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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,

Reaching the end of the year, I was very happy to be invited by the Spanish Presidency of the EU and the European Commission to participate in the 17th SET Plan Conference on Energy Research and Innovation for a Competitive Europe, which took place in Viladecans, Barcelona on 13-14 November 2023. My role was to moderate the thematic parallel session "Outlook for the industrial growth of advanced biofuels in EU (2022-2030)", on 14 November from 17.00 to 18.00.

The session aimed to inform about the potential of advanced biofuels in the EU in the short term (2022-2030) as driven by the energy and climate policies, the existing technologies, and the biofuel markets worldwide.

The distinguished panelists were:

Dina Bacovsky, Chair of IEA Bioenergy, gave an overview of the global and EU biofuels markets and drivers.

Pilar Sánchez García, Deputy Assistant Director of Hydrocarbons and New Fuels, Ministry for Ecological Transition, showcased the national and industrial interests and engagement of Spain's Bioenergy policy, which among others includes specific targets for advanced biofuels.

David Chiaramonti, Professor at Politecnico Torino and Scientific coordinator of the study 'Outlook for industrial capacity of advanced biofuels', assigned by the DG Research and Innovation, presented the study results.

Patrik Klintbom, ETIP Bioenergy Chair, shared the stakeholders' view on the technology status, readiness and growth prospects of advanced biofuels in the various transport sectors.

Commercially produced advanced biofuels exist already, like biomethane production from AD upgraded biogas, and hydrogenated vegetable oils but with limited production capacity so far (1.85Mt/y). Other innovative technology pathways such as gasification to FT synthetic fuels, biomethanol, and pyrolytic oils have been demonstrated in an industrial environment and are in the line for take-off, whereas some next-generation biofuels technologies are progressing well. On the other hand, international trade, though very well established for first-generation biofuels is nearly nonexistent for advanced biofuels.

Therefore, the first question that comes to mind is what factors are most critical to the capacity development of advanced biofuels. It is technology, national support, investment interest, or other. Then, taking into account that today advanced biofuels and biofuels in general are mainly destined for road transport, what would be their role after 2030, as electromobility will increase shifting their use gradually to aviation and maritime sectors. Will technologies allow such a transition?

It was loud and clear that we have the industrial interest assured with 40 operational plants already in place with different technologies at TRL 7-9 and a portfolio of technologies that altogether are necessary. Each group of technologies deals with different feedstocks and relevant regional specificities and capacities, energy efficiencies, and types of biofuels but combined, they will mitigate the risk of having biofuels in all sectors. In fact, in the Outlook study, it was revealed that biofuels can produce up to 27 Mtoe per year which can increase up to a bit less than 50 Mtoe per year by 2050. Feedstocks availability was also estimated at 1.6 Mt by 2030 technical potential according to RED II sustainability criteria, out of which some 300,000 to 800,000 Mt per year could be actually mobilized, depending on how stringent the sustainability criteria are. The largest potential lies in manure, followed by primary residues from agriculture and forestry, whereas from 2050 specifically for Mediterranean counties more potential will be released from the use of unused degraded and marginal lands estimated at 8.5 Mha. In conclusion, around 2-2.5 times fold increased biofuels can be produced by 2030, under the current policy framework. In addition to that, current advanced biofuel plants are able to progressively adapt to the changing markets and produce feedstocks for other technologies, being able to serve today's but also tomorrow's needs, like biocrude, alcohol or methanol to jet, biomethane to methanol, FT, etc.

It was thus concluded that we have the technologies that can lead to business opportunities, and the industry is here to support the industrial growth of advanced biofuels in the EU in the short term 2022-2030. On top of that, technologies are flexible enough to ensure the gradual transition from the road to the marine and aviation sectors after 2030. Aviation biofuels in particular are considered a permanent solution and the backbone for the fossilization of aviation. Nevertheless, biofuels production costs are still higher compared to fossil fuels prices thus policy needs to create market conditions.

Industry is willing to invest more than now if there are regulations in place and if these regulations are stable, long-lasting and clear, especially for technologies that are close to maturity but not yet fully commercial, like the case of most advanced biofuels, so that the investments of today are not lost. Level-playing field technology is needed with a neutral approach in terms of technologies. Enthusiasm from the EC and Member States for supporting advanced biofuels is also highly required and appreciated to mitigate on time the consequences of climate change.

Worldwide experience showed that policies create market conditions and regulations should not be dogmatic. EC regulations should offer a certain degree of flexibility to countries to build their legal and financial framework according to their needs, availability of resources, capacities, and skills. As an example, Spain has adopted a complex system of regulations and financial instruments for advanced biofuels. Ambitious mandatory targets (1% for 2025, 3.5% for 2030 in energy content), double counting systems, implementation of a roadmap for AD biogas to biomethane, complex certification system to include all advanced biofuels and renewable gases, institutional support also for improving infrastructure and conversion of traditional refineries to biorefineries, support availability of raw materials with Public Private Partnerships and Research and Innovation, are included, to name but a few.

In a nutshell:

To accelerate the deployment of sustainable biofuels as a fossilizing solution of today, with electromobility and hydrogen as tomorrow's (potential) solutions, we need all technological options, stable and clear policies, to build public and private collaborations and mobilize the technically available biomass, which can deliver sustainable advance biofuels at significant amounts today and in the future. Carbon is not the enemy, and the alternative to sustainable biofuels is not electrification or hydrogen, it is fossil fuels!

Myrsini

EERA Bioenergy news in brief

EERA BIOENERGY COORDINATOR PARTICIPATED IN THE 6th DOCTORAL COLLOQUIUM BIOENERGY - DOC2023

The sixth edition of the Bioenergy Doctoral Colloquium (DOC2023) took place on 18th-19th September 2023 at the HAWK University in Göttingen (Germany). This annual event organized by EERA Bioenergy's member DBFZ addresses all parts of the biomass conversion chain, from the feedstock, through the different conversion pathways and their technological application, to the resulting products and services.

The goal of this event is to bring together future researchers at an early stage, industry leaders and policy makers to share knowledge and discuss research gaps and challenges.

Within the busy agenda of the first day of colloquium, EERA Bioenergy was present through the online statement made by our coordinator, Myrsini Christou. In her appearance, she reminded the audience that decarbonizing industry and supporting renewables is currently at the heart of the European energy agenda and, therefore, EERA Bioenergy focuses mainly on research, accelerating and implementing advances in all branches of bioenergy.

Myrsini also pointed out the importance of all the contributions presented at DOC2023 to enrich the coming research agenda and encouraged the researcher applicants to become future members of EERA Bioenergy.

WEBINARS ON COLLABORATIVE EU PROJECTS GENERATION

EERA Bioenergy JP organized on 25th September two internal webinars for all its members to promote synergies among the five Subprogrammes and advance on collaborative EU projects generation.

Scientists and researchers from the organization were invited to join the discussions on the following topics:

- HORIZON-CL5-2024-D3-01-03: Demonstration of improved intermediate renewable energy carrier technologies for transport fuels
- HORIZON-CL5-2024-D3-01-10: Next generation of renewable energy technologies

These webinars explored key technologies and solutions for renewable energy and for transport fuels in order to boost project collaboration among EERA Bioenergy members and therefore contribute to European climate policies and the United Nation's Sustainable Development Goals.

EERA BIOENERGY SUBPROGRAMMES' COME TOGETHER IN CRETE, GREECE

EERA Bioenergy JP held on 31st October an on-site meeting for its five Subprogrammes in Crete (Greece) as a joint event with the kick-off meeting of the European ICARUS project.

In this uncommon face-to-face encounter between Subprogrammes (SP1. Sustainable production of biomass, coordinated by Dr. Wolter Elbersen; SP2. Thermochemical Platform, coordinated by Berend Vreugdenhil; SP3. Biochemical Platform, coordinated by Dr. Marcelo E. Domine; SP4. Stationary bioenergy, coordinated by Berend Vreugdenhil; and SP5. Sustainability / techno-economic analysis / public acceptance, coordinated by Raquel S. Jorge) the discussion mainly revolved around R&D gaps on bioenergy research and identifying key issues in need of further research.

The event, conducted by Raquel S. Jorge and Berend Vreugdenhil, was also attended by the European Commission Senior Expert Maria Georgiadou, who provided the updates in R&I policy context for renewable fuels and bioenergy and guided on upcoming EU funding opportunities.

In addition to these topics, the meeting was an opportunity for members of EERA Bioenergy JP to present several ongoing European projects and research initiatives: Norwegian University of Science and Technology (NTNU) overviewed the research activities on bio-based systems and sustainability at IndECol (Industrial Ecology Programme); Laboratório Nacional de Energia e Geologia (LNEG) and Laboratório Colaborativo para as Biorrefinarias (BIORREF) introduced the HYFUELUP project which aims to demonstrate hybrid biomethane production from biomass; Instituto de Tecnología Química (UPV-CSIC) presented the HIGHFLY and IDEALFUEL projects, that are working on the conversion of biomass into biofuel for sectors difficult to electrify, such as maritime transport or aviation. After that, WIP Renewable Energies presented BioTheRos project which purpose is to develop a holistic methodolgy that will boost the scale-up of sustainable biofuels via thermochemical conversion technologies.

Finally, the event coincided with the kick-off meeting of the European ICARUS project (led by Myrsini Christou, coordinator of JP Bioenergy) in which several members of EERA Bioenergy also participated as partners. Center for Renewable Energy Sources and Saving (CRES) introduced the ICARUS project which aims at developing best practices and concepts along entire value chains for accelerating the scale-up of sustainable aviation biofuel production worldwide.

The whole meeting was a unique opportunity to bring together multiple researchers focused on similar topics, which resulted in a most enriching dialogue and exchange of ideas.

EERA BIOENERGY SECRETARIAT PARTICIPATED IN A NEW MEETING OF THE EERA COMMUNICATIONS WORKING GROUP

On 27th September took place the fifth EERA Communications Working Group, a great chance to gather representatives from different joint research programmes and help them face communication challenges by developing a better strategy through the exchange of ideas, experiences, and success stories.

EERA Bioenergy Secretariat attended this online meeting which particular goal was to give an update on EERA's communications and actions so far for 2023 and display future action plans.

Furthermore, it aimed to discuss how to boost EERA communications to best showcase the JPs' work, with a specific moment of reflection around the newsletter and how this tool could serve this purpose.

EERA BIOENERGY COORDINATOR IN THE 17th SET PLAN CONFERENCE HELD IN SPAIN

EERA Bioenergy JP Coordinator, Myrsini Christou, participated as moderator in the panel discussion entitled 'Outlook for industrial growth of advanced biofuels in EU (2022-2030)', within the 17th SET Plan Conference, organized by the Spanish Presidency of the Council of the European Union.

This panel was attended by "hugely committed with bioenergy" experts, such as Pilar Sánchez, Deputy Assistant Director of the General Sub-Directorate for Hydrocarbons and New Fuels of the Ministerio para la Transición Ecológica y el Reto Demográfico; Dina Bacovsky, Chair of IEA Bioenergy; David Chiaramonti, Vice-Rector for International Affairs at Politecnico di Torino and Patrik Klintbom, chair of ETIP Bioenergy.

Myrsini pointed out that even though biofuel production capacity remains low and international trade is almost non-existent, new technologies and research advances are changing this paradigm, and so she raised the question of what can be done to boost the growth of biofuels in Europe.

The experts on the panel agreed that for biofuel business opportunities to exist, the right market conditions must be created and for this, the combination of ambitious and technology neutral regulation—both at a National and European level—, on one side; and investment in infrastructure and logistics —so crucial raw materials availability is ensured—, on the other, is key.

EERA BIOENERGY COORDINATOR PARTICIPATED IN THE 26th STEERING COMMITTEE MEETING AND IN THE 11th STAKEHOLDER PLENARY MEETING OF THE ETIP BIOENERGY

Within the framework agreement between EERA Bioenergy Joint Programme and ETIP Bioenergy (Bioenergy European Technology and Innovation Platform), Myrsini Christou, EERA Bioenergy Joint Programme Coordinator, participated in the 26th Steering Committee meeting of the ETIP Bioenergy held in Brussels on the 27th of September 2023 on behalf of EERA Bioenergy. The Steering Committee is the decision-making body and executive arm of ETIP Bioenergy and directs all activities of the platform, being accountable for defining the roles and responsibilities within the platform and outlining operations; compliance with the platform's mission and related activities; approval and launching of activities; follow-up activities and approval of deliverables; and setting high-level policy: coordination with external bodies and initiatives, communication and general organization.

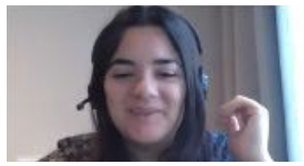
Myrsini Christou also participated in the 11th Stakeholder Plenary Meeting of the ETIP Bioenergy held in Brussels on the 27th and 28th of September 2023. This edition focused on the measures for accelerating the energy transition towards the 2030 targets. It was complemented by a workshop for experts on European citizens' visions of bioenergy, led by Center for the Study of Democracy (CSD).

The event covered two days and was structured around four prominent dimensions of the bioenergy and renewable fuels sector. The European policy landscape, the role of industry, and the Research and Innovation field were addressed in respective sessions. A new relevant focus was introduced on the societal topics concerning the energy transition, with a whole session dedicated to the social acceptance of bioenergy, which was further discussed in the expert workshop.

LAST STEERING COMMITTEE MEETING OF 2023

The EERA Bioenergy Steering Committee meeting that took place online through Zoom on 20th of November, addressed relevant issues related to the Joint Programme interests, actions and plans.

The European Commission representatives: Maria Georgiadou (DG-RTD), Zinovia Tsitrouli and Biljana Kulisic (DG-ENER), informed on the last news on renewable fuels and bioenergy research and innovation, and on the revised RED II and perspectives on the future use of biomass for bioenergy, respectively.



EERA Bioenergy position papers were identified by the EERA Bioenergy JP, followed by the introduction of 2024 perspectives for each SP by the Subprogramme Coordinators. Furthermore, the 2 new EERA Bioenergy associated members were presented by themselves: Energy Agency of Plovdiv (Bulgaria) and Çukurova University (Turkey).

EERA Bioenergy Secretariat presented the activities and services provided in 2023 as well as the financial issues. Lastly, the EERA aisbl Secretariat brought updated News and activities of EERA asbl.

Bioenergy highlights

INTEGRATING RENEWABLE ENERGIES SURPLUS INTO WASTEWATER TREATMENT PLANTS (WWTP) FOR BIOMETHANE PRODUCTION

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Europe targets to reach a zero-carbon economy by 2050. Such a challenge requires the development and implementation of new policies to boost the use of renewable energies, green hydrogen (H_2) and biomethane (CH_4) are two of the most promising energy vectors produced from renewable sources and European countries are heavily promoting them. In particular, the anaerobic digestion processes will play a central role in this transition as they also contribute to reducing waste generation by converting biomass residues and organic wastes into biogas.

The BIOUP project targets studying, developing, evaluating, and validating the biological transformation of H_2 from renewable sources and carbon dioxide (CO_2) from the anaerobic digestion of organic wastes into CH_4. The technology implemented in this project will contribute to overcoming some of the challenges associated with the intermittence in the generation of renewable energy surplus by adapting these technologies to Wastewater Treatment Plants (WWTP), which treats large volumes of sludge by anaerobic digestion. The process design targets biomethane production in one and two stages (*in-situ* and *ex-situ*) for its integration into the sludge line of a WWTP, —analyzing the influence of different co-digestion strategies during the bio-methanation process—. Overall, the main goal of the BIOUP project is to develop a *power-to-gas* technology that optimizes the energy demand of wastewater treatments.

The BIOUP project also focuses on prospecting renewable hydrogen production technologies that best fit in the production of biomethane at WWTP as well as scaling up to TRL 6 the development of this technology for its validation. The results of the project will provide a series of innovations including the following:

- Development of an innovative biogas enrichment technology in different energy scenarios to store renewable energy surplus in the form of biomethane.
- Optimization at the laboratory scale of the bio-methanation process before its scaling up and implementation in a pilot plant under industrial-like conditions, thus validating the operational feasibility of the technology.
- Knowledge of microbial populations and biological functionality of the in situ biomethanation process.
- Design of a new process to improve CH_4 yields via co-digestion and bioaugmentation increasing the H_2 buffer capacity and CO_2 transformation.

The BIOUP project (CPP2021-009086) receives funding from the Spanish Ministry of Science and Innovation (MCIN/AEI/10.13039/501100011033) and the European Union (NextGenerationEU/PRTR). The project is coordinated by the Spanish company Acciona Agua, in close collaboration with CIEMAT and the University of Valladolid.

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ICARUS - INTERNATIONAL COOPERATION FOR SUSTAINABLE AVIATION BIOFUELS

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icarus
INTERNATIONAL COOPERATION FOR SUSTAINABLE AVIATION BIOFUELS

The EU-funded ICARUS project (upcoming website: www.icarus-biojet.eu has officially started in October 2023. The project's kick-off meeting was held on October 30 and 31 2023 in Crete, Greece.

Background

Aviation forecasts anticipate ongoing international growth and long-term outlooks suggest that aviation will continue to expand due to its inherent value in providing safe, efficient, and high-speed transportation of goods and people for society. This growth will lead to increased demand for fuel, necessitating a boost in sustainable fuel production.

Aviation is one of the most difficult to defossilize transportation sectors since the fuel quality must meet stringent quality specifications defined by ASTM. However, the aviation industry has set aggressive targets for reducing greenhouse gas emissions and the process to achieve these goals for international aviation is under development with the UN's International Civil Aviation Organization (ICAO). In October 2022 IATA adopted the Long-Term Aspirational Goal to achieve net zero CO_2 emissions by 2050. In October 2023 a final agreement was reached on the ReFuelEU legislation, marking a crucial step toward cutting emissions in the aviation industry, and aligning the sector with EU's climate goals. The law sets strict requirements for fuel suppliers, requiring them to gradually increase their use of Sustainable Aviation Fuels (SAFs) from 20% by 2035 to 70% by 2050 for all commercial flights across Europe.

In order to comply with the targets, set by ReFuelEU the demand for SAF (both for sustainable biofuels and synthetic fuels) is expected to strongly increase. A wide range of potential alternative fuel options thus need to be developed and deployed worldwide, providing significant momentum for industry, R&I institutions, and governments to advance SAF. Furthermore, due to the global nature of the aviation sector, international collaboration is of crucial importance for the achievement of European and global goals and targets. Here, Icarus aims to build bridges for research and innovation cooperation between partners from Europe and Mission Innovation countries.

Icarus Project

The Icarus consortium, an international coalition of esteemed partners, is making significant strides in the advancement of Sustainable Aviation Fuel (SAF) production technologies. The consortium has identified critical technology barriers currently limiting the broader deployment of three pivotal SAF production routes: biocrude from hydrothermal liquefaction to SAF, isobutanol from lignocellulosic biomass to SAF, and synthetic Fischer-Tropsch fuels from biomass gasification to **SAF**.

These three value chains have been strategically chosen by Icarus due to their proximity to market deployment and their indispensable role in achieving European and international SAF deployment targets. Icarus is committed to enhancing these technologies with innovative solutions while addressing the entire value chain. Furthermore, Icarus is exploring novel biomass production concepts, such as sequential cropping and mix cropping, to ensure an increased and sustainable biomass supply for SAF production.

The project approach is comprehensive, encompassing techno-economic, environmental, and social assessments throughout the entire value chain to ensure the sustainability and efficiency of future innovative SAF production processes.

The ICARUS project is coordinated by the Centre for Renewable Energy Sources and Saving Foundation (CRES). The ICARUS consortium involves 20 renowned partners including five partners from Mission Innovation (MI) countries Canada, India, and Brazil.

Project coordinator contact: Myrsini Christou, CRES (mchrist@cres.gr).

Figure 1. Participants of the ICARUS kick-off meeting in Crete, Greece, 30-31 October 2023.

ICARUS has received funding from the *European Union's Horizon Europe research and innovation programme* under grant agreement no. 101122303

DEVELOPMENT OF AN ADVANCED AND FUEL-FLEXIBLE BIOMASS STOVE FOR CLEAN COOKING

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In West African Togo, biomass accounts for about 80% of energy consumption. This is mainly needed for cooking as well as for heat generation. While inefficient cooking fires with high emission levels and corresponding health consequences are the rule in rural regions, charcoal stoves are predominantly used in the city. For both paths, the required wood is usually taken directly from the forest and used for cooking or processed into charcoal. This uncontrolled and unsustainable wood extraction subsequently leads to a rapid and steady decline in African forest areas.

The efficient APELI biomass stove was developed within the LabTogo project as a possible solution for this problem. It can be operated virtually smoke-free and odorless and produces low emissions with various biomasses. The development was based on the fuels and production methods available in the target region and an analysis of the disadvantages of existing stove technologies. In addition to good technical parameters, a particular focus was placed on the lowest possible retail price and the possibility of local production as well as maintenance. An overview of this process is shown in Figure 1.

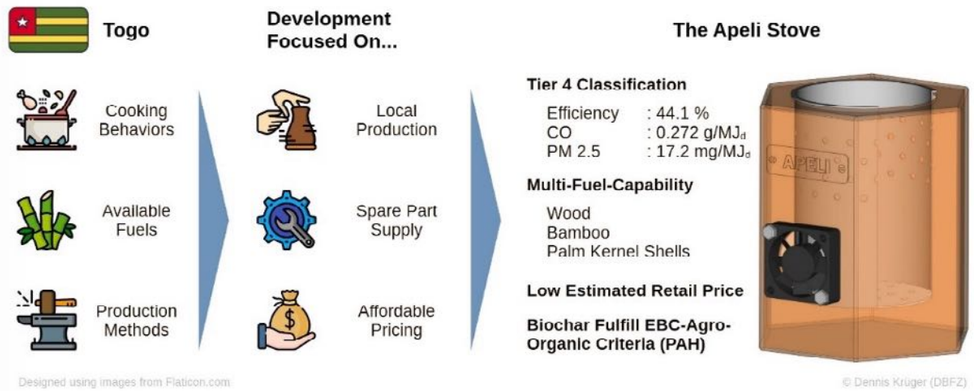

Figure 1. Graphical abstract for the development of the APELI stove

The APELI stove is multifuel capable and can be operated with various biomass fuels such as wood pellets, bamboo or palm kernel shells. Combustion takes place via the intermediate step of complete fuel gasification. In order to achieve the lowest possible price, the stove has a modular design and the function is divided into burner (see Fig. 2) and pot support to minimize the use of steel. The outer casing of the burner is made of ceramic, which can be produced in large quantities using a casting process. The combustion chamber is mainly made from a commercially available tin can (73 x 110 mm) and must be replaced every few months as a spare part. The built-in fan can be operated with any 5 V USB power source and ensures controlled and clean combustion. It also achieves a high power output using a low combustion chamber volume. The potholder is designed as an external frame that securely houses the burner and can also support large and heavy pots. Overall, the APELI stove weighs only 1.1 kg and the target selling price in Togo will be approx. 10 USD if mass-produced, which makes the stove affordable for broad sections of the population.

Figure 2: The APELI burner - small, lightweight, clean and powerful
© Dennis Krüger (DBFZ)

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In a follow-up project, the entire relevant process chain of the developed APELI stove is to be demonstrated in Togo. In addition to the production of the stove, this also includes long-term maintenance and local sustainable fuel production from various existing agricultural residues or fast-growing biomass.

LabTogo Project: https://www.dbfz.de/en/projects/labtogo

Publications:

[1] Mutlu, Ö.; Krüger, D.; Fontodji, J.K. **Development of an Affordable and Fuel-Flexible Biomass Burner for Clean Cooking in Togo: Analysis of Environmental and Climate Impacts.** 30. European Biomass Conference and Exhibition (EUBCE) Online. **2022**.

https://www.researchgate.net/publication/360725721_Development_of_an_affordable_and_fuel-flexible_biomass_burner_for_clean_cooking_in_Togo_Analysis_of_environmental_and_climate_impacts

[2] Krüger, D.; Mutlu, Ö. **The Apeli: An Affordable, Low-Emission and Fuel-Flexible Tier 4 Advanced Biomass Cookstove.** Energies **2023**, 16, 3278. https://doi.org/10.3390/en16073278

INTERNATIONAL CONSORTIUM LAUNCHES SUSTEPS EUROPEAN PROJECT FOR SUSTAINABLE ALGAE-BASED BIOFUEL GENERATION

International collaboration including full members of EERA Bioenergy kick-starts with online meeting; physical meeting is set for January 2024 in Türkiye

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In a significant stride towards advancing sustainable and secure energy solutions, the consortium members of the SUSTEPS project convened for an online kick-off meeting on October 17, 2023. The initiative, led by TÜBITAK (The Scientific and Technological Research Council of Türkiye) a full member of EERA and EERA Bioenergy, aims to revolutionize the production of algae-based biofuels on a global scale.

Project Overview:

SUSTEPS, acronym for Sustainable, Secure, and Competitive Energy Through Scaling Up Advanced Biofuel Generation, the project operates at Technology Readiness Levels (TRL) 4-5. Under the Research and Innovation (R&I) Action of HORIZON-CL5-2022-D3-03-02, SUSTEPS received funding from the European Climate, Infrastructure, and Environment Executive Agency, along with contributions from national agencies.

Key Details:

Starting Date: September 2023
Duration: 48 months
Consortium Structure: Comprising 11 partners, including 8 EU-Beneficiaries and 3 Associated Partners, the consortium boasts diverse geographic representation across Europe, America, and Africa. TÜBİTAK (Türkiye) takes the lead as the project coordinator, supported by partners: Jülich Research Center (Germany), Boğaziçi University (Türkiye), ARDITEC Association (France), University of Southern Denmark (Denmark), Albemarle Catalysts Company (Netherlands), ERINN Innovation Limited (Ireland), Institute for Solar Energy and New Energies (Morocco), Paul Scherrer Institute (Switzerland), University of Calgary (Canada) and Federal University of Itajubá (Brazil).

Objectives, Concept & Approach:

The overarching goal of SUSTEPS is to pinpoint systemic constraints and opportunities, generate novel insights, and propose best practices for scaling up a sustainable algae-based biofuel value chain. The project seeks to contribute to the cost-effective and sustainable large-scale production of biofuels derived from non-food/feed microalgae.

SUSTEPS tackles scale-up challenges across the entire microalgae-based biofuel production process. The project addresses key areas such as microalgae cultivation, CO_2 fixation, biocrude processing, upgrading, green hydrogen production, and aqueous stream valorization. Aiming to validate a bio-refinery concept, SUSTEPS emphasizes the efficiency of producing safe and sustainable biofuels from microalgae while ensuring socioeconomic viability.

Global Collaboration:

SUSTEPS places a strong emphasis on international collaboration, fostering efficient knowledge transfer and export. With experts from Europe, America, and Africa, the consortium aims not only to develop a cost-effective algae-based biofuel production technology but also to create geography-based cases for sustainability assessments. Working groups will be formed to build global knowledge for scaling up and assessing the sustainability of algae-based biofuels on a global scale.

Upcoming Events:

Following the successful online kick-off meeting, the consortium eagerly anticipates the next milestone—an in-person meeting scheduled for January 2024 at TÜBİTAK premises in Türkiye.

The SUSTEPS project is poised to shape the future of sustainable biofuel production, offering cost-effective, sustainable energy solutions on a global scale. For a deeper dive into the SUSTEPS project, we welcome you to explore our dedicated website at www.susteps.eu. Stay updated on the latest developments and engage with our community through our social media channels:

- LinkedIn
- Facebook
- Twitter
- Youtube

Connect with us across these platforms to join the conversation, gain insights, and be part of the sustainable energy revolution!

Figure 1. SUSTEPS project online kick-off meeting.

ACCELERATING SUSTAINABLE BIOFUEL PRODUCTION: THE BIOTHEROS PROJECT

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To meet European Union's mid-century climate goals, the transportation sector must reduce greenhouse gas emissions by at least 60%. Addressing this challenge, the EU funded BioTheRos project has started in October 2023, with the goal of scaling up lignocellulosic biomass conversion technologies for the production of advanced biofuels for marine, road and aviation sectors.

Background

The transportation sector, one of the largest contributors to greenhouse gas emissions, requires significant transformation. Sustainable biofuels, particularly those derived from lignocellulosic biomass, hold the promise of decarbonizing the sector and can be easily integrated into existing infrastructure. However, the majority of sustainable biofuels are currently produced from limited waste feedstocks.

The Project

The BioTheRos project aims to transform the production of sustainable biofuels. It brings together a diverse group of stakeholders on both European and global level, including technical experts, renewable energy associations, and industrial partners. International collaboration is crucial for scaling up and commercializing biofuels, and BioTheRos will establish close ties with ETIP Bioenergy and Technology Collaboration Programmes (TCPs) within the International Energy Agency (IEA) to leverage global expertise.

The project's approach begins with assessing current pre-treatment technologies and the availability of biomass feedstocks. Utilizing predictive AI models for biomass demand, the project will identify globally abundant biomass feedstocks suitable for sustainable biofuel production via innovative pyrolysis and gasification technologies. Pilot experimental validation of pyrolysis and gasification value chains will be carried out, exploring synergies between these technologies. The multidisciplinary approach includes feedstock selection, pilot experiments, as well as simulation and modelling for scale-up. Moreover, the project will evaluate market dynamics by calculating the energy demand for sustainable biofuels in 2030. It will determine the applicability and costs of renewable fuels for each transport sector, perform a high-level analysis of their availability, and develop a range of fuel mixtures tailored to marine, road, and aviation sectors.

BioTheRos is coordinated by CERTH (Centre for Research and Technology Hellas), Greece and features a consortium of six partners: CIRCE, Spain; BTG Biomass Technology Group, The Netherlands; BEST (Bioenergy and Sustainable Technologies), Austria; WIP Renewable Energies, Germany; and Motor Oil Hellas, Greece. Together, they aim to pioneer a more circular and sustainable approach to the transportation sector.

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Figure 1. Participants of the BioTheRos kick-off meeting in Athens, Greece, 18 October 2023

BioTheRos has received funding from the *European Union's Horizon Europe research and innovation programme* under grant agreement no. 101122212

GREEN WASTE UTILIZATION BY MEANS OF COMPOST HEATER FOR EMISSION-MINIMIZED PROVISION OF BIOGENIC HEAT AND COMPOST (KOMPOST4KLIMA)

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With increasing awareness of sustainability and demands for climate protection and biodiversity, the mass flows of heterogeneous organic residues will also increase in the future, as they arise in agriculture and horticulture as well as in urban and rural landscape and green space maintenance. Currently, there are not many sustainable recycling options available for these material streams. Due to the heterogeneity of these organics, with variable ratios of woody (e.g., tree and hedge trimmings) and herbaceous fractions (e.g., mowing, vegetable trimmings, flowering area growth), these residual material streams are not suitable for anaerobic digestion for biogas production, nor do they have favourable combustion characteristics. However, these extensive and almost uncompetitive material streams - green waste, forestry, horticultural and agricultural residues (more than 15 million t p.a. in Germany) can be put to competitive and sustainable use in a regulated composting process (also known as a biomeiler or compost heater). This Compost heater provides both process heat and high-quality compost.

The aim of the Kompost4Klima project (see Figure 1), led by the DBFZ - Deutsches Biomasseforschungszentrum gGmbH, is the further technical development of the Compost heater technology by increasing yields, e.g., by adapting insulation, heat transfer and aerating. Furthermore, a robust Instrumentation and Control was developed, and various operation mode's ware investigated. By simultaneously reducing labour and investment costs, the heat production costs could be lowered from former 2-3 €/kWh to competitiveness < 20 ct/kWh. Figure 2 and 3 shows a Prototype of a wooden compost heater with modular walls, internal dome aeration and vertical heat exchangers.

Within the scope of the project, the heat supply of greenhouse areas over the winter, for the purpose of frost-free conditions and young plant cultivation, demonstrated at the site of an ecological urban horticultural business (project partner ANNALINDE gGmbH). The project partner LAV Technische Dienste GmbH & Co. KG, which has many years of experience in the field of biogenic waste recycling and municipal services, ensures substrate provision and preparation. The Engineering office Dr.-Ing. Robert Pohl provided in a subcontracting support in planning and construction of the prototypes.

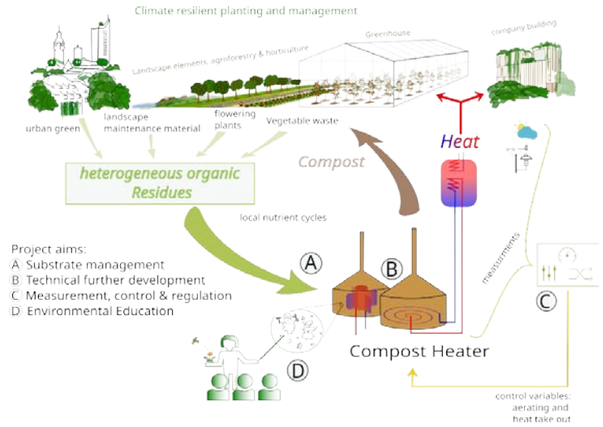

Figure 1. Project overview and aims.

Figure 2. Construction of a prototype with modular wall elements in wood construction (still without panelling). In the background: The three-aisled greenhouse to be heated and a round Compost heater made of double-bar fence elements with horizontal heat exchanger.

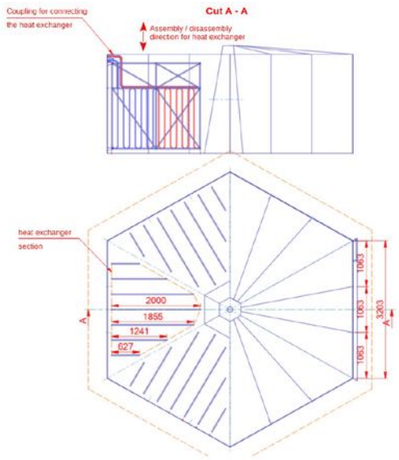

Figure 3. Sectional drawing of the wooden compost heater concept with positions of vertical heat exchangers.

Project partners:

Funded as part of the "Mehrwert"-initiative "Sustainably out of the crisis" and co-financed with tax revenue on the basis of the budget approved by the Saxon state parliament.

FLEXIBLE AND EFFICIENT CO-PRODUCTION OF CLEAN FUELS FOR HARD-TO-DECARBONIZE SECTORS

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BUTTERFLY is a new EU funded project that delivers a circular, cost-effective and flexible production process of advanced biofuels and renewable fuels, targeting the off-grid energy supply, the steel industry and heavy-duty transport.

One of the priorities of the European Green Deal is the transition of Europe into the first climate-neutral continent by 2050. To achieve this target, the European Union is required to reshape the energy system to become affordable, more efficient and circular, and to progressively achieve ambitious goals both in terms of renewable energy share and reduction of energy consumption.

Bioenergy will play a crucial role in this transition, supporting the achievement of the 32% renewable energy goal by 2030 and boosting renewable energy and feedstocks in sectors such as transport, off-grid energy and industry.

BUTTERFLY fits into this evolving context by providing multiple innovations in the production of advanced biofuels and renewable fuels, in line with the ambitions of the EU Green Deal. The project is carried out by an international consortium including industries, utility companies, research organizations and SMEs, coordinated by Dutch-based TNO.

Through the validation of three different residual feedstock families, this project will advance a co-production process of rDME (renewable & recycled carbon DiMethyl Ether) and SNG (Synthetic Natural Gas), with applications in the steel industry, off-grid energy supply and heavy-duty transport.

Figure 1. BUTTERFLY value chain.

Circular and cost-effective value chains

BUTTERFLY will demonstrate the use of three different waste and residual feedstock families (lignocellulosic biomass, industrial and organic waste) in order to produce a tuneable production ratio between SNG and rDME. The diversification and valorization of these new residual feedstocks will decrease production costs of the advanced and renewable fuels, while substituting fossil fuels in energy demanding applications and reducing GHG emissions arising from those sectors.

Innovative production process

The project will advance innovative solutions that have not been implemented so far, such as the integration of the SEDMES (*Sorption-Enhanced DME Synthesis*) process with a gasifier in a real operating environment (*TRL-Technology Readiness Level 7*) to produce rDME and the connection of SEDMES upstream a methanation technology to valorise off-gas from rDME synthesis into SNG. These cutting-edge technologies will allow multiple and flexible process configurations from max rDME to max SNG production, including tuneable ratios of products. The flexibility of this process will ensure adaptability to market demand and feedstock availability, as well as maximum fuel production and costs reduction, while the circularity feature will improve carbon efficiency towards 97% and biomass-to-fuel conversion efficiency by 15% compared to the state-of-the-art.

Boost the scale-up of advanced biofuels and renewable fuels

The connection of multiple innovative technologies and the tuneable production ratio between rDME and SNG will improve yield and efficiency production performance, with an increase of gasification and methanation plant size. Indeed, BUTTERFLY will upgrade SEDMES technology connection to indirect gasification from laboratory testing in relevant environment (TRL5) to a verification in relevant industrial environment (TRL6) and SEDMES process upstream methanation to a real operating environment (TRL7), boosting the scale-up of advanced biofuels and renewable fuels. This advancement will enable meeting the short and medium-term demand for renewable fuels in energy and transport: rDME and SNG could replace LPG and diesel used in off-grid domestic, industrial and commercial heating, steel industry and heavy-duty transportation (including marine sector).

Figure 2. The BUTTERFLY team at the kick-off meeting at TNO in Petten, the Netherlands, October 2023.

About BUTTERFLY

BUTTERFLY – *Biomass Utilized To The Extended portfolio of Renewable Fuels with Large Yields* is a Horizon Europe Innovation Action started on 1 July 2023 that will continue until November 30, 2026.

Partners

The BUTTERFLY project is coordinated by Netherlands Organisation for Applied Scientific Research (TNO) and has a consortium of 10 partners from 7 different EU countries.

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FOSTERING STRONG REGIONAL STRUCTURES IN THE REGIONAL BIOECONOMY – BRANCHES PROJECT

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The establishment of bio-based value chains that support more sustainable and circular regional development is not only linked to tangible components such as the availability of raw materials and available technologies. It is also highly dependent on intangible regional capacities, existing and disseminated knowledge and effective innovation structures. To support the implementation of new cost-effective technologies and promote innovative business opportunities in rural areas through the development of bioeconomy, the Horizon2020 project BRANCHES, launched in January 2021 and which finalizes by December 2023, has focalized in three main objectives:

1. The creation of National Thematic Networks (NTNs) for knowledge exchange between practitioners, researchers, and academics. The NTN participation model ensures close exchange between practitioners, R&D, policy, and other actors of the bioeconomy to enable the transfer of ideas and to facilitate collaborations.

2. Identification of innovative practices in bioeconomy, namely technological and value chains concepts, as well as business models. Bringing best practice factsheets (Practice Abstracts - PAs) closer to potential users and introducing among the created NTN novel business models that work at regional/local level.

3. The analysis of regional innovation models for the bioeconomy and factors influencing innovation in regional value chains. This analysis, led by the DBFZ - Deutsches Biomasseforschungszentrum, involved the assessment of the bioeconomy status quo in selected regions and the development of strategic measures to foster stronger innovation structures for the bioeconomy and thereby support the adoption of the collected best practices.

The project, leaded by the Natural Resources Institute Finland (Luke) counts with the participation of 12 partners representing five countries, namely Finland, Germany, Poland, Italy and Spain, and therefore the development of five National Thematic Networks in the EU. In Germany, the DBFZ - Deutsches Biomasseforschungszentrum, the UFZ - Helmholz Zentrum für Umweltforschung and the BioEconomy Cluster e.V founded the German NTN "Bioeconomy in Practice". The Network launched in November 2021 and since then has celebrated four workshops dedicated to dissemination of innovative practices and exchange between actors in the German bioeconomy community. With a total of 70 members to the date, the network has used various methods of knowledge transfer, such as organizing of a competition for the best innovative practice in 2022 and 2023 and selecting a case study from among the innovative practices identified. To disseminate this case study of a regional value chain in Central Germany using hemp fibers for the manufacture of composite products, the German NTN organized a showcase visit and produced a video to make the advantages of these regional bioeconomy practices known to a wider audience[1]. The Network "Bioeconomy in Practice" is planning to continue its work after the finalization of BRANCHES project.

Among the innovative practices from Germany summarized in Factsheets (PAs) by the DBFZ and UFZ the following are to be found:

- PA 13 – Conversion of organic residues to insect biomass.
- PA 18 – Agricultural cooperative biogas plant.
- PA 21 – Grass factory – from meadow to innovative materials.
- PA 22 – Hydrothermal carbonization of green waste to produce biocoals, carbons and biochemicals.
- PA 32 – New value chains to milk residues.

[1] The video, produced for the bioeconomy community in Germany, is in German language with English subtitles and can be seen here.

Figure 1. Factsheets of innovative bioeconomy practices selected by DBFZ and UFZ.

More than 60 PAs have been identified and disseminated within the project and can be download in English version in the BRANCHES Website. Likewise, DBFZ has guided the identification of exemplary business case models per country. These are summarized in the format of the business model canvas. Among the good business models selected can be found agro-forestry examples, such as "*Vineyard pruning valorisation for energy purposes as local strategy to promote circular economy (Spain)*" and digitalization solutions such as "*An online IT platform/market place for the revitalization of abandoned chestnut orchards in Southern Italy*", while Finland described different business models in which forest owners can benefit from the forest bioeconomy.

Finally, for the analysis of regional innovation models for the bioeconomy led by DBFZ, five regions have been selected per country, namely Northern Finland (FI), Central Germany (DE), the Ebro Valley (ES), Warmia and Mazury (PL) and Central Italy (IT). The analysis of their specific regional conditions and the enabling factors involved in the implementation of the selected innovations in the regional value chains has led to a better understanding of the implementation of the different innovation models in their bio-based economies [1,2]. This has been accompanied by a policy analysis to identify the main barriers and opportunities for the promotion of bioeconomy activities [3]. Currently, recommendations for the main value chains represented in the regions are being developed using the results of the combined SWOT and TOWS methodology applied in each region, which has allowed a structured analysis of the regional value chains and the definition of strategies to promote their further development [4].

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This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 10100375

New members

ASSOCIATE MEMBERS

ÇUKUROVA UNIVERSITY

Assoc.Prof. R. Irfan Nazli
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Çukurova University was founded in 1973 in Adana province of southern Turkey. The university took its name from the Çukurova plain, which is the cornerstone of Turkey in agricultural production with its favourable climatic conditions, high soil fertility and irrigation facilities. Çukurova University currently consists of 19 faculties, 12 vocational high schools, 38 research and implementation centers and approximately 112 departments. Additionally, it is one of the leading education and research institutions in Turkey with approximately 2300 academic staff and 48000 students. Cukurova University is committed to educate individuals who are open to improvement, development and who internalized the idea of democracy and share its scientific backgrounds with other scientific foundations and the society throughout the activities conducted in science, technology, art and research and development works.

Figure 1. Çukurova University.

Bioenergy studies are mostly concentrated in the departments of field crops (Agriculture faculty), chemistry (Science and letters faculty), food engineering (Engineering faculty), automotive engineering (Science faculty), and biology (Science and letters faculty). To date, many studies have been carried out within the university on sustainable biomass production, the production of liquid and gaseous biofuels through different conversion technologies from biomass, and the evaluation of GHG emissions occurring during the production stages via LCA. For more information about the Çukurova university please visit the website.

Sustainable Biomass Production Studies

Research activities on sustainable biomass production has been carried out in Field Crops Department. The department is divided into 3 main branches of science: cereals, industrial and forage crops. However, research activities have been carried out for many years in sub-sections such as plant breeding, turf grasses, grain legumes, and bioenergy crops within the department. To date, many research projects have been carried out within the framework of university-industry cooperation, and as a result, many new varieties with high yield and quality have been improved. In addition, training on sustainable agricultural practices have been arranged for farmers and public and private sector representatives on a regular basis. Field experiments have been conducted in the Research and Implementation Area with approximately 50 ha of arable land.

Figure 2. Field Experiments in Research and Implementation Area of Field Crops Department.

Our research priority is on the determination of suitable cropping systems and promising perennial grass species that allow satisfactory biomass production with low input in marginal agricultural lands of the semi-arid Mediterranean environment. In southern Turkey where typical Mediterranean climate prevails, severe and prolonged drought conditions which frequently occ occur during late spring and summer is the main bottleneck to achieving satisfactory biomass yields from dedicated bioenergy crops (miscanthus, switchgrass, and giant reed) under rainfed conditions due to the poor establishment and low levels of crop survival [1]. For this reason, these crops generally are needed to extensive irrigation support during their growing seasons for good establishment and high biomass productivity. However, it is well known that irrigation increases costs and GHG emissions in bioenergy farming systems [2,3].

Additionally, allocating irrigation water to bioenergy crops instead of food crops could threaten global food security. In this context, we have carried out several projects so far on examination of the suitability of high-yielding and summer dormant cool season grasses as feedstock for biobased industries in semi-arid Mediterranean environment through comparing them with dedicated bioenergy crops in terms of biomass productivity, combustion quality and energy balance. As a result, we suggested that bulbous canary grass (*Phalaris aquatica L.*) and tall wheatgrass (*Agropyron elongatum L.*) may be considered as promising bioenergy crops in the dry marginal lands of Mediterranean where warm season grasses cannot likely be well established because of water scarcity, due to their high biomass yields, low input requirement and superior drought tolerance [1,4]. These crops produce the major portion of their vegetative growth during rainy seasons (autumn, winter, and spring), and remain dormant during summer to protect themselves from high temperatures, increasing day lengths, and water stress conditions [5,6]. Hence, this growing pattern enables them to produce satisfactory biomass yields (up to 22 t ha^{-1}) under rainfed or less-watered conditions. For detailed information you can access our articles: https://www.sciencedirect.com/science/article/pii/S0926669018307891 / https://www.sciencedirect.com/science/article/pii/S0961953420301616

Figure 3. Bulbous canary grass (above) and Tall wheatgrass (below).

Within the scope of our projects, chemical analyses are carried out in bioenergy crops and central research laboratories. Only basic analyses such as crude fat, crude protein, cell wall composition (lignin, cellulose, and hemicellulose), and ash can be carried out in the bioenergy crops laboratory. On the other hand, more specific analyses such as fractionated sugars, cellulose crystallinity, and mineral and ash compositions can be carried out in the central research laboratory. You can access detailed information about infrastructure facilities of central research laboratory via website.

Fig.4. Bioenergy crops laboratory

Figure 5. Central research laboratory.

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Useful information

International Energy Agency, optimistic for bioenergy international prospects

The International Energy Agency (IEA) released on 24th October its World Energy Outlook (WEO) 2023, which states that even though renewable energies will approach half of the global energy mix, much stricter policies would be needed to achieve 1.5 °C. However, IEA is quite optimistic for bioenergy prospects.

According to this report, modern bioenergy —which comes in solid (biomass), liquid and gaseous forms—, makes up already more than half of global renewables supply, as overall production increased by 5% in 2022, reaching 40 EJ. Biomass derived from organic waste sources such as forestry residues or municipal solid waste accounts currently for most of the production and forecasts agree that its trend is exponentially upward, as it could represent more than 70 EJ by 2050.

Even though biogas and biomethane are still the smallest part of the bioenergy supply chain, there is growing interest —especially in Europe— in biomethane as a source of low-emissions domestic gas supply. Worldwide, around 300 bcm of potential production from agricultural wastes and residues lies within 20 kilometres of major gas pipeline infrastructure, providing a good match with possible large-scale production and injection into gas networks.

In all foreseen scenarios, combined biogas and biomethane production nearly doubles by 2030 to reach 80 billion cubic metres equivalent (bcme), and the share of biomethane in total biogas demand increases, driven in large part by the value attached to its use as a dispatchable source of energy and drop-in substitute for natural gas. In fact, total biomethane production could reach between 240 and 300 bcme by 2050.

2030: greater role for clean technologies

In general, the latest edition of the World Energy Outlook describes an energy system in 2030 in which clean technologies play a significantly greater role than today. This includes almost 10 times as many electric cars on the road worldwide; solar PV generating more electricity than the entire US power system does currently; renewables' share of the global electricity mix nearing 50%, up from around 30% today; heat pumps and other electric heating systems outselling fossil fuel boilers globally; and three times as much investment going into new offshore wind projects than into new coal and gas-fired power plants.

And all these forecasts are based only on the current policy settings of governments around the world. If countries deliver on their national energy and climate pledges on time and in full, clean energy progress would move even faster. However, even stronger measures would still be needed to keep the goal of limiting global warming to 1.5 °C.

Figure 1. Investment Flows

The costs of inaction could be enormous

The combination of growing momentum behind clean energy technologies and structural economic shifts around the world has major implications for fossil fuels, with peaks in global demand for coal, oil and natural gas all visible this decade –the first time this has happened in a WEO scenario based on today's policy settings–. In this scenario, the share of fossil fuels in global energy supply, which has been stuck for decades at around 80%, declines to 73% by 2030, with global energy-related carbon dioxide (CO_2) emissions peaking by 2025.

As things stand, demand for fossil fuels is set to remain far too high to keep within reach the Paris Agreement goal of limiting the rise in average global temperatures to 1.5 °C. This risks not only worsening climate impacts after a year of record-breaking heat, but also undermining the security of the energy system, which was built for a cooler world with less extreme weather events. Bending the emissions curve onto a path consistent with 1.5 °C remains possible but very difficult. The costs of inaction could be enormous: despite the impressive clean energy growth based on today's policy settings, global emissions would remain high enough to push up global average temperatures by around 2.4 °C this century, well above the key threshold set out in the Paris Agreement.

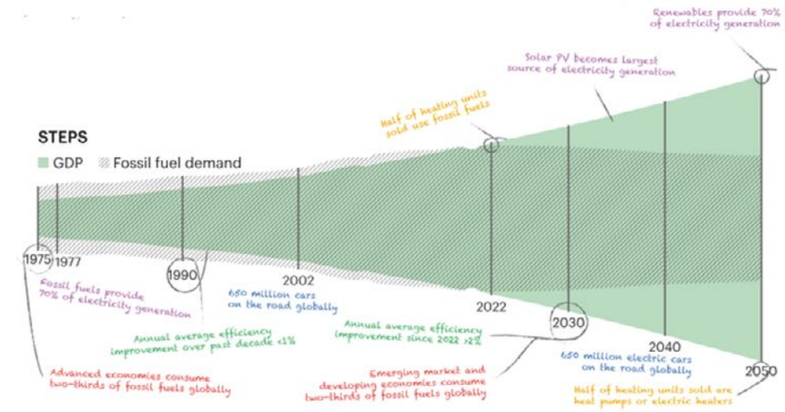


Figure 2. Transformative changes in parts of the global energy system are coming into view

Finally, the WEO-2023 proposes a global strategy for getting the world on track by 2030 that consists of five key pillars:

- Tripling global renewable capacity.
- Double the pace of energy efficiency improvements.
- Reduce methane emissions from fossil fuel operations by 75%.
- Innovative, large-scale financing mechanisms to triple clean energy investments in emerging and developing economies.
- Measures to ensure an orderly decline in fossil fuel use, including an end to new coal-fired power plant approvals.

RefuelEU aviation initiative: new regulation to decarbonise the aviation sector

The Council of the EU adopted on 9th October a new law that is estimated to reduce CO_2 emissions from aviation by more than 60% by 2050, compared to 1990 levels, and to bring additional air quality benefits by reducing non-CO_2 emissions. In addition, it will enable investments to be triggered by a long-term predictable legal framework and so, both demand for and supply of **sustainable aviation fuels** (SAF), in Europe and globally, are expected to increase.

The main objective of the so-called **'RefuelEU aviation'** initiative, as a key part of the EU's 'Fit for 55' package, is to put air transport on the trajectory of the EU's climate targets for 2030 and 2050, as SAF are one of the key short- and medium-term tools for decarbonising aviation. It should address the current situation which is hindering their development: low supply and prices much higher than prices of fossil fuels.

The new legislation covers more than 95% of air transport originating at EU airports as it involves fuel providers supplying EU airports —with an increasing minimum percentage of sustainable aviation fuels blended with paraffin —, and most aircraft operators.

The Regulation maintains a level playing field as a basic element by introducing EU-wide minimum percentages which will also replace those indicated in any existing national legislation governing the supply and uptake of sustainable aviation fuels. Aircraft operators will have better access to increasing shares of sustainable aviation fuels across the EU, thanks to the European minimum shares. In particular, the level of minimum sustainable aviation fuel shares is defined for the period 2025 to 2050 at the following levels:

- 2% from 2025;
- 6% from 2030;
- 20% from 2035;
- 34% from 2040;
- 42% from 2045;
- and 70% from 2050.

The obligation to blend sustainable aviation fuels covers synthetic aviation fuels (electro-fuels), biofuels (except those produced from food and feed crops) and recycled carbon fuels, all in line with the sustainability criteria of the Renewable Energy Directive.

In addition, there will be specific minimum percentages for synthetic aviation fuels, which are the most sustainable fuels and can be most easily increased in production, to drive the decarbonisation of aviation. These percentages go from 1.2% in 2030 to 35% in 2050.

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

To avoid both carbon leakage and unnecessary emissions, aircraft operators departing from Union airports will have to refuel at least 90% of the fuel required for their flight when departing from a Union airport. This will avoid situations where aircraft operators transport excessive amounts of fuel in order to avoid having to refuel at a particular airport, where costs may be higher due to the supply of sustainable aviation fuels, as the transport of excessive amounts of fuel also leads to excess weight, higher fuel consumption and higher emissions.

Together with the revised rules on the EU Emissions Trading Scheme in the aviation sector, ReFuelEU Aviation will thus put aviation on the right track to reach European overall objective of reducing greenhouse gas emissions from transport by 90% by 2050 (compared to 1990 levels). With the adoption of this initiative, the European Commission is pleased to have finalized the key 'Fit for 55' legislation, which puts the EU on track to exceed the 2030 targets by setting legally binding climate goals covering all key sectors of the economy.

New Renewables Energy Directive to raise the share of renewable energy in the EU's overall energy consumption

As a response to the energy aspects of the EU's climate transition under the 'Fit for 55' package, the *Council of the EU* also adopted on 9th October the new **Renewables Energy Directive**. The goal of this proposal is to raise the share of renewable energy in the EU's overall energy consumption to 42.5% by 2030, with an additional 2.5% indicative top up to allow the target of 45% to be achieved.

This measure is intended to **speed up the integration of renewables** in sectors where incorporation has been slower and, therefore, all member states will have 18 months after the entry into force of the directive to transpose it into national legislation and contribute to achieving more ambitious sector-specific targets in transport, industry, buildings and district heating and cooling.

Besides, permit procedures for renewable energy projects will be accelerated to fast- track the deployment of renewable energies in the context of the EU's 'REPowerEU' plan to become independent from Russian fossil fuels, after Russia's invasion of Ukraine. Member states will design renewables acceleration areas where renewable energy projects will undergo simplified and fast permit-granting processes and renewable energy deployment will also be presumed to be of 'overriding public interest', which will limit the grounds of legal objections to new installations.

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

Bioenergy

The directive strengthens the sustainability criteria for the use of biomass for energy, to reduce the risk of unsustainable bioenergy production. Member states will ensure that the cascading principle is applied, with a focus on support schemes and with due regard to national specificities.

Transport

Member states will have the possibility to choose between:

- a binding target of 14.5% reduction in greenhouse gas intensity in transport from the use of renewables by 2030
- or a binding share of at least 29% of renewables within the final consumption of energy in the transport sector by 2030

The new rules establish a binding combined sub-target of 5.5% for advanced biofuels (generally derived from non-food-based feedstocks) and renewable fuels of non-biological origin (mostly renewable hydrogen and hydrogen-based synthetic fuels) in the share of renewable energies supplied to the transport sector. Within this target, there is a minimum requirement of 1% of renewable fuels of non-biological origin (RFNBOs) in the share of renewable energies supplied to the transport sector in 2030.

Industry

The directive states that industry will need to increase the use of renewable energy annually by 1.6%. Member states agreed that 42% of the hydrogen used in industry should come from renewable fuels of non-biological origin (RFNBOs) by 2030 and 60% by 2035.

Buildings, heating and cooling

The new rules set an indicative target of at least a 49% renewable energy share in buildings in 2030.

Renewable targets for heating and cooling will gradually increase, with a binding increase of 0.8% per year at 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 increases calculated specifically for each member state.

Bioenergy produced from agricultural, forestry and organic waste feedstock continues to be the main source of renewable energy in the EU

The latest European Commission report on **Bioenergy Sustainability** pointed out that bioenergy produced from agricultural, forestry and organic waste feedstock continues to be the main source of renewable energy in the EU. According to the report, which was released in October as required by 2023 State of the Energy Union Report, primary solid biofuels (70.3%) represent the largest share of bioenergy, followed by liquid biofuels (12.9%), biogas/ bio-methane (10.1%) and renewable share of municipal waste (6.6%).

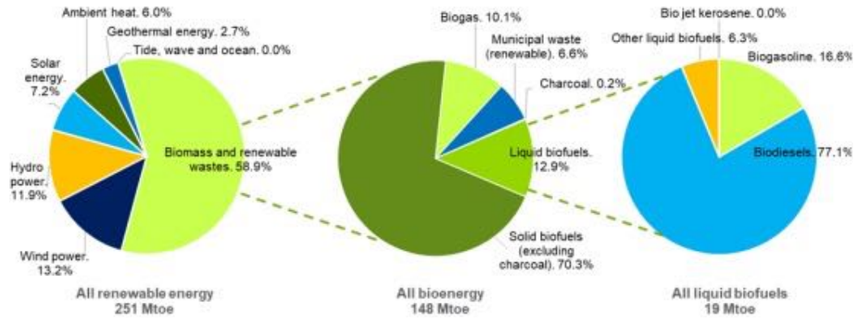


Figure 1. Gross EU consumption of renewable energyper type (2021, %Mtoe)

In line with the Commission proposal in the REPowerEU plan to accelerate the sustainable production of biomethane, most member states have reported measures related to the promotion of **biogas and biomethane** to reduce their reliance on imported fossil fuels. That is the main reason why Indigenous biogas production in the EU in 2021 rose to 14.9 million tonnes of oil equivalent (mtoe), a 1.7% increase compared to 2020. Focusing on country-by-country, Germany remained the largest producer (7.5mtoe – 50.4% of the total), followed by Italy (13.9%, 2.1mtoe), and France (9.4%, 1.4 mtoe), while Belgium, Finland, Hungary, and Sweden did not report any biogas production.

The report also provides details on **solid biomass supply**, which mainly comprises woody biomass/forest biomass (66%), biomass from organic waste (26%) —three-quarters of which was in Germany— and agricultural biomass (8%), notably in Sweden and Finland. Overall, from 2008 to 2021, primary supply of solid biomass in the EU increased a 33.5% to reach 4,454,768 TJ, with wood pellets use (413%) and animal waste (351.9%) leading the biggest rises.

As regards the **transport sector**, renewable energy is continuously increasing, especially based on the use of advanced biofuels, which final consumption in the EU has increased by 39% in 2021, compared to 2013, to reach 16.5. Biodiesel accounted for roughly 80% of total biofuel consumption in the transport sector, bioethanol was the second most consumed fuel type (18%), and biomethane and other liquid biofuels aggregated to less than 1%.

While bioethanol is mainly produced from feedstock originating from the EU (at a percentage of around 78%), only around half of biodiesel (43%) is produced from EU-originating feedstock.

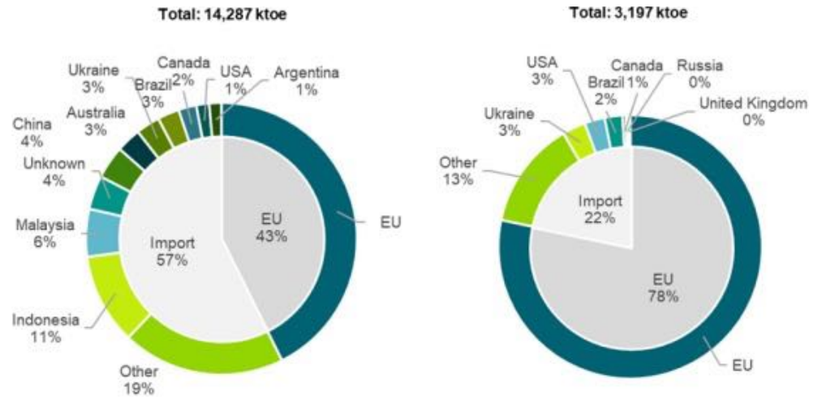


Figure 2. Geographical origin of feedstock for biodiesel (left) and bioethanol (right) for the EU in 2021

As for **heating and cooling**, biomass fuels and bioliquids were used for the production of 17.3 mtoe of gross heat in the EU in 2021, notably using solid biomass (76%), followed by renewable municipal waste (18.1%) and biogases (5.0%).

Finally, in the **electricity sector**, 45.6 mtoe of biomass fuels and bioliquids were used in 2021 to produce 14.6 mtoe of gross electricity, which represents 15% of the total gross renewable electricity mix and 6% of the total gross electricity. 74% of gross electricity from biomass was produced in combined heat and power plants, mainly from solid biomass (54.8%), biogases (31.1%), and renewable municipal waste (11.6%).

Concerns about the exclusion of biogas and biomethane of the Net Zero Industry Act disappear

On October 25th, the European Parliament's Industry, Research, and Energy Committee (ITRE) adopted its position on the Net Zero Industry Act (NZIA) proposal, by suggesting a stand-alone list of net-zero technologies eligible for EU funding and regulatory perks, which finally included aviation fuel (SAF), and biomethane-related technologies.

The European Biogas Association (EBA) welcomes the recognition by the European Parliament of the important contribution of biomethane to the decarbonisation of the sector through the introduction of a CO_2 neutral fuel definition in line with the sustainability criteria of the Renewable Energy Directive. EBA had previously shown its "deep concerned" about the decision the European Parliament's Environment Committee (ENVI) made in September to exclude "sustainable biogas and biomethane technologies" from the scope of the Net Zero Industry Act (NZIA), a landmark legislation to promote clean technology manufacturing in the European Union.

Sustainable biogas and biomethane are not only a local, European-made, and cost-competitive renewable alternative to oil and natural gas, but also meet the requirements set for this Act by the European Commission's proposal last March. This makes them, according to EBA's statement, a key solution in the transition to a low-carbon economy for EU industries:

- Firstly, the EBA highlighted the technological readiness, as the main biogas production route (anaerobic digestion) is a mature technology, as evidenced by the fact that there are more than 18,000 biogas and 1,320 biomethane plants currently in operation, with a combined production capacity that exceeds 200 TWh, the equivalent to the gas consumption of Belgium.

- On the other hand, the EBA said the contribution to decarbonisation and competitiveness should also be considered, as in 2020, the combined production of biogas and biomethane saved the equivalent of Portugal's greenhouse gas emissions (60 Mt CO_2eq emissions).

- Finally, the EBA recalled the risks to security of supply, since the European biogas industry covers the supply chain of production technologies and therefore the sector not only does not create new dependencies on third countries, but also contributes to energy and technology security.

The vote of the European Parliament's Industry, Research and Energy Committee was considered a new opportunity to recognize the strategic role of biogas in the NZIA so the gas sector's hopes remain finally high.

Source: European Biogas Association

SET Plan progress report aims to map the landscape of clean energy research and innovation in the EU

In conjunction with the SET Plan Annual Conference in Viladecans, Barcelona (Spain), where stakeholders come together to discuss the most recent developments in clean energy research and innovation, the latest European Strategic Energy Technology Plan (SETPlan) progress report has been published, a valuable resource for policy makers, researchers and industry stakeholders.

The Strategic Energy Technology Plan (SET Plan) plays a key role in coordinating European and national R&I agendas for low-carbon energy solutions. But, as the policy landscape is changing fast, SET Plan's Communication is on revision to refine its strategic objectives according to the new policy framework (but always aligned with the European Green Deal, setting ambitious targets, and expanding its technology scope).

Following an extensive consultation process, the European Commission published a Communication on 20th October outlining the SET Plan's revision, which proposes a refinement of the SET Plan's strategic objectives to align them with the new policy framework. It also proposes to elevate the SET Plan's political status, linking it structurally to the European Research Area (ERA), setting ambitious targets, expanding the technology scope, strengthening its reporting (in which this report plays a part) and establishing task forces for crosscutting issues.

Going into further detail, the Joint Research Centre of the European Commission will be working in collaboration with the Directorates-General for Energy and for Research and Innovation and the SET Plan community to strengthen this monitoring and reporting function. Besides, to accelerate the development and deployment of clean and efficient energy technologies, the SET Plan will take a systematic approach to crucial cross-cutting issues and, therefore, five task forces will be established to explore:

- digitalization for the energy transition;
- circularity by design and the advanced materials;
- needed for the production of renewable energy technologies;
- R&I for societal needs and human-centered technologies;
- upskilling and reskilling; and
- the acceleration of market uptake for new clean energy technologies.

Figure 1. SET Plan task forces

Next year's annual progress report is expected to be the first to record the new, improved SET Plan, and will count on the active participation of its 14 working groups, alongside the ETIPs and EERA, demonstrating the effectiveness of the SET Plan's collaborative approach to meeting the ambitious targets of the European Green Deal.

ETIP Bioenergy released its Strategic Research and Innovation Agenda (SRIA) 2023

The Strategic Research and Innovation Agenda (SRIA) 2023 of the ETIP Bioenergy was officially released and presented on the occasion of the ETIP Bioenergy 11th Stakeholder Plenary Meeting held on the 27th and 28th September 2023 in Brussels.

This Strategic Research and Innovation Agenda published by the Bioenergy European Technology and Innovation Platform aims to identify important activities and focus areas that need to be considered in research and innovation, either fundamental or applied, in order for the value chains to reach their full market potential. It is an update of the last release of 2018. SRIA 2023 addresses the status of development and deployment of biomass technologies, including key research and innovation challenges; the biomass supply for a growing bioeconomy industry, advanced conversion technologies, emerging markets (aviation and shipping) and concludes with an outlook for biofuels beyond 2030.

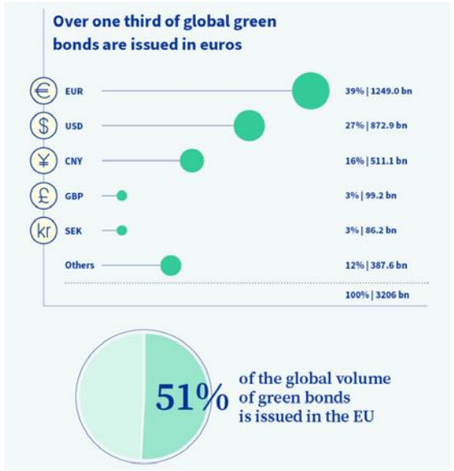
This document has been produced from input gathered from ETIP Bioenergy Working Groups and their participants, as well as ETIP Bioenergy Steering Committee members, and a number of external experts.

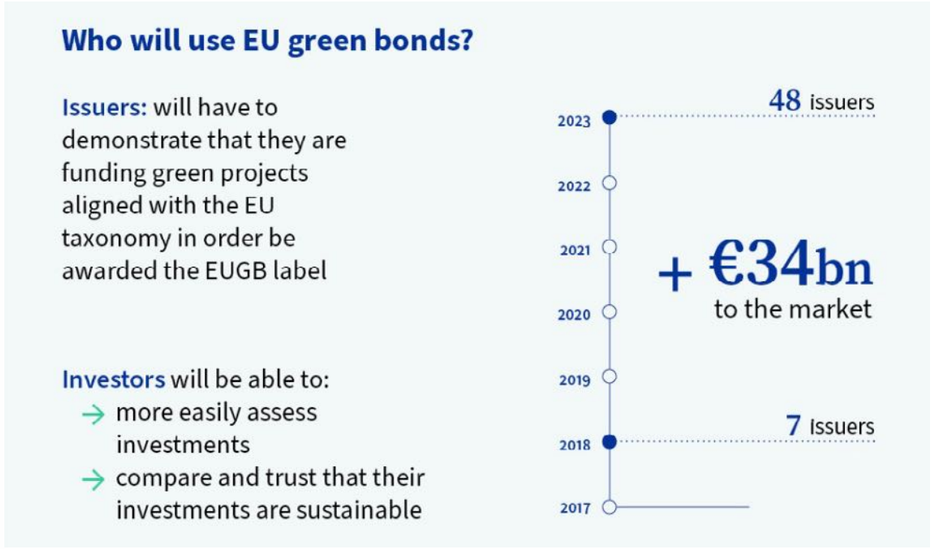
European Green Bonds: the first environmental and sustainable global bond standard

The Council of the EU adopted on 23th October a new regulation creating a **European green bond standard** that lays down uniform requirements for issuers of bonds that wish to use the designation 'European green bond' or 'EuGB' for their environmentally sustainable bonds. This way, European green bonds —which are one of the main instruments for financing investments related to green technologies, energy efficiency and resource efficiency— will be aligned with the EU taxonomy for sustainable activities and made available to investors globally.

The green bond market, both globally and at EU level, grew by an average of 50% per year in the period 2015-2020. Green bond issuance is, however, small compared to total bond issuance (representing 3 to 3.5% of overall bond issuance) which represents lots of potential for green bond growth.

The regulation, which will start applying 12 months after its entry into force, is a further step in implementing the EU's strategy on financing sustainable growth and the transition to a climate-neutral, resource-efficient economy as the new standard will foster consistency and comparability in the green bond market, benefitting both issuers and investors of green bonds: on the one hand, issuers will be able to demonstrate that they are funding legitimate green projects aligned with the EU taxonomy. On the other hand, investors' confidence in green investment will be enhanced thanks to a framework that reduces the risks posed by greenwashing, ultimately stimulating capital flows into environmentally sustainable projects.





Infography - European green bonds

The regulation establishes a registration system and supervisory framework for external reviewers of European green bonds. To prevent greenwashing in the green bonds market in general, the regulation also provides for some voluntary disclosure requirements for other environmentally sustainable bonds and sustainability-linked bonds issued in the EU.

All proceeds of European green bonds will need to be invested in economic activities that are aligned with the EU taxonomy for sustainable activities, provided the sectors concerned are already covered by it. For those sectors not yet covered by the EU taxonomy and for certain very specific activities there will be a flexibility pocket of 15%. This is to ensure the usability of the European green bond standard from the start of its existence.

The use and the need for this flexibility pocket will be re-evaluated as Europe's transition towards climate neutrality progresses and with the increasing number of attractive and green investment opportunities that are expected to become available in the coming years.

Publications

Bioenergy Europe: Statistical Reports 2023

Bioenergy Europe

Within the last months, the European Biomass Association (Bioenergy Europe) has published the three next chapters of its statistical report 2023.

Bioenergy Europe: Statistical Report 2023 – Biomass Supply

PDF

This report presents the state of play of forest management and biomass feedstock in the European Union and one of its main conclusions is that European forests continue to grow while almost 15% of total EU land use is unused and/or abandoned.

Bioenergy Europe: Statistical Report 2023 – Pellets

PDF

This report provides readers with a description of the current state of the pellet market, exploring different aspects such as production, consumption, prices, imports, exports, sales of heating appliances, etc. Even though the document admits the current crisis of this sector, it also presents it as one of the key solutions to decarbonising energy production for homes, businesses, and industries worldwide.

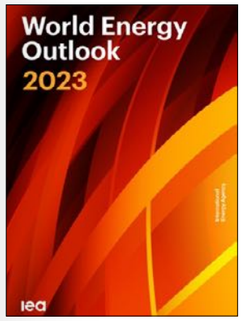
Bioenergy Europe: Statistical Report 2023 – Bioheat

PDF

Through this report, readers will become aware of the importance of heating in the EU27 energy mix, both industrial and residential, but also of the versatility of biomass when it comes to meeting these needs.

The document highlights the key role that biomass plays in the production of renewable heat with data that covers a range of indicators such as consumption by member states, fuels used, the role of biomass in industrial heat production and decentralised heating systems.

World Energy Outlook 2023



PDF

International Energy Agency (IEA)

This flagship publication of the International Energy Agency provides in-depth analysis and strategic insights into every aspect of the global energy system. Against a backdrop of geopolitical tensions and fragile energy markets, this year's report explores how structural shifts in economies and in energy use are shifting the way that the world meets rising demand for energy.

This annual Outlook also assesses the evolving nature of energy and examines what needs to happen at the COP28 climate conference in Dubai to keep the door open for the 1.5 °C goal.

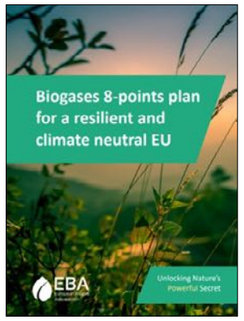
Biogas Barometer 2023

PDF

EurObserv'ER

The barometer measures the progress made by biogas in each sector and in each member State of the European Union in an as up-to-date way as possible. The initial EurObserv'ER estimates put the European Union's primary biogas energy output for 2022 at over 15.8 million tonnes of oil equivalent (Mtoe), which amounts to modest annual growth of 1.3% (196 410 tonnes of oil equivalent). Biomethane injection into the natural gas grid has dominated this increase, driven by the proactive policies of a few Member States, primarily France and Denmark. More than a quarter of whose gas consumption is already supplied by biomethane injection in this last country.

Manifesto 2024-2029: Biogases 8-points plan for a resilient and climate neutral EU



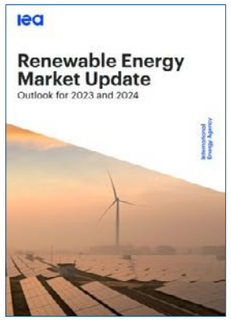
PDF

European Biogas Association (EBA)

By this manifesto, the European Biogas Association stands ready to collaborate with policymakers, industry stakeholders, and communities to realize a vision for a greener and more sustainable Europe by prioritizing biogas and biomethane as essential components of the green circular transition.

The European Green Deal and the REPowerEU plan have charted a visionary course for a sustainable, carbon-neutral Europe by 2050 and, as representatives of the European biogases sector, EBA stands firmly committed to these pivotal objectives and highlight the legislative priorities needed to achieve those objectives.

Renewable Energy Market Update - Outlook for 2023 and 2024



PDF

International Energy Agency (IEA)

This report provides the IEA's latest assessment of the state of play in renewables markets since the publication of Renewables 2022 report in December.

The document looks at key topics for renewables this year and next, including how the energy crisis will affect their deployment in the EU, their impact on energy affordability, and the latest trends in the United States, China and India. It also explores the implications of developments affecting major technologies like solar, wind and biofuels, including market dynamics, financing, energy security priorities, manufacturing and power system integration.

Biomass supply and uses in the EU

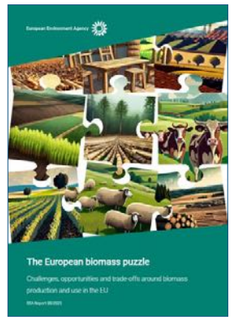
PDF

European Commission's Joint Research Centre (JRC)

This summary presents some selected facts, figures and findings of the JRC Biomass Mandate 2023 report "Biomass production, supply, uses and flows in the European Union" to highlight some main findings and direct the readers to the relevant JRC data and knowledge resources. The content of this Summary for Policymakers was taken from the main report.

In this document, the biomass sources and uses for the agricultural, forestry, algae, and fisheries and aquaculture sectors are described with the latest available data, both in comparative terms (using the same units), as well as with deep dives into the sectors themselves, highlighting the most salient issues in the respective sectors. It also examines the contribution of food, wood and other biowaste to the biomass supply.

The European Biomass Puzzle



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European Environment Agency (EEA)

This report looks at how biomass can help us reach our climate and environmental objectives, and how climate change might affect the EU's biomass production in agriculture and forest sectors. It also discusses key synergies and trade-offs in the use of biomass for different policy objectives.

The European Green Deal foresees biomass fulfilling several roles in relation to food and energy security, nature conservation, pollution reduction, and climate change mitigation and adaptation. However, scientific research indicates that not enough EU-sourced biomass will be available to fulfil all these envisaged roles in the future. Thus, this report highlights the challenges, co-benefits and trade-offs that must be understood and quantified so that biomass can help reach — and not hamper — the European Green Deal's objectives.

Save the date! International bioenergy events

JANUARY 2024

22-23 January 2024
Fuels of the Future 2024
Berlin, Germany

24-25 January 2024
Bio360 Expo 2024
Nantes, France

24-25 January 2024
RENMAD Hidrogen + Biomethane 2024
Zaragoza, Spain

FEBRUARY 2024

21-23 February 2024
3rd Bioenergy International Conference
Jaén, Spain

MARCH 2024

4-6 March 2024
2024 International Biomass Conference & Expo
Richmond, USA

12-13 March 2024
2nd Annual Advanced Biofuels Forum
Amsterdam, The Netherlands

APRIL 2024

11-12 April 2024
Biofuels Expo 2024
Rome, Italy

23-25 April 2024
Argus Biomass Conference
London, United Kingdom

MAY 2024

15-16 May 2024
10th International Conference on Renewable Energy Gas Technology, REGATEC 2024
Lund, Sweden

21-23 May 2024
Sustainable Aviation Futures Congress
Amsterdam, The Netherlands

JUNE 2024

10-12 June 2024
2024 International Fuel Ethanol Workshop & Expo
Minneapolis, USA

13-14 June 2024
19th World Bioenergy Congress and Expo
Rome, Italy

18-19 June 2024
International Biogas Congress & Expo
Brussels, Belgium

24-27 June 2024
EUBCE 2024
Marseille, France

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

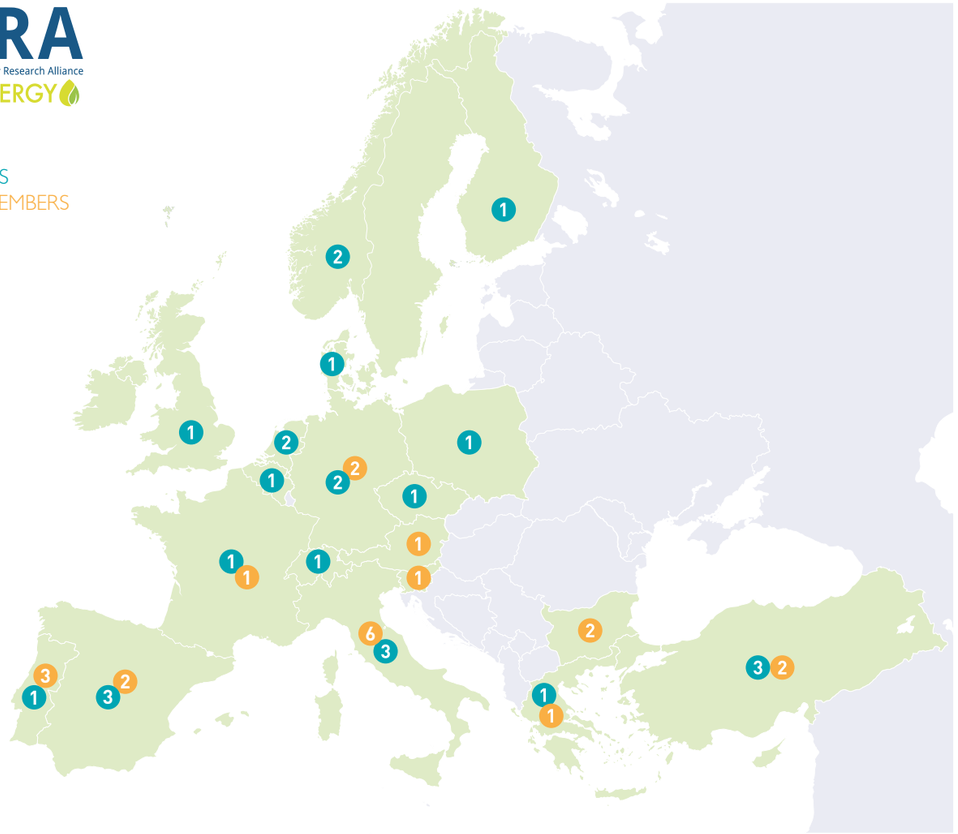

Figure 1: The EERA Bioenergy Joint Programme consists of 46 members (25 Full members and 21 Associate members) from a total of 19 countries. Link

www.eera-bioenergy.eu

Contacts

Bioplat
BIOMASS FOR THE BIOECONOMY

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