioenergy members to find potential activities in which collaborate with the members of other Joint Programmes of EERA.

The EERA Bioenergy Secretariat took stock of the first half of the year and presented all the meetings and webinars that took place in this period and pointed out the increasing engagement that the LinkedIn page of EERA Bioenergy was gaining lately. Finally, the Steering Committee members were informed about an amendment that was going to be included in the BIOPLAT's contract to avoid signing a new contract each year.

Finally, the researchers granted by the EERA Bioenergy Researchers Exchange Programme, Maria Braune and Karl-Friedrich Cyffka, both from DBFZ, presented the research they carried out at WUR and LNEG, respectively.

WORKSHOP ON "BIOFUELS AND BIO-CHEMICALS: INITIATIVES AND PERSPECTIVES"

The EERA Bioenergy Subprogramme 3 (Biochemical platform) coordinator, Dr. Marcelo E. Domine, from the Institute of Chemical Technology - ITQ (Universidad Politécnica de Valencia – CSIC), organized a dedicated **workshop on "Biofuels and Bio-chemicals: Initiatives and Perspectives"** held on 9th February 2023 in Valencia, Spain (agenda).

The international workshop, supported by the EERA Bioenergy Joint Programme, joined experts from industry and academia interested in developments and novel technologies for biofuels and bio-chemicals production, with particular emphasis on advanced biofuels production for aviation and maritime applications.

DELIVERING ON REPowerEU: BRINGING RESEARCH AND INDUSTRY CLOSER TO ACCELERATE INNOVATION AND UPTAKE OF BIOMETHANE

The SUPEERA project (SUpport to the coordination of national research and innovation Programmes in areas of activity of the European Energy Research Alliance), in which EERA aisbl participates as a partner, brought together a group of European scientists and leading industry to participate at a workshop in order to discuss research-industry cooperation practices and opportunities to accelerate innovation in the biomethane/biogas sector and to explore their replicability potential across Europe.

The unprecedented crisis Europe faces due to Ukraine's invasion forced the European Commission to present REPowerEU, a plan to rapidly reduce Europe's dependence on Russian fossil fuels. The plan, among others, involves boosting sustainable biomethane production to 35 bcm/year by 2030 and to meet this gigantic growing demand, European biogas/biomethane producers and other key players along the value chain need to incorporate innovative solutions, always supported by R&I.

That was the main purpose of the workshop that was held on 7 June as a parallel event during the 31st European Biomass Conference & Exhibition in Bologna (Italy), organized by EERA aisbl, EERA Bioenergy JP and SUPEERA Project.

In this endeavor, the SUPEERA project also joined forces with the GreenMeUp project, which aims to enhance the biomethane market by designing market uptake measures for biomethane deployment in countries with slower market development rates, increasing also social acceptance and awareness.

Among the speakers who participated in the workshop there were several members of EERA Bioenergy, such as Myrsini Christou, Joint Programme Coordinator, who participated as a representative of the Centre for Renewable Energy Sources and Saving (CRES) to point out the available R&I to unlock feedstock potential for biomethane production; and Francisco Gírio, Head of Bioenergy Unit at LNEG and President of the Board of BIOREF - Collaborative Laboratory (CoLAB), who put the focus on the importance of R&I to achieve efficient and cost-effective production of biomethane through thermochemical technologies, and introduced the HyFuelUp project which aims to develop and advanced technology for biomethane production using gasification and methanation.

Bioenergy highlights

WOOD: A WILD CARD FOR THE ENERGY TRANSITION

Prof. Oliver Kröcher
Leader of the Bioenergy and Catalysis Laboratory
Paul Scherrer Institut (PSI)
oliver.kroecher@psi.ch

Researchers at the Swiss Federal Institute for Forest, Snow and Landscape Research WSL, the Paul Scherrer Institute PSI and other institutions have calculated the energy potential of Swiss wood and further developed technologies for wood combustion and conversion into electricity and fuels. They also investigated how bioenergy should best be embedded in the Swiss energy system and published the results in the "White Paper Wood", which summarises part of the results of the Federal Government's multi-year energy research programme "Biomass for Swiss Energy Future" (SCCER Biosweet). This program, headed by Prof. Oliver Kröcher, involved up to 15 research groups and dozens of industry partners.

Currently, wood energy accounts for about 5% of the total final energy consumption in Switzerland, namely about 40 petajoules (PJ) per year. That is slightly more energy than the city of Zurich needs in a year. This share could - economically and ecologically sustainable - increase by a maximum of one-third (14 PJ). Among the different wood resources, the most untapped potential (5 to 10 PJ) remains in forest wood.

For maximum energy production and CO_2 savings, wood should be used differently on a larger scale than it is today. In industry, wood can be used to generate high-temperature process heat, for example in the form of steam. Or it can be used to produce gaseous and liquid fuels - including for aircraft. The waste heat and CO_2 produced during conversion should be captured and used. This helps the CO_2 balance and compensates for other emissions, such as those from agriculture, which are unavoidable. The conversion technologies developed in the research programme improve the efficiency and CO_2 balance of such applications, but not all are ready for the market.

Furthermore, electricity can be generated from energy wood in combined heat and power plants, which would be the next best use, especially in winter, to bridge the winter electricity gap. If space heating is to be obtained from wood, this should ideally and if possible be done in large plants connected to the district heating network. These can be operated with fewer pollutants and more efficiently than a large number of small units.

Because energy wood can be used in so many ways, it can be regarded as a wild card for shaping the energy transition. Energy wood can stabilise the energy supply and the electricity grid, as wood can be stored and converted when needed to balance peak loads in the grid.

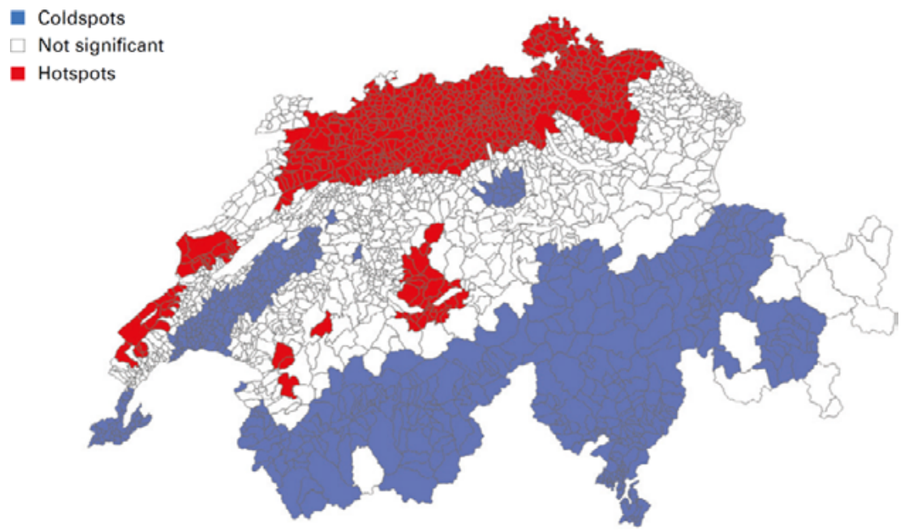


Figure 1. Hot- and coldspots in the sustainable potential per unit area of wood fuel from Swiss forests. More information is available at map.geo.admin.ch (under "woody biomass").

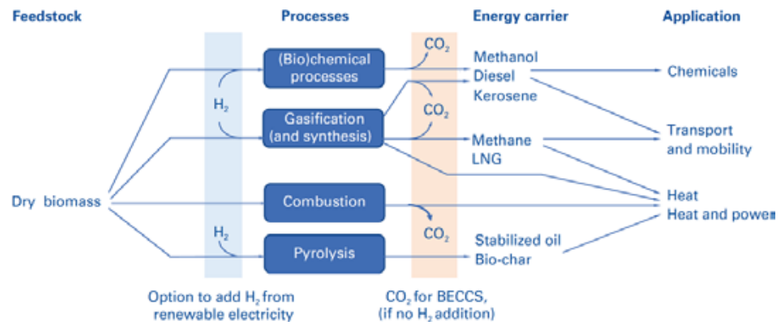
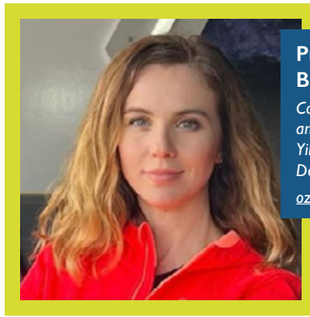


Figure 2. Overview of important conversion pathways of dry biomass (BECCS: bioenergy with carbon capture and storage, LNG: liquefied natural gas).

Original article:

Thees, O.; Erni, M.; Burg, V.; Bowman, G.; Biollaz, S.; Damartzis, T.; Griffin, T.; Luterbacher, J.; Marechal, F.; Nussbaumer, T.; Schildhauer, T.; Schweier, J.; Studer, M.; Kröcher, O., 2023: White paper – Wood fuel in Switzerland: energy potential, technology development, resource mobilization, and its role in the energy transition. SCCER-BIOSWEET; Birmensdorf, Swiss Federal Research Institute WSL. 34 pp. https://doi.org/10.55419/wsl:32791

VALORIZATION OF HYDROTHERMAL CARBONIZATION PROCESS WATER USING MICROALGAE WITH BIOECONOMY APPROACH



Prof. Dr. Didem Balkanlı Özçimen
Coordinator, Algal Biotechnology and Bioprocess Laboratory
Yildiz Technical University-Department of Bioengineering
ozcimen@yildiz.edu.tr

In recent years, wastewater treatment applications shifted from just sanitation to treatment and nutrient recovery by using microalgae. Microalgae cultivation in wastewater has received increased interest due to the specific properties of microalgae. This approach provides utilization of organic and inorganic carbon, phosphorous and nitrogen by microalgae from wastewater, reduction in the concentration of undesired substances in water, and effective growth of microalgae simultaneously [1].

Today, with the bioeconomy concept, utilizing wastewater in an appropriate environment for microalgae cultivation is of great importance to meet the targets determined in the Paris Agreement. Since recycling is crucial in this concept, using microalgae to convert excessive amounts of nutrients in wastewater is valuable [2]. The studies about biological removal of phosphorus, carbonaceous and nitrogenous substances via microalgae in wastewater have been investigated by different studies including several microalgae species on a wide range of wastewater mediums such as a brewery, municipal, refinery, agricultural, and industrial wastewater [3].

One of these wastewater types used for growing microalgae is the process water released as a result of hydrothermal carbonization of liquefaction treatment. Hydrothermal carbonization (HTC) is a biomass conversion technology that is performed in compressed water and relatively lower temperatures (180-250 °C). The process water (PW) or aqueous phase (AP) obtained from HTC is called the "waste phase" and needed to be valorized [4].

Studies investigated the characterization of PW showed that it contains some organic compounds such as sugars, hydrocarbons, phenols, alcohols, carboxylic acids which have potential toxicity to different life forms including various microorganisms. Considering the environmental and health issues, utilization of PW is important in succeeding in better economic and environmental sustainability for the entire process. Valorization of PW can help the recovery of valuable materials and decreasing the toxic effect [5], [6].

Our studies in collaboration with Prof. Dr. İskender Gokalp's research team from Institut de Combustion Aérothermique Réactivité et Environnement (ICARE) – CNRS, showed that the process water (PW) from HTC of orange and olive pomace can be utilized for microalgae production (Fig 1). In these studies, tested microalgae *(Chlorella sorokiniana, Chlorella minutissima* and *Botryococcus braunii)* grew efficiently up to a certain concentration of PW. It was observed that the growth rates were higher and the doubling times were shorter at low dilution rates for these microalgae species.

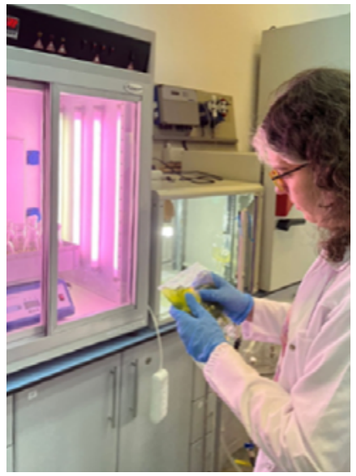


Figure 1. Valorization of HTC PW using microalgal biomass

As a result of these studies, it was understood that HTC PW can be used in microalgae cultivation and it can be a prominent strategy to increase the sustainability of the algal industry. Yet, further studies are needed to observe the fate of organic pollutants during microalgae production and to verify and calibrate the process design such as Fig 2, for the production of high-value-added products such as biofuels from microalgae produced by valorizing wastewater.

You can access our recent studies using the links below:

https://www.sciencedirect.com/science/article/pii/S2352186423000445
https://www.sciencedirect.com/science/article/pii/S2214714420306607

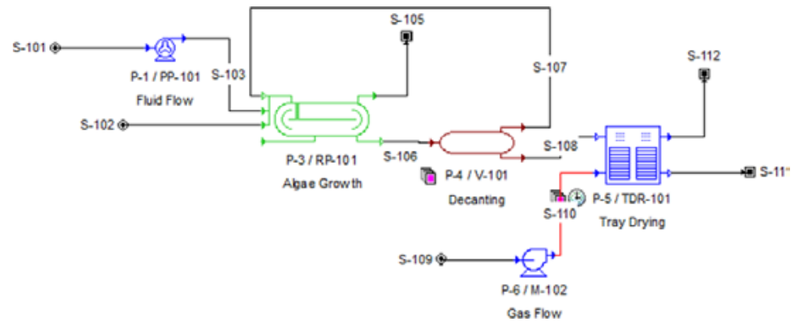


Figure 2. Design of microalgal production system

References:

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PILOTING OF GASIFICATION AND GAS FERMENTATION PLANTS: BioSFerA PROJECT

Ilkka Hiltunen
Gasification team manager
VTT Technical Research Centre of Finland Ltd
Ilkka.Hiltunen@vtt.fi

Pedro Acuña López
R&D Engineer
Bio Base Europe Pilot Plant (BBEPP)
pedro.acuna.lopez@bbeu.org

Stefano Rebecchi
R&D Engineer
Bio Base Europe Pilot Plant (BBEPP)
stefano.rebecchi@bbeu.org

Koen Quataert
Innovation Manager Gas Fermentation
Bio Base Europe Pilot Plant (BBEPP)
koen.quataert@bbeu.org

Ville Nikkanen
Research scientist
VTT Technical Research Centre of Finland Ltd.
ville.Nikkanen@vtt.fi

The BioSFerA project aims to develop a cost-effective interdisciplinary technology to transform maritime transport and aviation into green sectors. In this line, biogenic residues will be converted into jet and bunker fuels, combining thermochemical, biological, and thermocatalytic processes. The overall BioSFerA concept involves biomass gasification to produce syngas (CO_2, CO, and H_2) and a 2-stage fermentation process. The latter aims to first convert the syngas into acetate through gas fermentation (1st stage), which then is used as feedstock to produce triacylglycerides (TAGs) in an aerobic fermentation process (2nd stage).

Under the scope of this EU project, VTT and Bio Base Europe Pilot Plant (BBEPP) aim to validate the integration of the gasification and gas fermentation processes for the production of acetate from biomass-derived syngas at pilot scale (TRL5) (Figure 1).

Figure 1. Overall BioSFerA project concept, and piloting integration of gasifier and gas fermentation unit

VTT and BBEPP are respectively owners of a gasification plant and a mobilized gas fermentation plant utilized in process piloting (Figure 2). VTT's pilot plant consists of a Dual Fluidized Bed (DFB) gasifier and a syngas ultra-purification unit (Figure 3). BBEPP gas fermentation pilot plant, the Bio Base Mobile Pilot Plant (BBMPP), consists of a containerized mobile unit that contains high-pressure gas fermentation reactors (25L and 150L), analysis equipment, and all required utilities to operate it in a stand-alone manner. The BBMPP can be placed close to the gas-emission source, avoiding the issues related to industrial gas compression and transport, and enabling the validation of different gas fermentation processes in an industrial environment (Figure 4).

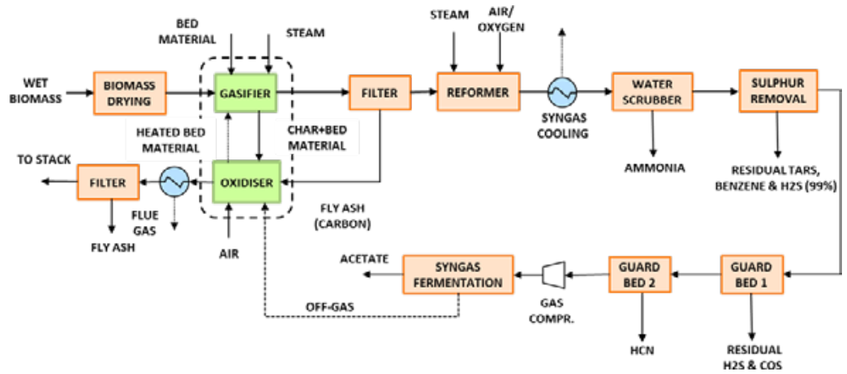


Figure 2. Schematic diagram of integrated gasification and synthesis gas fermentation pilot at VTT Bioruukki pilot centre

Figure 3. DFD gasification pilot and syngas ultra-purification unit at VTT Bioruukki pilot centre

Figure 4. Bio Base Mobile Pilot Plant (BBMPP), a containerized mobile unit dedicated for gas fermentation processes. BBMPP at the site of Arcelor Mittal Ghent (Belgium) in the framework of BIOCON-CO2 project (top picture) and BBMPP loaded onto a truck and delivered to its new location at VTT (Finland) (bottom picture)

The piloting activities aim to validate the integrated processes using real syngas, which contains impurities that cannot be tested or simulated reliably in a lab. Therefore, tests at TRL5 are needed in order to validate the process in an industrial environment. One of the main goals is to study the effect of these impurities on the microorganism and process performance. Several tests will be performed in order to evaluate to which extent the syngas produced by VTT requires purification before it can be adopted as an adequate feedstock for the gas fermentation process. To this end, modifications will be implemented into the syngas cleaning unit to obtain different qualities of syngas (in terms of impurities and their concentration) and evaluate the tolerance of the microorganisms.

Additionally, BBEPP and VTT aim to improve acetate productivity and gas conversion rates. When the processes are validated with real syngas, the main focus will be on the improvement of the fermentation conditions to boost the acetate productivity. The project targets to achieve a high acetate production rate, which will be achieved by combining the optimal gas processing requirements and optimizing the fermentation conditions (e.g. installation of a cell recycle system to allow continuous fermentation). This latter approach will eventually aid in increasing the total gas conversion rates as it allows an increase in biomass concentration while removing the produced acetate, which inhibits the microorganism at high concentrations. Another strategy to increase the total gas conversion rates would be to recycle the off-gas back to the fermenter.

Figure 5. Ilkka Hiltunen, Stefano Rebecchi and Pedro Acuña Lopez in front of the BBMPP in its new location at VTT Bioruukki pilot centre (Espoo, Finland)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement 884208.

CEE2ACT PROJECT AND ITS BOTTOM-UP, PARTICIPATORY APPROACH TO FOSTER THE BIOECONOMY TRANSITION

Maider Gómez Palmero
Project Manager
CIRCE
mgomez@fcirce.es

María Beatriz Rosell
CEE2ACT project coordinator and senior project manager Geonardo Environmental Technologies
maria.beatriz.rosell@geonardo.com

Bioeconomy plays a significant role in bringing forth a sustainable systemic change addressing environmental, social, and economic issues alike. According to the EU Bioeconomy Strategy Progress Report released on 9 June 2022, 10 countries have already adopted a bioeconomy strategy or action plan to pave the way for the sustainable development of the bio-based sectors. Five of the seven countries currently developing their national bioeconomy strategy are part of the Central Eastern European (CEE) region.

Currently, the CEE countries generally adopt a traditional and linear approach to their development policies, with more innovative and participatory approaches needing more present. This is at odds with the increasingly interdisciplinary nature of the bioeconomy, which requires a wide range of experts and stakeholders to be involved in the various innovative processes and products.

A sustainable bioeconomy transition can only occur with strategies that accommodate regional and local needs and challenges and facilitate the interaction between various actors (including producers, decision-makers, researchers, industry, academia, other stakeholders, business, citizens, and non-governmental organizations). The lack of these strategies leads to disparities across the Member States regarding the activity and development of circular bioeconomies affecting the realization of the Green Deal objectives.

It is becoming clear that Member States need to adopt a more bottom-up approach that will challenge the previous conceptualizations about how states, citizens, and stakeholders interact regarding natural resources governance.

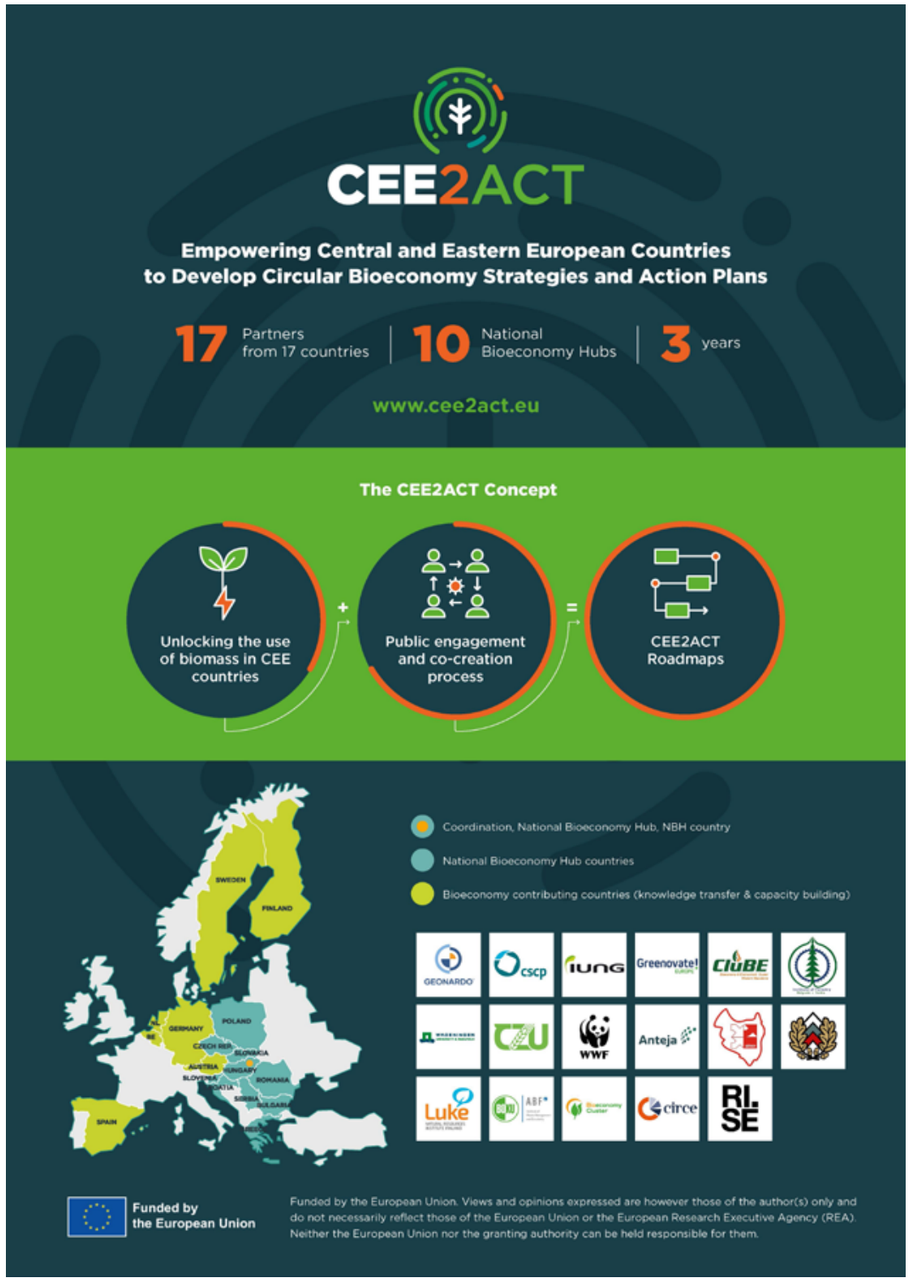
CEE2ACT project aims to facilitate this by empowering countries in Central Eastern Europe (Hungary, Bulgaria, Croatia, Czechia, Poland, Romania, Slovakia, Slovenia) and beyond (Greece, Republic of Serbia) to develop circular bioeconomy strategies and action plans.

CEE2ACT will apply an interactive, collaborative approach that empowers stakeholders to discuss and work together on issues directly affecting their environment. CEE2ACT's stakeholder engagement strategy combines a top-down and bottom-up approach. The aim is to engage and bring together key relevant actors, such as government ministries, universities and research institutes, private companies, associations, and NGOs.

The project promotes dialogue and knowledge exchange between these actors so that they can benefit from each other's expertise and resources, leading to an increased awareness of bioeconomy issues and opportunities among the stakeholder groups and the public. This helps foster a more profound commitment of the involved actors to bioeconomy strategies, thus increasing the readiness and efficiency of strategy implementation.

The development of digital solutions, such as an online inventory of good practices on bioeconomy, a self-assessment tool for bioeconomy promotion, an e-learning platform for the advancement of sustainable governance, and the CEE2ACT business-to-business matchmaking online tool will be carried out to support the process of capacity building of target groups by testing and validating the digital solutions.

By helping to realize the vision of a European circular bioeconomy, in time, CEE2ACT will facilitate the restructuring of industries, modernization of production systems while preserving biodiversity and the welfare of European citizens.



ELECTROCHEMICAL ACTIVITY AND STABILITY OF *Geobacter spp.* DOMINATED BIOFILM ANODES IN ANAEROBIC DIGESTION

Dr. Daniel Dzofou Ngoumelah
Researcher & Electrobiotechnology expert
DBFZ Deutsches Biomasseforschungszentrum gemeinnützige GmbH
daniel.Dzofou.Ngoumelah@dbfz.de

One of the greatest challenges facing mankind is the mitigation of climate change. For this, renewable energy supply systems need to be further developed. The transition from unsustainable energy systems based on fossil fuels to sustainable energy production based on renewable energy sources, such as solar, wind and biomass, seems to be the most effective way to ensure environmental security as well as energy and food supply worldwide. Several technologies can be used to meet these needs, including anaerobic digestion (AD) and microbial electrochemical technologies (MET).

AD is a key technology for stabilising organic waste streams and producing energy in the form of biogas. To achieve high biogas production, the AD process needs to be monitored, as a high substrate feed or a disturbance of the process parameters (e.g. a high pH fluctuation) can disrupt the underlying biological processes. MET are technologies or applications that take advantage of the electrochemical interaction of microbes and electrodes. AD performance can be supported and enhanced by MET in a variety of hybrid technologies. The strength of combining both technologies lies in their complementary nature, e.g. application areas, substrates (e.g. wastewater) or process conditions (e.g. neutral pH and mesophilic temperature range). Potential benefits of the AD-MET combination include: 1.) process monitoring, control and stabilisation, 2.) nutrient recovery, 3.) wastewater treatment and 4.) biogas upgrading. These applications can be achieved by using electroactive bacteria of the genus *Geobacter spp.* that form a biofilm on solid electrodes (e.g. graphite rods) as receptors for microbial electrochemical sensors (MESe). However, the combination of AD and MET not only enables a new ecological niche between microorganisms, but also leads to different interactions between biofilm electrodes and AD components. So far, most studies combining both technologies have reported inhibition of biofilm anodes dominated by *Geobacter spp.* It is suggested that the observed biofilm inhibition may be caused by certain components of the AD fermenter contents acting as alternative terminal electron acceptors (TEA) (Fig. 1).

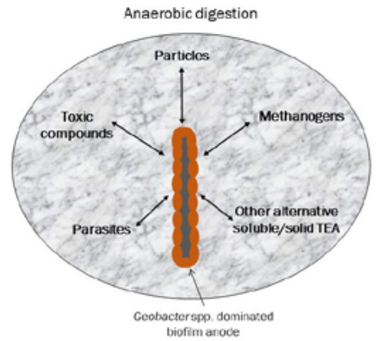


Figure 1. Potential inhibitors of *Geobacter spp.* dominated biofilm anodes in anaerobic digestion. Double-line arrows represent possible interactions.

The aim of the PhD work was to elucidate and address the main cause of the inhibition of *Geobacter spp.* dominated biofilm anodes previously observed in AD environments. The results indicated that the combination of AD and MET requires constant activity and stability of electroactive biofilms such as *Geobacter spp.* dominated biofilm anodes under AD conditions. Parameters such as the age of the biofilm, the composition of the methanogenic community in the AD effluents and the applied anode potential were found to be crucial in this combination. However, identifying other potential triggers of biofilm inhibition dominated by *Geobacter spp.* (e.g. other detrimental AD components to EAM in biofilms) and strategies to overcome them could represent an unprecedented breakthrough in AD-MET combinations. For this, further improvements and a better overview of AD-MET combinations need to be achieved, e.g. by: 1.) analysing and comparing the chemical, physical and biological composition of AD plants with different feedstocks, 2.) monitoring biofilm activity and changes in the microbial community of Geobacter spp. dominated biofilm anodes in a wider range of AD effluents from different feedstocks, 3.) monitoring *Geobacter spp.* gene regulation (knock-out/down/in) under different AD environments, and 4.) investigating in depth all possible syntrophic reactions between *Geobacter spp.* dominated biofilms and the AD microbiome.

The results of this doctoral thesis have been published in several peer-reviewed articles:

Publications:

[1] Dzofou Ngoumelah, D.; Harnisch, F.; Kretzschmar, J. (2021). "Benefits of Age-Improved Resistance of Mature Electroactive Biofilm Anodes in Anaerobic Digestion". *Environmental Science & Technology* (ISSN: 1520-5851), Vol. 55, Nr. 12. p. 8258–8266. DOI: 10.1021/acs.est.0c07320.

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[3] Dzofou Ngoumelah, D.; Harnisch, F.; Sulheim, S.; Heggeset, T. M. B.; Aune, I. H.; Wentzel, A.; Kretzschmar, J. (2023). "A unified and simple medium for growing model methanogens". *Frontiers in Microbiology* (ISSN: 1664-302X), Vol. 13. DOI: 10.3389/fmicb.2022.1046260.

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BeonNAT – INNOVATIVE VALUE CHAINS FROM TREE & SHRUB SPECIES GROWN IN MARGINAL LANDS AS A SOURCE OF BIOMASS FOR BIO-BASED INDUSTRIES

Dr. Luis Saul Esteban
Biomass Unit Head
Department of Energy, CIEMAT, Spain
luis.esteban@ciemat.es

Dr. Ana Susmozas Torres
Biobased Fuels and Products Unit
Department of Energy, CIEMAT, Spain
analsabel.Susmozas@ciemat.es

Dr. Raquel Iglesias Esteban
Biobased Fuels and Products Unit Head
Department of Energy, CIEMAT, Spain
raquel.iglesias@ciemat.es

Nowadays, fossil fuel scarcity, environmental concerns and energy security have driven the transition from a fossil-based economy towards a bio-based economy. Lignocellulosic biomass is considered a key feedstock to achieve this transition since it represents one of the most available resources, has a wide variety of sources (energy crops, forestry residues, agro-industrial residues, etc.) and can be transformed into a wide variety of biofuels and bioproducts through biotechnological processes. However, it is important to ensure a sustainable use of biomass, while avoiding competition with the use of land for food production. To meet this objective, the **BeonNAT** project (https://beonnat.eu/) proposes the use of marginal lands in Europe to obtain lignocellulosic biomass for the production of eight products based on new bio-based value chains such as essential oils, herbal extracts, wood pulp, particleboard, bioplastics, biochar, active carbon, and absorbent for pets. In this way, the main aim of this project is to select underused tree and shrub species in Europe with potential to grow in marginal lands in Romania, Spain and Germany, as well as create added-value bio-based products following a cascade exploitation in biorefineries.

The project Consortium is coordinated by CIEMAT (Spain) and is constituted by 15 partners and 1 association: CESEFOR (Spain), RE-CORD (Italia), AIMPLAS (Spain), ATB (Germany), BTU (Germany), USV (Romania), IPB-CIMO (Portugal), CONTACTICA (Spain), IDOASIS (Spain), EL JARPIL (Spain), ENVIROHEMP (Spain), NNFCC (United Kingdom), TOLSA (Spain), MAVERICK (Spain), PEFC (Spain).

The main activities in the BeonNAT project include the following: (1) selection of the most promising underutilised tree and shrub species for new bio-based products production; (2) guarantee the forest-based biomass supply chain to feed BeonNAT biorefineries, (3) assessment of the benefits of intercropping/mixed-plantations in marginal forest or agricultural land versus the monospecific growing in Spain, Germany and Romania, (4) definition of agricultural and forest marginal land in Spain, Germany and Romania to grow BeonNAT feedstock and identify potential marginal lands in the three countries to ensure future supply, (5) validation of eight new forest-based value chains through optimised production processes and (6) demonstration of the environmental, social & economic feasibility of the BeonNAT cascade biorefinery.

In this project, CIEMAT is mainly involved in the tasks that address the selection of the most promising underutilized species for different European countries, the cultivation, harvesting, logistics and supply plan of the project, and the development of two value chains, bioplastics and essential oils. In addition, it also actively contributes to environmental, social and economic assessments and the dissemination of results.

The main outcome of BeonNAT project will be the production of biodegradable bio-based products and bioactive compounds from sustainable lignocellulosic biomass that will play an important role to replace fossil-based competing substitute products. BeonNAT will help to mitigate the impacts of climate change, enabling smarter and more sustainable products and materials, to make the most efficient use of our renewable natural resources, as well as providing huge economic opportunities for the bio-based economy in Europe.

Figure 1. Portable distillation prototype of Biomass Unit at CIEMAT.

Figure 2. Steam explosion pilot unit of Advanced Biofuels and Bioproducts Unit at CIEMAT.

VALUE ELEMENT RECOVERY FROM BIOMASS RESOURCES

Dr. rer. nat. Steffi Formann
Team Value element recovery
DBFZ Deutsches Biomasseforschungszentrum gemeinnützige GmbH
steffi.formann@dbfz.de

Dipl.-Phys. Thomas Schliermann
Team Value element recovery
DBFZ Deutsches Biomasseforschungszentrum gemeinnützige GmbH
thomas.schliermann@dbfz.de

Biogenic resources are valuable suppliers of a variety of human-use products. From materials and storage media to fiber optic cables, digital technologies and water treatment, our live functions depending on the availability of metal and mineral raw materials. Infrastructure, communication, renewable energies, electro mobility, security of supply - the demand for resources and value elements continuously grow rapidly. In order to be able to provide raw materials in a future-proof sustainable manner, global challenges are also increasing. To avoid deficits, the material use of biomass-bound value elements from biomass residues and agricultural by-products through sustainable bioeconomy technologies is an essential contribution in terms of sustainable and efficient raw material use in economic cycles. While plants take up various bioavailable elements via mass flow, in the form of ions, bioavailable nutrient elements, other elements such as trace and value elements are absorbed concomitantly. Depending on existing biotic and abiotic factors, these are enriched in the plant tissue in usable concentrations. In addition to essential nutrients, therefore crops also store bioavailable trace and value elements in various parts of the plant. The influence of climatic or anthropogenic conditions can additionally favor the uptake of value elements through altered uptake rates as a result of increased bioavailability and climatic changes within the vegetation period. Cereal plants accumulate large amounts of silicon, partly via special cellular transporter systems, which plays a crucial role, especially with regard to biotic and abiotic stress tolerance, mechanical strength and sturdiness of cereal stalks as well as for the quality and quantity of yields [1]. Rye plants (*Secale cereale* L.), include rare earth elements such as europium and cerium in the plant shoot [2]. Bioavailable forms of elements such as rare earth elements and noble metals can be found enriched in the biomass of roadside greenery.

In our team, we are focusing on the coupled material and energetic use of biomass as sources for metal or mineral raw materials and energy. Through a targeted recovery strategy, raw elements are recovered from multiple biomass sources and processed for a cascade use in technology applications. In an interdisciplinary team, we are working on the recovery of value elements based on a precise analysis of biomass raw materials and the value element properties obtained from them for a sustainable, careful and economic use of raw materials. In our working group, we have established a material-energy process chain in various sub-steps with pre-treatment, concentration, extraction and post-treatment of valuable elements for combined technical biomass processing [3], shown in figure 1.

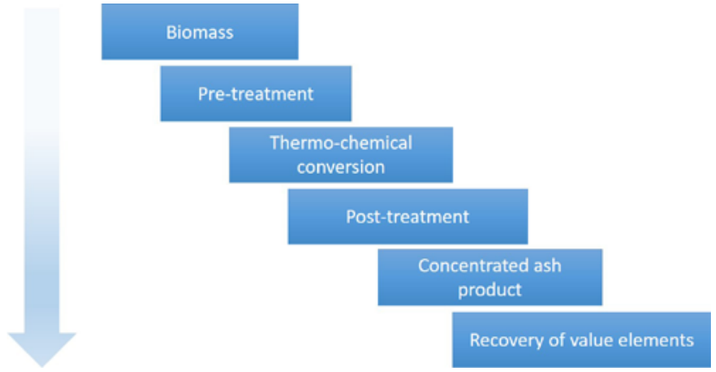

Fig. 1: Gradual process chain of value element recovery.

Future demand for valuable raw materials can be covered proportionally by biogenic resources in this way. The recovery of valuable resources such as biogenic silica from biogenic sources is already being established in our working group in a targeted and adapted process. Currently, we are developing this gradual process chain for the recovery of other valuable elements as a technically established method [4]. Valuable raw materials can therefore be obtained through a coupled material-energy use of biomass. Through a cascade use of these biogenic resources, an economic added value can be combined with an economically sensible multiple uses. These include silicon, rare earth elements, trace elements and heavy metals. Due to high extraction costs and strongly limited availability with simultaneously high demand, the use of valuable elements from biomass such as agricultural residues or roadside greenery is an attractive and environmentally friendly source of supply. In the long term, this will contribute to a sustainable, resource-conserving and cycle-oriented use of materials. The utilization of plant biomass and biomass residues in the sense of a sustainable bioeconomy strategy, therefore, represents an important contribution to an environmentally friendly and value-adding use of resources [5].

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UPGRADING BIOCARBON FOR SUSTAINABLE METALLURGICAL INDUSTRIES (BioCarbUpgrade)

Øyvind Skreiberg
Chief Scientist &
BioCarbUpgrade project leader
SINTEF Energy Research
oyvind.skreiberg@sintef.no

In the project BioCarbUp (Optimising the biocarbon value chain for a sustainable metallurgical industry; 2019-23) a large effort has been made towards optimising the biocarbon value chain for the metallurgical industry through 1) Production of biocarbon with sufficient quality satisfying the end user quality requirements while ensuring optimum utilisation of the by-products, 2) Optimised sourcing of Norwegian forest resources for biocarbon production towards the specific metallurgical processes, and 3) Maximising the energy and cost efficiency of the biocarbon value chain for the metallurgical industry.

Results and recommendations from the BioCarbUp project are available in the BioCarbUp handbook and are summarised in this blog.

Now a new knowledge-building project, Upgrading biocarbon for sustainable metallurgical industries (BioCarbUpgrade), is starting and will run for 4 years. This time the main focus is on the need to broaden the resource base and adapt the resources and the biocarbon properties to fit the specific needs of the different metallurgical industries. BioCarbUpgrade is led by SINTEF Energy Research and 80% financed by the Research Council of Norway and 20% financed by a number of industrial partners.

The **overall objective** of BioCarbUpgrade is **Sustainable biocarbon value chains for the metallurgical industries**. The sub-objectives are:

1) Broadening of the biomass resource base for the specific metallurgical processes, including biomass pretreatment,

2) Identifying enhanced biocarbon production processes and scale-up requirements of these to produce optimum yields and qualities,

3 Developing methods for upgrading biocarbon and biooil to increase their suitability for the specific metallurgical processes,

4) Sustainability assessment of value chain performance of existing and improved metallurgical processes and connected systems for different metallurgical industries in Norway,

5) Assessment of the future role of woody biomass for reductants and materials in the Norwegian metallurgical industry within the context of progress towards the UN SDGs,

6) Increasing expertise throughout the biocarbon value chains for the metallurgical industries,

7) Education of highly skilled candidates within this area and training of industry partners,

8) Monitoring of activities and state-of-the-art within this area and dissemination of knowledge to the industry partners, and other interested parties when applicable.

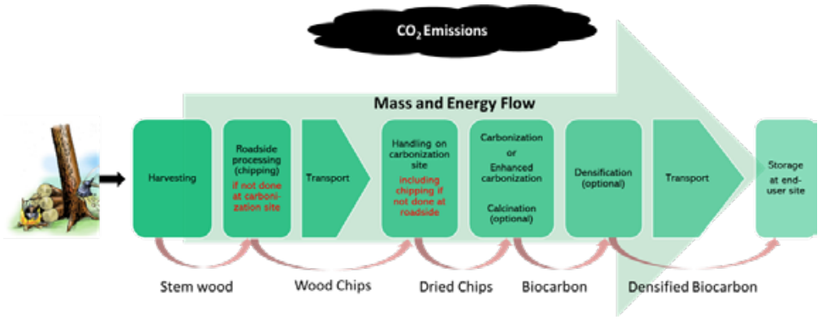
Metals have a wide range of uses and can be found in countless products that we take for granted today. Our society is, quite literally, built on a foundation of metal. To produce these metals in the future we need to produce from renewable biomass something similar to what Mother Earth has spent millions of years producing, i.e. fixed carbon as in fossil coals, and which can actually be used as a reductant (removing oxygen from metal oxides) in current metallurgical processes. This we need to do in a way that satisfies all pillars of sustainability. A lot of work remains to further develop, test, verify, streamline and optimise concepts and processes, as well as expand the biomass resource base to ensure access to resources, reduce the resulting CO_2 emissions and the CO_2 footprint (from the use of fossil resources) throughout the entire value chain, and – not least – reduce costs.

We must not forget why we are doing this; we are doing it to reduce global warming. All biomass that is used for various energy or material purposes, and that, by definition, does not contribute to global warming, is a very valuable resource, with the potential to substitute fossil resources used for the same purposes. In order to maximise this substitution effect, we need to utilise our biomass resources in an optimal way, including reducing the associated CO_2 emissions, and in interaction with other renewable resources.

BioCarbUpgrade started in 2023 and will continue to develop the knowledge base, which will enable us to obtain biocarbon for use in various metallurgical industries. This will be a very important contribution to substituting the fossil resources that are currently used, and which contribute significantly to global warming. In the end, this substitution is about enabling sustainable carbon cycles for the production of much-needed metals in our society.

The BioCarbUpgrade project will be highly international, through both international partners and scientific collaborators, and has as well a significant integrated educational activity, through a PhD candidate financed by the project, focussing on sustainability assessments of biocarbon value chains for the metallurgical industries, and connected graduate students as well.

The biocarbon value chain for the metallurgical industry (except the end-use in the metallurgical process), including the adaption of biocarbon production processes and/or biocarbon upgrading to approach the biocarbon quality requirements of the different metallurgical industries, is illustrated in the figure below, for stem wood.



While stem wood would be preferred from a properties point of view, there is a need to broaden the resource base, to increase the resource base and to reduce costs. For several metallurgical processes, their upstream value chain must be tuned towards satisfying the quality requirements of the specific metallurgical processes, including upgrading the biocarbon.

More information about the BioCarbUpgrade project, project partners, and results, is available on the project homepage: https://www.sintef.no/en/projects/2023/biocarbupgrade/

DOC2023 | 6th DOCTORAL COLLOQUIUM BIOENERGY

Prof. Dr. Achim Loewen
Professor for Energy Technology and Environmental Managemen
Head of the Department "Sustainable Energy and Environmental Technologies" University of Applied Science and Arts in Göttingen
achim.loewen@hawk.de

Prof. Dr.-Ing. Daniela Thrän
Deputy scient. Managing Director DBFZ / Head of Bioenergy Systems Department, DBFZ Deutsches Biomasseforschungszentrum gemeinnützige GmbH
Head of the Department "Bioenergy" (BEN), UFZ - Helmholtz Centre for Environmental Research
Professorship at the University of Leipzig (Chair of Bioenergy Systems at the Institute for Infrastructure and Resource Management of the Faculty of Economic Science)
daniela.thraen@dbfz.de

Dr. rer.nat Elena H. Angelova
Research Coordinator DBFZ Deutsches Biomasseforschungszentrum gemeinnützige GmbH
elena.angelova@dbfz.de

The 6th Doctoral Colloquium BIOENERGY will take place from 18th to 19th of September 2023 at the HAWK University of Applied Science and Arts in Göttingen, Germany. EERA Bioenergy supports this event as a Europe-wide partner platform for scientists.

BIOENERGY DOC2023 | 6TH DOCTORAL COLLOQUIUM BIOENERGY

Energy supply is a basic need of mankind. However, climate change and other environmental impacts or crises such as the war in Ukraine enforce a re-thinking about energy sources, energy generation and distribution technologies and energy consumption in all different sectors. Wind and solar energy will play an increasingly important role but are fluctuating strongly and still cannot cover the rising global demand. Therefore, bioenergy can provide an important contribution to electricity, heat, and fuel production. Nevertheless, as biomass resources are limited, it is important to apply only sustainable resources in the most efficient conversion paths, e.g., in biorefineries with integral production of energy, fuels, platform chemicals, or other products.

Research in this area is already diverse and at a high level. However, it is highly important to bring together the "future researchers, industry leaders and policymakers" early on to share knowledge and discuss research gaps and challenges. Simultaneously networking between scientific institutions that are already intensively involved in bioenergy research needs to be extended.

Addressing that demand, the Doctoral Colloquium BIOENERGY was initiated in 2018. Since then, it not only serves as a platform for junior scientists to gain further qualifications but also provides them an opportunity for networking and scientific exchange. Every year, about 70-80 young scientists from universities and other research institutions and from more than 20 countries worldwide participate in the Doctoral Colloquium BIOENERGY and present their results and findings in more than 40 oral presentations and posters. The program offers interesting lectures and ideas as well as intensive scientific discussions with experienced supervisors (Get-in Touch Session) and a lot of fun through interactive group activities like our scientific Talk Show in 2022 on the topic "Not in My Backyard Phenomenon".

This year, the Doctoral Colloquium BIOENERGY will be organized by Prof. Dr.-Ing. Achim Loewen from the Faculty of Resource Management of the HAWK University of Applied Science and Arts in Göttingen and his team. The event is supported by the DBFZ team and especially the patron and initiator of the Doctoral Colloquium BIOENERGY, Professor Dr.-Ing. Daniela Thrän, Head of the Bioenergy Systems Department at the DBFZ, Head of the Bioenergy Department at the UFZ (Helmholtz Centre for Environmental Research) and chair holder for Bioenergy Systems at the University of Leipzig.

A Scientific Advisory Board consisting of 46 renowned bioenergy scientists from Germany, Austria, Switzerland, Italy and Norway and representing 37 research and higher education institutions significantly ensures scientific quality and shows the magnitude of the event. A detailed list of all participating scientific institutions and members can be found on our website at www.doc-bioenergy.de

DOC2023 will take place in the "Shet roof building", an old industrial facility, which was completely renovated and now is an integral part of the "Gesundheitscampus Göttingen", a joint venue of the HAWK University of Applied Science and Arts and Göttingen University.

The Program Committee is currently reviewing all the submitted abstracts for oral and/or poster presentation. We are sure to set up an interesting DOC2023 program by mid/end June 2023 and invite you to register for the event.

Registration for the event will open soon. For more information, please visit our website at https://www.dbfz.de/en/6th-doctoral-colloquium-bioenergy

New members

ASSOCIATE MEMBERS

ENERGY AGENCY OF PLOVDIV

Energy Agency of Plovdiv
https://www.eap-save.eu/
Tel.: +359 32 62 57 55
E-mail: eap@eap-save.eu
liyana.adjarova@eap-save.eu

The Center for Bioeconomy Technology Transfer with Laboratory for Testing of Solid Biofuels, Compost and Biowastes
https://biolab.eap-save.eu/
Tel.: + 359 32 625 754
E-mail: biofuels-lab@eap-save.eu
ani.ivancheva@eap-save.eu

Energy Agency of Plovdiv was established in 2000 as the first SAVE agency in Bulgaria. It is a science-based organization developing and implementing technical, environmental, and social innovations in the field of EE & RES, energy-efficient engineering solutions, advanced renewable biofuels and materials, bioenergy and bioeconomy. The agency's activities cover: energy and environmental modelling, management and planning at local and regional level; energy and environmental analyses, emissions inventories, energy auditing of buildings and SMEs, designing of EE measures implementation; ISO 50001 and carbon footprint consultations; development of sustainable energy communities/smart cities; emissions inventories and monitoring; testing of biofuels, compost and bio-wastes; technical support and advice, pilot projects implementations. It has the status of a research organization (reg. No913 - register of the Ministry of Education and Science).

The team of the Energy Agency of Plovdiv builds its capacity by developing and implementing projects under the programs: Intelligent Energy Europe, Sixth and Seventh Framework Programs, Horizon 2020. More than 50 European projects under these programs have been successfully implemented, as well as numerous national projects, including the OP Competitiveness of the Bulgarian Economy 2007-2013.

Experts from the Agency developed a National Report on biomass availability and utilization for bioeconomy development: https://celebio.eu/wp-content/uploads/2021/04/CELEBio_D.2.1_BiobasedEconomy-Business-Opprotunities-in-BG.pdf and Bioeconomy National Action Plan of Bulgaria: https://celebio.eu/wp-content/uploads/2021/04/CELEBio_D.3.1_-BIOECONOMY-ACTIONPLAN_BULGARIA.pdf. The documents present the current state of the bioeconomy, and discuss the country's comparative strengths, opportunities, and barriers. They provide an overview of the existing policy regime per value chain stage (i.e. biomass production, conversion, distribution, end use). The reports also focus on the innovation potential and on the policy framework. Potential financing options related to the development of biobased production chains are also discussed.

The **Center for Bioeconomy Technology Transfer** at the Energy Agency of Plovdiv operates the **Laboratory for Testing of Solid Biofuels, Compost and Biowastes**. Established in 2014, the laboratory is accredited by the Bulgarian Accreditation Service according to the requirements of ISO 17025 (certificate reg. №192 LI/08.02.2023).

The laboratory has a modern R&D infrastructure. Its highly sensitive analytical equipment provides testing of • solid biofuels - wood and non-wood pellets, wood and non-wood briquettes, wood chips, saw dust, biomass, hog fuel and other biofuels • wood pellets according to the requirements of ENplus® certification • Mediterranean biofuels according to requirements of BIOmasud® certification • solid recovered fuels • biochar, charcoal based products • compost, fermentation products, after anaerobic digestion and other stabilized organic fractions • sewage sludge and sludge from urban and industrial WWTPs • soils • waste - solid and liquid waste - infiltrates, eluates, sediments.



Photo credit: Energy Agency of Plovdiv

The Laboratory is constantly expanding its capabilities and scope of activity and provides R&D, consultancy and testing in one in parallel with the following services: • R&D activities in the field of biofuels, bioenergy and bio-based materials and products • development of regional and municipal waste management programs • assessment of the resource and energy potential of biomass and biodegradable waste • assessment of the potential of biomass residues and wastes for biofuels, bioenergy and biogas production • consultations on technical equipment for logistics centers for biomass and composting plants • training.

The Laboratory is listed as a testing body in the following EU certification schemes:

- For wood pellets ENplus® http://www.enplus-pellets.eu/about-enplus/testing-bodies
- Mediterranean biofuels BIOmasud® https://biomasud.eu/en/independent-entities/. The Center for Bioeconomy Technology Transfer has excellent potential and is interested in taking part in EU projects on bioeconomy / circular bioeconomy.

The Center for Bioeconomy Technology Transfer has excellent potential and is interested in taking part in EU projects on bioeconomy / circular bioeconomy.

Useful information

How bioenergy contributes to a sustainable future

Bioenergy is today the largest source of renewable energy, a key element in tackling climate change, securing energy supply and providing income through regional biomass supply chains. And it is also an integral part of a circular biobased economy, often valorising the waste or residues of other biobased production processes.

Bioenergy has the potential to improve the resilience of societies around the world by providing greenhouse gas emission reductions, regional energy supply, income to rural communities and energy system flexibility.

A necessary facilitator of a sustainable future

The sustainable use of biogenic resources to provide food and feed, building materials, chemicals, textiles and energy services (known as the bioeconomy) has played a key role throughout history in helping humanity secure the resources necessary for its social base, and the same is now expected of bioenergy: that it is able to meet the needs of the present without compromising the ability of future generations to meet their own needs.

Greenhouse gas emissions, local air pollutant emissions, biodiversity, land and water use, etc. fall within the scope of ***environmental sustainability***. There are ways to sustainably manage forests and agricultural landscapes so that they can provide biomass for bioenergy to reduce greenhouse gas emissions while maintaining or enhancing biodiversity, carbon sinks and species abundance. In many regions, bioenergy has to meet strict sustainability criteria and standards to ensure effective emission reductions, and there is a growing awareness that the preservation of soil carbon stocks as well as the conservation of biodiversity must be important elements in all our activities.

The term ***economic sustainability*** encompasses the supply of sufficient quantities of biomass feedstocks at reasonable prices. Costs for biomass feedstocks and bioenergy carriers vary regionally and also depend on their intended use and what competition there is from other market actors for the same feedstocks.

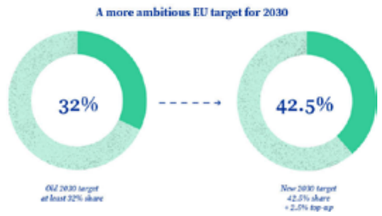
Social sustainability, finally, deals with how sustainability affects people, their health and well-being, and their ability to make a decent living. The 17 Sustainable Development Goals (SDGs), which all United Nations Member States have adopted and aim to achieve by 2030, balance the three dimensions of sustainability and aim for a just transition to a sustainable future. Biomass production and use can positively contribute to the achievement of various Sustainable Development Goals (SDGs) as has been demonstrated in different cases around the globe.

Modern bioenergy allows for more efficient use of domestic resources for energy production and economic activity. It is not only part of the solution, modern bioenergy is a facilitator of the whole process.

Source: IEA Bioenergy

Council and Parliament reach a deal on Renewable Energy Directive

The Council and the European Parliament reached a political agreement in June to increase the share of renewables in overall EU energy consumption to 42.5% in 2030, with an additional indicative supplement of 2.5% to reach 45%, which each Member State will have to contribute to. The agreement, which updates the current legal target of 32%, is based on a political negotiation concluded in March and has been validated by the European Parliament, including the final touches introduced by the countries.



The agreement includes fast-track permitting procedures for renewable energy projects to contribute to the EU's REPowerEU plan to become independent of Russian fossil fuels, following Russia's invasion of Ukraine.

Member states will design Renewable Energy Acceleration Zones where renewable energy projects will be subject to a simplified and fast-track permitting process. Renewable energy deployment will also be presumed to be in the "overriding public interest", which will limit the grounds for legal objections to new installations.

Moreover, more ambitious targets were also agreed upon in those sectors where the integration of renewables is slower:

Bioenergy

The agreement strengthens sustainability criteria for the energy use of biomass, in order to reduce the risk of unsustainable bioenergy production. It ensures the application of the cascade principle, focusing on support schemes and taking due account of national specificities.

Transport

Member States are given the choice between a binding target of a 14.5% reduction of greenhouse gas intensity in transport from the use of renewables by 2030, or a binding share of at least 29% of renewables in final energy consumption in the transport sector by 2030.

The agreement sets a binding combined sub-target of 5.5% for advanced biofuels (generally derived from non-food feedstocks) and renewable fuels of non-biological origin (mainly renewable hydrogen and synthetic hydrogen-based fuels) in the share of renewables supplied to the transport sector. Within this target, there is a minimum requirement of 1% of renewable fuels of non-biological origin (RFNBO) in the share of renewable energy supplied to the transport sector in 2030.

Industry

The industry is expected to increase its use of renewables annually by 1.6%. They agreed that 42% of hydrogen used in the industry should come from renewable fuels of non-biological origin (RFNBO) by 2030 and 60% by 2035.

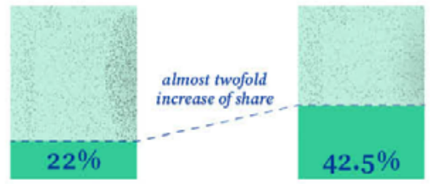
The agreement introduces the possibility for the Member States to discount 20% of the contribution of RFNBOs in industrial use under two conditions: if the Member States' national contribution to the overall EU binding target meets its planned contribution or if the share of hydrogen from fossil fuels consumed in the Member State does not exceed 23% in 2030 and 20% in 2035.

Buildings, heating and cooling

Sets an indicative target of at least 49% renewable energy in buildings in 2030. It foresees a gradual increase of the renewable targets for heating and cooling, with a binding increase of 0.8% per year at a national level until 2026 and 1.1% from 2026 to 2030. The minimum annual average rate applicable to all Member States is complemented by additional indicative increments calculated specifically for each Member State.

This agreement comes after months of discussions among two blocs: France, on the one hand, calling for greater recognition of nuclear energy, with the support of a dozen member states such as Finland, Slovenia and Romania; and Germany, on the other, trying to distance atomic energy from the legislation on renewable energy, with countries such as Spain and Luxembourg behind it.

The group of Germany and Spain wanted to raise the threshold to 45%, while France advocated leaving it at 40%. The final agreement, therefore, sets the bar in the middle of the two claims.



In 2021, almost 22% of the energy consumed in the EU came from renewable sources. The new 2030 EU target will **almost double the share of renewable energy** in the EU.

Each member state must play its part to help reach the EU goal. National contributions to the EU-level target for renewables are set in the national energy and climate plans (NECPs).

Infographic - Fit for 55: how the EU plans to boost renewable energy

European Green Deal: new law agreed to cut aviation emissions by promoting sustainable aviation fuels

The Council of Europe and the European Parliament reached a political agreement on the European Commission's ReFuelEU Aviation proposal, which aims to decarbonize the aviation sector by progressively increasing the use of Sustainable Aviation Fuels (SAF) from 2025. Thus, the percentage of SAF that fuel suppliers will be obliged to blend with paraffin should increase from 2% in 2025 to 6% in 2030; 20% by 2035; 34% in 2040; and to a target of 70% in 2050.

The new EU aviation fuel mix must also contain a minimum proportion of the most modern and environmentally friendly synthetic fuels, which will increase over time.

This agreement is an important step towards the implementation of the Commission's 'Fit for 55' legislative package and will contribute to achieving the EU's climate ambitions under the European Green Pact.

Emissions from aviation in Europe increased by an average of 5% year-on-year between 2013 and 2019. Although drastically reduced during the pandemic, aviation emissions are expected to continue to grow. Increasing the climate ambition of the aviation sector will be crucial for the EU to reach its climate targets under the Paris Agreement and make the European Green Pact a reality. To achieve climate neutrality, the EU needs to reduce transport emissions by 90% by 2050 (compared to 1990 levels). RefuelEU Aviation will help the aviation sector contribute to achieving this goal, along with revised rules on the EU Emissions Trading Scheme in the aviation sector.

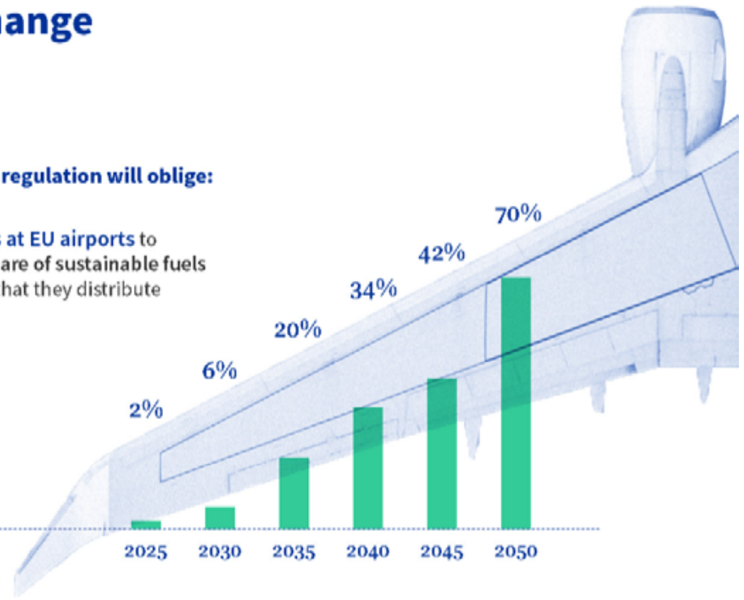
Another measure in the agreement is that aircraft operators departing from EU airports must refuel only as much fuel as necessary for the flight, in order to avoid emissions related to extra weight or carbon leakage caused by "tanking" practices (deliberately overfuelling to avoid refuelling with UFG). In addition, airports must ensure that their refuelling infrastructure is available and suitable for the distribution of UFG.

As it will apply across the EU, the new mandate will ensure a level playing field in the EU internal market, provide legal certainty for fuel producers and help boost large-scale production across the continent. It will also increase the EU's energy security by reducing dependence on energy products from third countries and creating thousands of new jobs in the energy sector. EU airlines will have access to increasing quantities of sustainable aviation fuel across the EU.

What will change

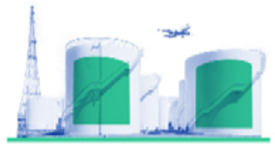
The ReFuelEU aviation regulation will oblige:

1. aircraft fuel suppliers at EU airports to gradually **increase the share of sustainable fuels** (notably synthetic fuels) that they distribute



2. airlines departing from EU airports to refuel aircraft only with the **fuel necessary for the flight** to avoid emissions related to extra weight caused by tankering practices (carrying extra fuel to avoid refuelling at a destination airport where fuel is more expensive)

3. EU airports to guarantee the necessary **infrastructure** to deliver, store and refuel with sustainable aviation fuels



Infographic - Fit for 55: increasing the uptake of greener fuels in the aviation and maritime sectors

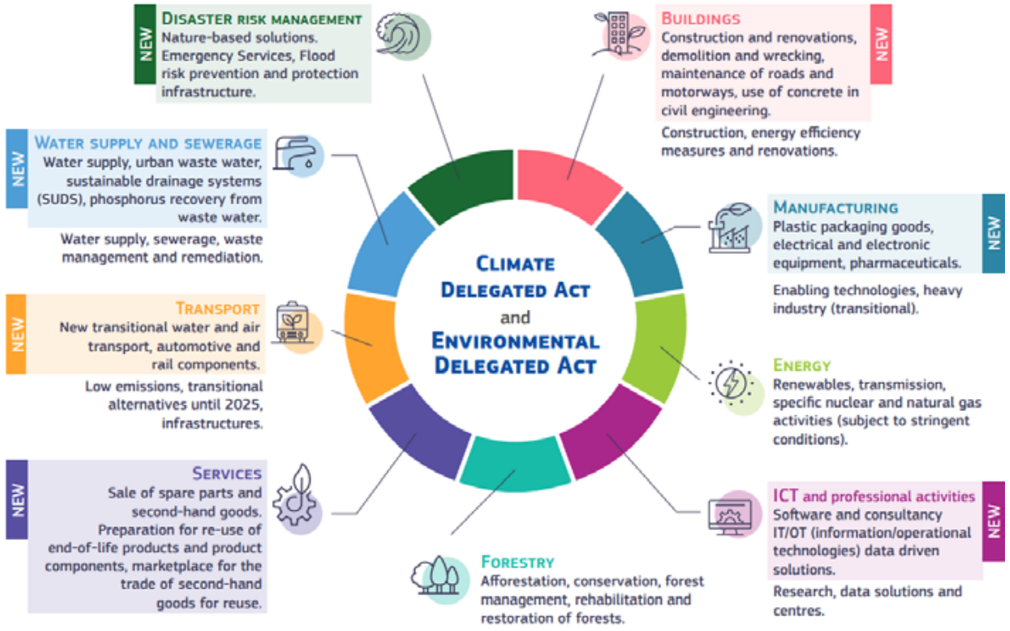
Sustainable Finance: The EU Commission takes further steps to boost investment for a sustainable future

The European Commission presented on 13th June a new package of measures to develop and strengthen the foundations of the EU's sustainable financing framework to contribute to the transition to a climate-neutral and sustainable economy by 2050.

The aim of the adopted package is, therefore, to ensure that the EU's sustainable financing framework continues to support businesses and the financial sector while encouraging private financing of transition projects and technologies. To this end, the Commission is proposing new standards for providers of environmental, social and governance (ESG) ratings, which will increase transparency in the sustainable investment market.

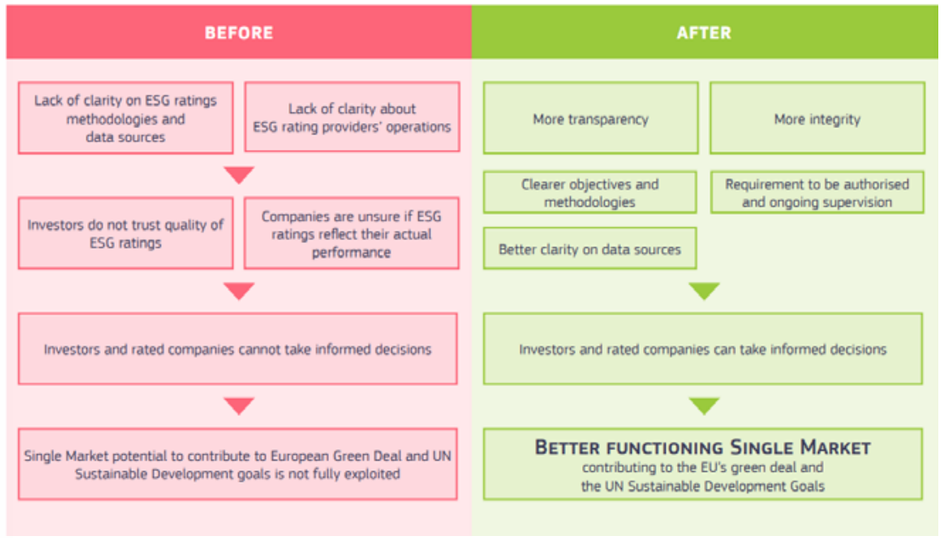
Specifically, the Commission adding **additional activities to the EU Taxonomy** and proposing **new rules for Environmental, Social and Governance (ESG)** rating providers, which will increase transparency on the market for sustainable investments. The package aims to ensure that the sustainable finance framework works for companies that want to invest in their transition to sustainability. It aims also to make the sustainable finance framework easier to use, thereby continuing to contribute effectively to the European Green Deal objectives.

EU TAXONOMY ECONOMIC SECTORS AND ACTIVITIES COVERED



The EU Taxonomy is a cornerstone of the EU's sustainable finance framework and an important market transparency tool that helps to direct investments towards the economic activities most needed for a green transition. The new EU Taxonomy criteria focus on economic activities that contribute substantially to one or more of the non-climate environmental objectives, largely based on the recommendations of the Sustainable Finance Platform, published in March and November 2022. The Commission has also adopted amendments to the Delegated Act on disclosure of information on EU Taxonomy to clarify the disclosure obligations for additional activities.

WHAT IS CHANGING WITH TODAY'S ESG RATINGS PROPOSAL?



ESG ratings play an important role in the EU sustainable finance market as they provide information to investors and financial institutions regarding, for example, investment strategies and risk management on ESG factors. The new rules will enable investors to make better-informed decisions regarding sustainable investments. Moreover, the proposal will require that ESG rating providers offering services to investors and companies in the EU be authorised and supervised by the European Securities and Markets Authority (ESMA). This will also ensure the quality and reliability of their services to protect investors and ensure market integrity.

€18 billion has already been earmarked for investment in biomethane production in Europe

The industry has set aside a first tranche of €18 billion in investments until 2030 to ensure the scale-up of biomethane production to support both Europe's energy security and its climate change mitigation ambitions according to the first edition of the Biomethane Investment Outlook by the European Biogas Association (EBA).

Following the announcement of the REPowerEU target a year ago, EBA estimated that reaching 35 bcm of sustainable biomethane production will require an investment effort of €83 billion by 2030, depending on plant size, location and type of sustainable feedstock. The first 'EBA Investment Outlook on Biomethane', indicates that progress is underway.€4.1 billion is due to be invested between 2023 and 2025, while a further €12.4 billion will be unlocked in 2026-2030- For a further €1 billion the timeframe is yet to be specified.

Level of investment for the timeframes 2023–2025 and 2026–2030

	2023–2025	2026–2030	Timeframe not specified
Investment	€4.1 billion	€12.4 billion	€1 billion

To secure the announced capital injection, the right policies, stable framework conditions and long-term end-use pathways are essential, as demonstrated by France (€1.4 billion) and Italy (€1.1 billion), which lead the list of largest investments. They are followed by the Netherlands (951 million euros), Spain (948 million euros), Germany (658 million euros), Sweden (635 million euros) and Poland (429 million euros). In addition, EUR 5.5 billion of the capital injection will remain in the EU with its final destination still open and EUR 3.3 billion will go to non-EU territories, including the UK and Ukraine.

These investments provide society with additional system-wide benefits of up to €7.9 billion per year.

Aligning the EU Taxonomy with the REPowerEU targets for biomethane will drive capital flows to the sector, as investors indicate that compliance with EU-specific sustainable finance regulations is key to boosting green investments. A harmonized EU-wide cross-border trading system is also of great importance, especially for non-subsidized projects.

The use of biogenic CO_2 to replace fossil-based CO_2 products is included in most of the business plans analyzed. However, the importance of biogenic CO_2 in offsetting fossil CO_2 is often underestimated; efforts should be made to assess its value fairly. One of the prominent uses of biogenic CO_2 is the production of green synthetic methane (using green hydrogen), which could add substantial volumes of sustainable green gas to the energy system.

Source: European Biogas Association

HYFUELUP project: shaping a better tomorrow with renewable natural gas

At a time when biomethane is emerging as one of the most promising renewable fuels for Europe to decarbonise energy and transport systems, a new project funded by the European Union's Horizon Europe Research and Innovation Programme was launched last November to develop advanced technology for biomethane production through gasification and methanation. This project was promoted and generated within EERA Bioenergy members, in the webinars on the topic CL5-2021-D3-02-016: Innovative biomethane production as an energy carrier and a fuel, that took place in March 2021.

The HYFUELUP project (Hybrid Biomethane Production from Integrated Biomass Conversion), aims to develop and advanced technology for biomethane production using gasification and methanation. The biomethane produced will then be liquified and used for the decarbonization of long-distance road freight transport and maritime transportation. The project will demonstrate a flexible pathway for efficient and cost-effective biomethane production based on local renewable resources -crops, wastes, and by-products- (only low-cost biogenic wastes are used) through thermochemical technologies combined with renewable hydrogen. One demonstrator will convert biomass feedstocks to syngas (a mixture of hydrogen and carbon monoxide) and "clean" it. A second will employ dynamic hydrogen addition for methanation of the syngas (or flue gas). These will be integrated to demonstrate biomethane production at a pre-commercial scale.

This will allow accelerate the energy transition in the EU and increase sustainability in the transport and energy sector (replication is expected Europe-wide) and reduce greenhouse gas emissions (GHG) and improve competitive sustainable growth (higher than 90% GHG reduction, compared to use natural gas).

HYFUELUP integrates a SEG®/Oxy-SEG process to turn biowaste into syngas or flue gas. Syngas with high H2 content (>65%) and a CO_2-rich flue gas suitable for catalytic methanation are obtained as a result. The process takes place in a main demonstration site located in Tondela (Portugal).

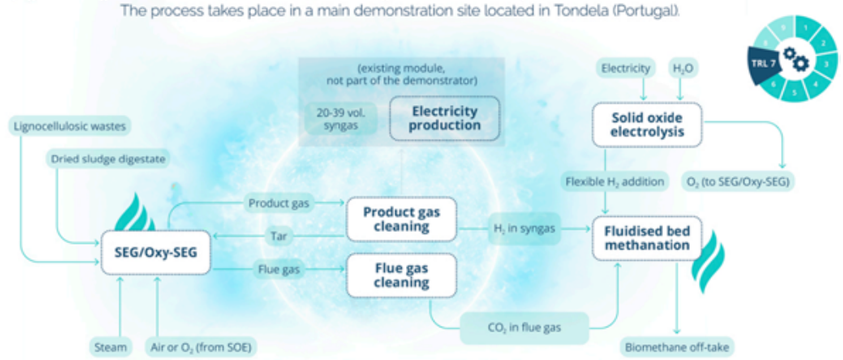


Figure 1. HYFUEUP project concept

Partners from Portugal (BIOREF -project coordinator-, LNEG, Instituto Politécnico de Portalegre, Dourogás Renovável, Circle Molecule), Spain (BIOPLAT), Germany (USTUTT), Greece (CRES), Switzerland (PSI, AlphaSYNT GmbH) and the United Kingdom (Johnson Matthey PLC) reflect the true integration of Europe regarding the need of demonstrating novel biomethane production pathways and scale up the European renewable gas capacity.

More information: https://hyfuelup.eu/

Figure 2. HYFUELUP kick-off meeting in Matosinhos (Porto), on 24th November 2022

Parliament adopts new law to fight global deforestation

The European Parliament approves a new law to combat global deforestation, after more land than the EU has been lost to deforestation in the last three decades, of which EU consumption was responsible for at least 10%.

While no country or commodity will be banned, companies will only be able to sell products in the EU if the supplier of the product has issued a so-called "due diligence" statement confirming that the product does not originate from land that has been deforested or has caused forest degradation, including irreplaceable primary forests, after 31 December 2020.

In addition, companies will also have to verify that these products comply with relevant legislation in the country of production, including human rights legislation, and that the rights of affected indigenous peoples have been respected.

The European Commission will classify countries, or parts of countries, as low, normal, or high risk through an objective and transparent assessment within 18 months of the entry into force of this regulation. Products from low-risk countries will be subject to a simplified due diligence procedure. The proportion of checks will be carried out on operators according to the risk level of the country: 9% for high-risk countries, 3% for standard-risk countries, and 1% for low-risk countries.

The products covered by the new legislation are the same as those already proposed by the European Commission: livestock, cocoa, coffee, palm oil, soya and wood, including products containing or having been fed with these raw materials (such as leather, chocolate and furniture), but during negotiations, MEPs managed to add rubber, charcoal, printed paper products and a number of palm oil derivatives.

Parliament also secured a broader definition of forest degradation that includes the conversion of primary forests or naturally regenerating forests into forest plantations or other wooded lands.

EU competent authorities will have access to relevant information provided by companies, such as geolocation coordinates, and will carry out checks with the help of satellite tracking tools and DNA analysis to verify the provenance of products. Penalties for non-compliance will be proportionate and dissuasive, and the maximum fine will be at least 4% of the total annual EU turnover of the non-compliant operator or trader.

Publications

Bioenergy Europe: Statistical Reports 2023

Bioenergy Europe

The European Biomass Association (Bioenergy Europe) has published the first two chapters of its statistical report in 2023.

Bioenergy Europe:
Statistical Report 2023 – Bioelectricity

PDF

This report provides readers with accurate information on the current dynamics of electricity, both renewable and non-renewable, with a focus on electricity generated from biomass and its role in Europe's energy transition.

Bioenergy Europe:
Statistical Report 2023 – Biogas

PDF

This report provides readers with an accurate analysis of recent trends in the consumption and production of biogas and biomethane in the EU, both as a transport fuel and for heat and power generation, as well as their role in Europe's energy transition.

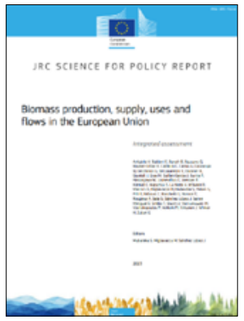
Renewable Capacity Statistics 2023

PDF

International Renewable Energy Agency (IRENA)

IRENA presents in this publication renewable power generation capacity statistics for the past decade (2013-2022) in trilingual tables. Renewable power generation capacity is measured as the maximum net generating capacity of power plants and other installations that use renewable energy sources to produce electricity. For most countries and technologies, the data reflects the capacity installed and connected at the end of the calendar year. Data has been obtained from a variety of sources, including an IRENA questionnaire, official national statistics, industry association reports, other reports and news articles.

Biomass production, supply, uses and flows in the European Union



PDF

European Commission's Joint Research Centre (JRC)

This report is the 3rd public-facing report that was requested by Commission services to periodically provide data, processed information, models, and analysis on EU and global biomass supply and demand and its sustainability. As Europe strives to find solutions to increasingly pressing and alarming direct and indirect impacts of the climate and biodiversity crises, we find great consensus for the bioeconomy. We turn to biomass, and therefore the bioeconomy, as a means to transform our societies and economies so that we can live in harmony with the planet and achieve a sustainable balance in the socio-ecological system.

Decarbonising Europe's hydrogen production with biohydrogen

PDF

European Biogas Association (EBA)

EBA, in collaboration with biogas experts, launched a white paper on the sustainability, affordability and accessibility of biohydrogen to support its production and use in Europe. Insights are provided as to the place of biohydrogen within total hydrogen production, the technologies available to produce biohydrogen, how biohydrogen contributes to the decarbonizing of Europe's hydrogen production, the economics of biohydrogen production and the readiness of the markets to facilitate its commercialization. Taking into consideration the current policy context as well as the technical background, the paper concludes by making recommendations for an EU regulatory framework to support the production and use of biohydrogen.

Energy Technology Perspectives 2023

PDF

International Energy Agency (IEA)

ETP-2023 provides an analysis of the risks and opportunities surrounding the development and scaling up of technology and energy supply chains from the perspectives of energy security, resilience, and sustainability. It also explores the main bottlenecks to sustainably scaling up supply chains at the required pace and how governments should shape their industrial policy.

Innovative biomethane for REPowerE

PDF

Community Research and Development Information Service (CORDIS)

Europe's energy security is under pressure from rising costs, climate change, domestic and international energy policy, and conflict. Biomethane – natural gas produced from renewable sources such as municipal and agricultural waste – offers a reliable, drop-in fuel that can meet the energy needs of citizens. This Projects Info Pack showcases the research being carried out to grow Europe's biomethane industry, boosting energy security and helping to deliver on the EU's ambitions for a competitive, low-carbon economy.

Save the date! International bioenergy events

JULY 2023

21 – 23 July 2023
12th International Conference on Environment, Energy and Biotechnology (ICEEB 2023)
Jeju-si, South Korea

28-29 July 2023
4th International Conference On Biofuel and Biomass
Singapore

AUGUST 2023

7 – 8 August 2023
11th World Congress and Expo on Green Energy
Toronto, Canada

17 – 19 August 2023
8th International Conference on Green Energy Technologies
Frankfurt, Germany

SEPTEMBER 2023

18 – 19 September 2023
6th Doctoral Colloquium Bioenergy
Hildesheim, Germany

20 – 21 September 2023
Advanced Biofuels Conference 2023
Gothenburg, Sweden and Online

20-21 September 2023
Green Gas Mobility Summit
Madrid, Spain

21 – 22 September 2023
14th International Conference on Biofuels and Bioenergy
Toronto, Canada

27-28 September 2023
Biogas PowerOn 2023
Hamburg, Germany

28 September 2023
IEA Critical Minerals and Clean Energy Summit
Paris, France

OCTOBER 2023

2 October 2023
Climate and Energy Summit: Building a Grand Coalition to Keep 1.5 °C Within Reach
Madrid, Spain

4-6 October 2023
Bio-energy Pavillion 2023
Greater Noida, India

11 – 12 October 2023
5th European Conference | Trade & Power Biomass
PowerON 2023 Stockholm, Sweden

12 – 13 October 2023
4th International Conference on Biofuels and Bioenergy
London, UK

24 – 25 October 2023
European Biogas Conference
Brussels, Belgium

NOVEMBER 2023

10 - 12 November 2023
8th International Conference on Renewable Energy and Conservation
Paris, France

DECEMBER 2023

7-9 December 2023
4th International Conference on Advances in Energy Research and Applications (ICAERA 2023)
Lisbon, Portugal

14-15 December 2023
7th Biogas Congress
Warsaw, Poland

EERA Bioenergy in Europe

Table 1. Full members of the EERA Bioenergy Joint Programme.

Aalborg University
Department of Energy Technology (Denmark)

BERA
Belgian Energy Research Aliance (Belgium)

BESTMER
Ege Üniversitesi Biyokütle Enerji Sistemleri ve Teknolojileri Merkezi Ege (Turkey)

BOUN
Boğaziçi University (Turkey)

CEA
French Alternative Energies and Atomic Energy Commission (France)

CIEMAT
Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (Spain)

CNR
Istituto Motori del Consiglio Nazionale delle Ricerche (Italy)

CRES
Center for Renewable Energy Sources and Saving (Greece)

CSIC
Agencia Estatal Consejo Superior de Investigaciones Científicas (Spain)

DBFZ
Deutsches Biomasseforschungszentrum gemeinnützige GmbH (German Biomass Research Center gGmbH)

ENEA
Italian National Agency for New Technologies, Energy and Sustainable Economic Development (Italy)

IEN
The Institute of Power Engineering (Poland)

KIT
The Research University in the Helmholtz Association (Germany)
KIT / BIOLIQ

LNEG
Laboratório Nacional de Energia e Geologia (Portugal)

NTNU
Norwegian University of Science and Technology (Norway)

PSI
Paul Scherrer Institut (Switzerland)

SINTEF
(Norway)

TNO
(Netherlands)

TÜBITAK
Scientific and Technological Research Council of Turkey (Turkey)

UKERC
UK Energy Research Centre
ASTON UNIVERSITY
SUPERGEN Bioenergy Hub
(United Kingdom)

UNIBO
Universitá di Bologna (Italy)

UPV/EHU
University of Basque Country (Euskal Herriko Unibertsitatea) (Spain)

VŠB
Technical University of Ostrava (Czech Republic)

VTT
Technical Research Centre of Finland Ltd (Finland)

WUR
Wageningen University & Research (The Netherlands)

Table 2. Associate members of the EERA Bioenergy Joint Programme.

Agricultural University of Plovdiv (Bulgary)	**CAMPUS IBERUS** Campus de Excelencia Internacional del Valle del Ebro (Spain) Campus / Universidad	**CIRCE** Centro de Investigación de Recursos y Consumos Energéticos (Spain)
CNRS Centre National de la Recherche Scientifique (France)	**CoLAB BIOREF** Collaborative Laboratory for the Biorefineries (Portugal)	**Çukurova Üniversitesi** University of Cukurova, Faculty of Agriculture, Department of Field Crops (Turkey)
Energy Agency of Plovdiv (Bulgaria)	**ETA-Florence Renewable Energies** (Italy)	**FCiências.ID** Associação para a Investigação Desenvolvimento de Ciências (Portugal)
IFK Stuttgart Institute of Combustion and Power Plant Technology (Germany)	**IIASA** International Institute for Applied Systems Analysis (Austria)	**NIC** National Institute of Chemistry (Slovenia)

NTUA The National Technical University of Athens (Greece) web / web	**RE-CORD** Renewable Energy Consortium for Research and Demonstration (Italy)	**UNICT** Università degli studi di Catania (Italy)
UNIMORE University of Modena and Reggio Emilia (Italy)	**UNIPD** Università degli Studi di Padova (Italy)	**UNITO** Università di Torino (Italy)
UNL Universidade NOVA de Lisboa, Faculdade de Ciências e Tecnologia (Portugal)	**WIP** WIP Renewable Energies (Germany)	**YTU** Yıldız Teknik Üniversitesi (Turkey)

EERA Bioenergy in Europe

EERA Bioenergy is open to new complementary RTD organisations.
Please contact the Joint Programme Secretariat for further details at secretaria@bioplat.org

EERA European Energy Research Alliance BIOENERGY

● FULL MEMBERS
● ASSOCIATE MEMBERS

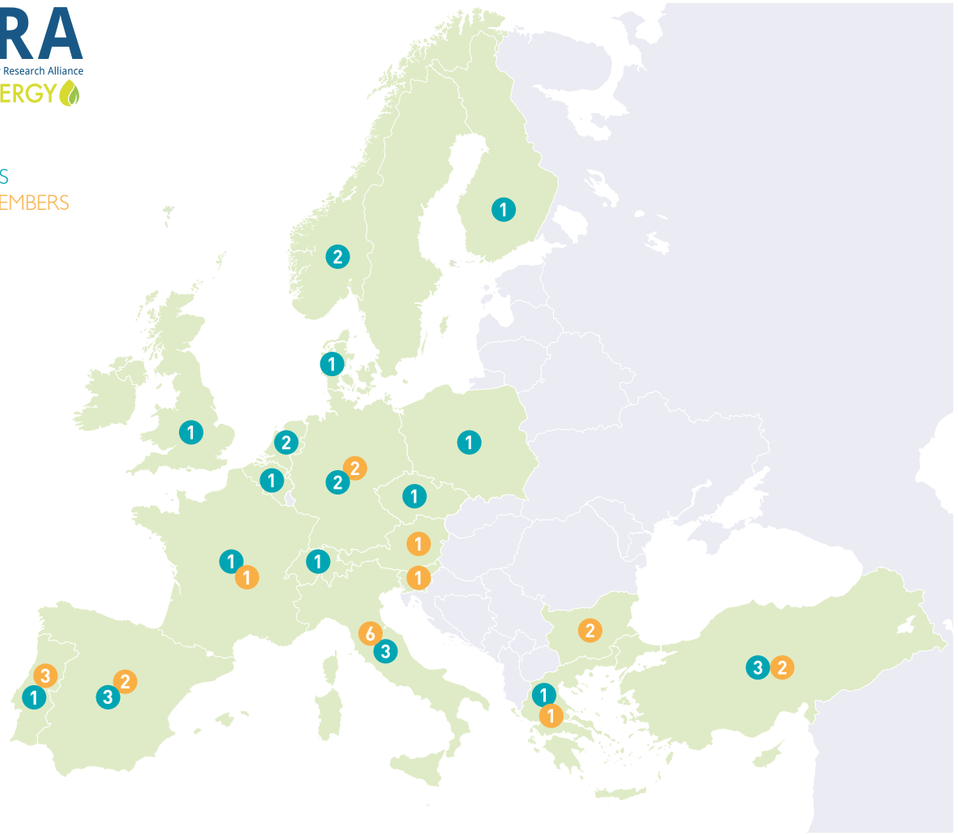


Figure 1: The EERA Bioenergy Joint Programme consists of 46 members (25 Full members and 21 Associate members) from a total of 19 countries. Link

www.eera-bioenergy.eu

Contacts

Bioplat
BIOMASS FOR THE BIOECONOMY

Editor
Margarita de Gregorio
BIOPLAT - Spanish Technology and Innovation Platform "Biomass for the Bioeconomy"
Doctor Castelo 10, 4D. Madrid, Spain.
T: +34 629 48 56 29
E: margadegregorio@bioplat.org

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