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Joint Programme Coordinator's corner

Myrsini Christou
EERA Bioenergy Coordinator

Dear EERA Bioenergy members, dear eebionews readers,

I am very honoured and proud to be elected as coordinator of the EERA Joint Programme on Bioenergy in June 2022, sadly in the turmoil caused by the war in Ukraine.

In the shadow of the Russian-Ukraine war which resulted in geopolitical complexities in the energy sector, Europe had to redefine its agenda on energy policies and strategic priorities. The REPowerEU Plan, submitted by the European Commission in May 2022 aimed exactly to reduce our dependence on Russian fossil fuels and fast forward the green transition, while increasing the resilience of the EU-wide energy system. Especially when referring to electrification, energy efficiency and uptake of renewables for clean energy production, specific measures are requested that could allow industry to save 35 bcm of natural gas by 2030 beyond Fit for 55 targets. This opens huge opportunities for bioenergy to be further developed and cover a significant part of it.

On the other hand, the potential simultaneous effects of the war on the food market strengthen more than ever the need to fast forward the transition forwards advanced biofuels, using biomass waste streams from agriculture, forestry and relevant industries, municipal wastes as well as new feedstocks grown under sustainable techniques (cover crops, intermediate crops, use of marginal lands, and other).

Renewable energy is getting cheaper as technologies mature and new ones rise. EERA Bioenergy coordinates a massive public research effort to develop more efficient and cheaper low-carbon energy technologies by identifying R&I priorities that will accelerate the implementation of bioenergy technologies in Europe, while at the same time promoting international cooperation to accelerate the SET-Plan priorities and activities. The main European universities, research alliances, technology centers, scientific agencies, institutes and associations involved in R&D&I in bioenergy and bioeconomy are part of EERA Bioenergy.

Coordinating the Joint Programme on Bioenergy is thus a great honour for me but also a big challenge.

Personally, I'm leading the Biomass Department of CRES – Center for Renewable Energy Sources and Saving, with technical experience as coordinator and scientific responsible for a range of RTD projects related to the assessment of biomass availability and energy potential, as well as research on sustainable biomass production from a wide range of energy crops (lignocellulosic, oilseeds, starch and sugar crops), since the early nineties'. Especially through the coordination of the Bioenergy chains project, thereafter my participation as scientific responsible in the projects FP7 EUROBIOREF - EUROpean multilevel integrated BIOREFinery design for sustainable biomass processing (2010-2014) (www.eurobioreg.org), LIFE-Stymfalia 'Sustainable management and financing of wetland biodiversity' (www.life stymfalia.eu) (2013-2017) and recently in H2020 BECOOL - Brazil-EU Cooperation for Development of Advanced Lignocellulosic Biofuels (2017-2022) (www.becoolproject.eu), H2020 MUSIC - Market Uptake Support for Intermediate Bioenergy Carriers (2019-2022) (www.music-h2020.eu), AGROCHAINS – Supply chains of green residues for energy exploitation (www.agrochains.gr) I got considerable expertise not only on the biomass production but also on the technical evaluation of integrated biomass value chains for energy and biorefinery concepts.

In addition, through my participation as expert of the Greek team in the project H2020 CA-RES Concerted Action on the Renewable Energy Sources Directive (https://www.ca-res.eu/), in the Core Theme 4: Biomass Mobilisation and Sustainability and Core-Theme 5: RES in Transport, as well as through the recently granted project GreenMeUp on the green biomethane market uptake in Europe, I'm constantly informed on policy instruments and measures promoting biomass and biofuels in the participating countries.

Apart from my technical expertise, I am a member of the Advisory Board and the Biomass Working Group of the ETIP Bioenergy, the Scientific Committee of the Biomass panel of the ETIP Renewable Heating and Cooling, the Scientific Committee of the European Biogas Association and of the Board of Directors in Bioenergy Europe.

This 'second hat' offers me the possibility to see how the several policy Committees work, what kind of technical information they could need and what channels may be used in order to pass them our messages.

In my actual job position, I am determined to support and enrich the mission of the Bioenergy Joint Programme to the best of my ability, taking the thread from where Andrea Monti, our previous JP coordinator left it, after his highly successful mission.

I have the great pleasure to work closely with an excellent Management Board, with my dear friends and colleagues Walter Elbersen from Wageningen University leading Sub-programme 1 'Sustainable Production of Biomass'; Berend Vreugdenhil from TNO leading SP2 'Thermochemical Platform' and SP4 'Stationary bioenergy'; Marcelo Domine from Instituto de Tecnología Química (UPV-CSIC) leading SP3 'Biochemical Platform'; Raquel Jorge from the Norwegian University of Science and Technology (NTNU) leading SP5: 'Sustainability / techno-economic analysis /public acceptance' and last but not least Margarita de Gregorio and Paloma Perez from BIOPLAT who offer superb secretariat support.

During my few months of duties I have presented our works at the 5th Doctoral colloquium Bioenergy organised by DBFZ in Leipzig on 13-14 September 2022 and at the 23rd Steering Committee meeting of ETIP Bioenergy in Vienna on the 16th November 2022.

Myrsini.

EERA Bioenergy news in brief

NEW MEMBERSHIP

We warmly welcome Yıldız Teknik Üniversitesi, from Turkey, to the EERA Bioenergy Joint Programme as an associate member.

http://yildiz.edu.tr/

EERA BIOENERGY COORDINATOR PARTICIPATED IN THE 5TH DOCTORAL COLLOQUIUM BIOENERGY - DOC2022 AND IN THE 23rd STEERING COMMITTEE MEETING OF ETIP BIOENERGY

Myrsini Christou from Center for Renewable Energy Sources and Saving (CRES) and EERA Bioenergy Joint Programme Coordinator, participated online on the last 13th of September 2022 in the 5th Doctoral Colloquium BIOENERGY (DOC2022).

BIOENERGY DOC2022 | 5TH DOCTORAL COLLOQUIUM BIOENERGY

The Doctoral Colloquium BIOENERGY, organized by organized by the DBFZ - Deutsches Biomasseforschungszentrum gGmbH, a member of EERA Bioenergy, addresses every part of the biomass conversion chain, from the feedstock via different conversion pathways and their technological implementation, up to the resulting products and services. Bioenergy system analyses and system integration measures round off the topic.

During her speech, Myrsini Christou provided an overview of the bioenergy sector in Europe and highlighted the role of EERA Bioenergy Joint Programme currently and in the future. EERA Bioenergy JP addresses the challenges of the European energy and environment policies from a research and innovation perspective in bioenergy and bioeconomy.

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 23rd Steering Committee meeting of ETIP Bioenergy held in Vienna on the 16th of November 2022 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.

Bioenergy highlights

THE CONTRIBUTION OF BIOMASS TO REDUCE GLOBAL WARMING

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Global warming is on top of almost every country's agenda these days, and it is maybe the biggest overarching challenge humanity currently faces. As we have an obligation to our children and future generations, from whom we borrow planet Earth, we need to use our planet's resources in the most efficient way so that this obligation can be upheld.

Biomass has from mankind's beginning provided us with a multitude of materials for different purposes, including for energy production. More than enough was available until the industrial revolution started, and with all that followed in its trail. Energy needs increased, and easily available coal became the solution for many energy purposes. Later oil was discovered, and finally natural gas as the last addition to the fossil resources arsenal. Increasing prosperity and increasing population have contributed to ever-increasing energy demand, and it is just until recently that real efforts have been made to try to slow down global warming and stabilize the temperature on Earth.

Biomass is in a unique position, as it is a renewable resource that can be used for **energy** and a multitude of material purposes and can be considered **CO_2 neutral** since the CO_2 is part of a relatively short-term continuous cycle, where the CO_2 emitted to the atmosphere is used in the photosynthesis to produce new biomass. The fact that biomass is (of course) emitting CO_2 when burned for energy production is sometimes used as an argument against using biomass for energy purposes. In fact, in this continuous and sustainable carbon cycle, one CO_2 molecule emitted is at once compensated for by a CO_2 molecule becoming new biomass, somewhere on Earth. Some say that we should use our forest to store more carbon (i.e. let it grow), instead of using it for energy production. However, in general, the forest is not used primarily for energy production, but for providing us with materials, while residues from this activity are used for energy purposes. In many countries the forest stock is increasing, naturally due to global warming, but also due to improved forest practices that improve forest growth conditions. In any case, forest growth will stagnate relatively soon if the forest is left unattended. However, in our exploitation of our biomass resources, land or sea-based, the focus should always also be on **biodiversity**, i.e. not negatively influencing biodiversity when exploiting biomass resources.

Biomass, as a limited resource, needs to be used in an optimum way to maximise its contribution to slowing down global warming. Then it becomes a matter of overall **sustainable carbon cycles**. Any fossil carbon atom that is taken out from its very long-term storage and inserted into the short-term carbon cycle needs to be compensated for by the removal of a carbon atom from this short-term carbon cycle. It is in principle as simple as that. This is partly done naturally, but must to an increasing extent be done by mankind, as nature doesn't have the ability to follow the speed of humans in their exploitation of Earth's long-term carbon storage.

Renewable energy is the natural solution for covering our future energy needs and biomass is the natural resource for covering our future material needs, as in principle anything that is produced from fossil resources also can be produced from biomass. Of course, by efficiently capturing and permanently storing CO_2 resulting from the use of fossil resources, we could still use fossil resources in processes where efficient capture and storage can be realised. It is even possible to capture CO_2 directly from the atmosphere. However, the cost of all this should be carefully weighed against the need for the removal of fossil carbon from its safe storage in the first place. The challenge is to capture and permanently store the CO_2 at a cost that defends the fossil carbon outtake. We are in a way borrowing money from the bank, without having the economic resources to pay a very high-interest rate. Therefore we need to pursue all possible ways of reducing our energy demand, using energy more efficiently, recycling carbon, exploiting usages of CO_2, and storing carbon also in more short-term storages as well as permanent storages.

Sustainable carbon cycles mean using our carbon resources in a way that minimise environmental, climate and health impacts as well as costs, while still covering our social needs. This requires a shift in our thinking and priorities. Reduced energy demand and increased energy efficiency are the foundation, the potential of non-biogenic renewable energy resources must be exploited, and then our biomass resources must be used in an optimum manner to cover material needs (including in metallurgical industries), provide net CO_2 reduction (e.g. biocarbon for soil amendment), as well as cover energy needs. Biomass is a storable resource that also provides energy security and balances non-continuous energy and electricity supply from some other renewables.

Therefore, as part of the efforts to reduce global warming, all stones must be turned to maximise the contribution of biomass to this. This is not an easy exercise, as many factors must be considered in a multitude of value chains where technologies still may be in their infancy and current practises are sometimes very hard to change due to constraints of existing processes. Hence, there is also a need to develop new technologies and processes more adapted to our future resource base.

In parallel with technology and process developments, policies and measures must be introduced to support this. This is not necessarily straightforward, even if global warming reduction goals are officially set, as other factors, e.g. the current energy situation in Europe, may force governments to choose between two evils, where the currently closest evil will (naturally) get priority.

Meanwhile, researchers should continuously focus on the key aspects, i.e. providing the planet with means to combat climate change in a sustainable way, through all possibly sustainable pathways. Currently, the renewable resources that we are able to harvest are by far not enough to cover our global needs, and as long as that is the case, prioritising is in principle needed, based on realism and not idealism.

Such prioritising is not up to researchers, but to politicians, but we are for sure indispensable in the search for assessing possibilities and providing technologies and processes that can enable politicians to prioritise.

Here EERA in general and EERA Bioenergy have important roles to play, ensuring that all possibilities are pursued in the hunt for future sustainable solutions covering in sum all our material and energy needs. It is not a competition, it is a joint undertaking of enormous dimensions where all sustainable solutions are needed to arrive at the goal, which is sustainable carbon cycles, that do not contribute to unsustainable global warming.

In parallel, others will exploit non-carbon energy alternatives, based on renewable electricity and hydrogen produced using renewable electricity. Some will also make hydrocarbons using captured CO_2 and hydrogen, and renewable electricity. All contributions to cover our future materials and energy needs are welcome if they are or can become sustainable.

We simply cannot afford to use our renewable resources in an unsustainable way in the future if we want to combat global warming. The efforts needed to do this are indeed global, as the negative effect of emitting a CO_2 molecule is indeed global and the positive effect of preventing the emission or removing a CO_2 molecule is as well. Europe has the potential to show the path for others to follow, but others need to walk down that path also, to effectively combat global warming.

The need for a global effort has never been clearer in the history of mankind.

THE LABTOGO PROJECT: ESTABLISHMENT OF RESEARCH ACTIVITIES AND DEMONSTRATION OF TECHNOLOGIES FOR THE USE OF BIOMASS POTENTIALS IN TOGO

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In 2020, the Federal Ministry of Education and Research (BMBF) initiated a joint project between the West African Science Service Center on Climate Change and Adapted Land Use (WASCAL), the University of Lomé and the Deutsches Biomasseforschungszentrum gemeinnützige GmbH (DBFZ). The development of research infrastructure and transfer of knowledge for the bioenergetic use of agricultural, forestry and organic residues are the main aims of this project in order to implement measures against climate change. Three work packages, focussing on different topics, are defined within the project.

A comprehensive analysis of the biomass potential in Togo has been conducted in work package 1. Satellite-based analyses of the spatial and temporal distribution of crops and forests allowed us to estimate the total energetic biomass potential in Togo. In a second step, preference regions and spots, for the sustainable energetic use of biomass were identified. Another important part of this work package is capacity building. A GIS-course was held in September/October 2022 as a combined online- and in-person course with a focus on biomass potentials mapping. Participants were WASCAL students as well as employees of the University of Lomé. This measure will enable the Togolese partners to continue and improve biomass potential analyses.

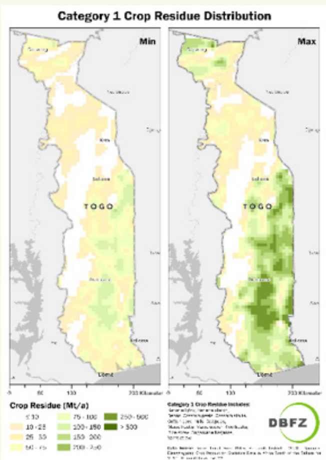

Figure 1. Left: results of the GIS-mapping of biomass potential / right: participants of the GIS-course at the University of Lomé (© Fabian Sittaro, DBFZ)

Work package 2 aims at establishing a Biogas Lab at the University of Lomé. The lab is designed as a container building and will be fully equipped with experimental and analytical devices. This lab will be the local hub for bioenergy and biogas research in Togo and the entire region of west Africa. The container building has been pre-manufactured in Germany and then shipped to Togo. The final assembly at the University of Lomé is currently ongoing, and the final commissioning of the lab is scheduled for March 2023.

Figure 2. Left: the pre-manufactured lab building at the manufacturer's site in Germany (© Platal Mobilsysteme GmbH)/ Right: biogas lab digesters in the central lab container (© Martin Apelt, DBFZ)

In work package 3, an efficient, low-emission, low-cost and easy-to-operate stove has been developed. The stove was tested in the lab at DBFZ with good results regarding power output, efficiency and emissions. The development focused also on a design that allows local craftsmen to produce the main parts of the stove in Togo. The result, the so-called APELI-stove has been introduced in a Togolese village and is currently undergoing a practical field test. (APELI is an expression of the local language Ewe and means “good for the household and the environment“). The first feedback from the users is positive. In the next step, the stoves will be tested with a broad variety of locally available solid biofuels, most of them biogenic residuals such as e.g. palm kernel shells or chopped bamboo.

Figure 3. Left: traditional cooking place / Right: the APELI stove in use during the field test (© Dennis Krüger, DBFZ)

MUSIC CASE STUDY ON CO-PROCESSING IBCS IN INDUSTRIAL BIOREFINERIES

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The MUSIC project (www.music-h2020.eu) is a HORIZON2020 initiative that aims to facilitate the market uptake of three types of intermediate bioenergy carriers (IBCs: torrefied biomass, fast pyrolysis liquid, and microbial oil) by developing feedstock mobilisation strategies, improved logistics and IBC trade centres.

MUSIC
Market Uptake Support for Intermediate Bioenergy Carriers

Central part of the MUSIC project are **concrete case studies on full value chain applications of IBCs**, such as the investigation of opportunities and challenges of Microbial Oil (MO) as innovative lipid feedstock for advanced biofuels production.

MO is produced by oleaginous yeasts from lignocellulosic biomass. Presently it is at the early stages of development as a potential feedstock for an EU bio-based economy, with a Technology Readiness Level (TRL) ranging between 4 and 5. However, MO has immense potential as a substitute for vegetable oils and food-related lipid feedstocks, i.e. for commercial Hydrotreated Vegetable Oil (HVO) biorefineries. This is especially true since the Renewable Energy Directive II set a cap for food- and feed-based biofuels and also defined targets to reduce the use of high Indirect Land Use Change (ILUC)-risk feedstock - such as palm oil - starting in 2023 and with a complete phase-out by 2030. Furthermore, MO could also be of specific interest to the fossil refineries sector when used as co-feeding feedstock, supporting their transition towards a low-carbon economy.

The **Italian MUSIC strategic case study** analyses the feasibility of collecting agricultural residues and converting these to sugars via enzymatic hydrolysis, followed by a production of microbial oil. This microbial oil can be used as feedstock in refineries to produce green transport fuels. Two regions were focussed on: Sicily and the Veneto region, both in Italy.

Biomass availability was year-round sufficient. The INFER-NRG model, used for assessing the biomass potential in this case study, showed a 50% biomass surplus. The average total price of dry biomass for the IBC plant use has been assessed per crop type, and values ranged in different modelling scenarios from 87 €/t to 105 €/t. Such variability is mostly related to the transport costs, which in turn is affected by the existing transport infrastructure, which is better around Veneto compared to Sicily.

Various scenarios and alternatives were considered, such as variations in the locations (decentral versus central MO production, use or sale of lignin). Depending on these choices, costs for Microbial Oil were determined to lie between 1127 €/t and 1363 €/t. It should however be noted that this Microbial Oil needs to still be upgraded to produce green transport fuels. Sales of the surplus lignin are considered economically advantageous for the development of this IBC value chain.

The MUSIC project is coordinated by BTG Biomass Technology Group, The Netherlands. The consortium consists of sixteen partners from seven European countries: Sweden, Finland, The Netherlands, Belgium, Germany, Italy, and Greece. The partnership has strong industrial participation, comprising three industry-driven network organisations and seven industry partners, including Europe's leading IBC technology developers, and is capable to achieve broad relevance and transferability of all results in the European bioenergy sector.

USE OF MULTIBLEND JET A-1 IN PRACTICE – INSIGHTS FROM THE DEMO-SPK PROJECT

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The need to reduce and avoid emissions is set for the German aviation sector as well. In addition to technical and operational measures to reduce emissions, the focus is on the substitution of conventional fossil aircraft fuel with renewable aircraft fuels (so-called synthetic kerosene, SPK). For this purpose, new manufacturing processes specified in an international ASTM standard are used instead of conventional oil treatment and processing. Since, depending on the process, the composition of SPK can differ from that of conventional fossil kerosene, the marketing of SPK is subject to conditions. For example, SPKs may not be placed on the market in their pure form at present, but must first be blended with JET A-1 petroleum-based kerosene (so-called "blending").

Today, various SPK production processes have already been approved in accordance with ASTM (e. g. HEFA-SPK, ATJ-SPK, FT-SPK, SIP); others are in the approval process. In the medium term, it is expected that airports in Germany will be supplied with kerosene, which also contains SPK of various types in variable proportions. As individual kerosene batches of different origins are usually transported and stored together within an airport's supply infrastructure, there is no physical separation of the batches delivered, which inevitably leads to mixing. Since only JET A-1 that conforms to specifications may be used, this is formally permissible. However, the mixing behaviour and compatibility of JET A-1 blends containing different SPK in variable proportions ("multi-blending") has not yet been investigated in Germany or internationally. A multiblend JET A-1 is a mixture ("blend") of conventional fossil JET A-1 according to ASTM D1655 and at least two other ("multi") renewable kerosene according to ASTM D7566.

The primary objective was to investigate and verify the behaviour of mixtures of several renewable kerosenes under realistic conditions at a major airport. To this end, the aim was to successfully demonstrate for the first time internationally the use of multiblend JET A-1 in the general fuel supply infrastructure, i. e. from procurement to in-flight refuelling. In addition to analyses of the kerosene properties, emission measurements, life-cycle analyses, practicable sustainability documentation and studies on the verification and crediting of renewable fuels in the European emissions trading system were also carried out. In addition, legal issues had to be clarified and organisational framework conditions created.

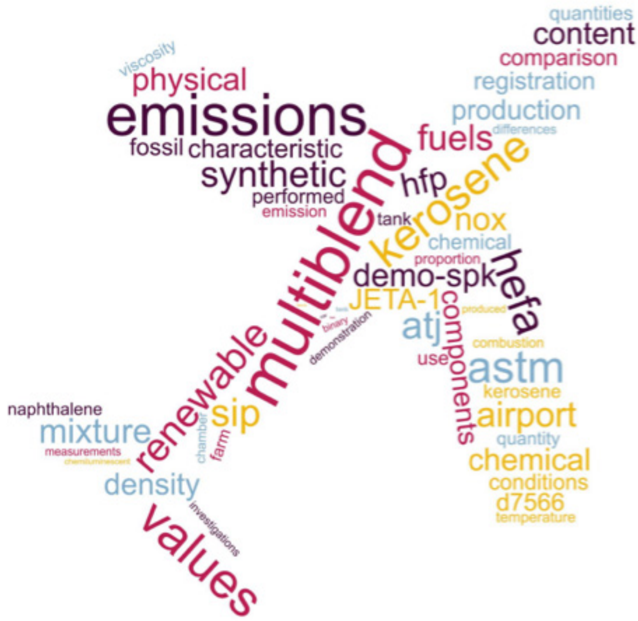
Thanks to the commitment of the project partners, the procurement of renewable kerosene, it's blending with fossil JET A-1 to form multiblend JET A-1, as well as is provision and use in the fuel infrastructure of a major airport could be successfully demonstrated. Almost 600 tons of multiblend JET A-1 were provided and flown. The demonstration also included comparative measurements of pollutant emissions in an engine test stand with an A300-600 (cargo version). Two successive ground runs were carried out according to a defined measurement protocol, whereby first a reference measurement with a fossil JET A-1 and then a measurement with the multiblend JET A-1 was performed. The expected soot reduction could be proven by using the multiblend JET A-1; this was approx. 30 to 60% for different operating points in relation to the particle mass. Since the majority of GHG emissions are caused by the combustion of fossil kerosene, the fossil part in the multi-blend JET A-1 can be identified as the main driver of total GHG emissions. Multiblend JET A-1 thus has the lowest GHG emissions with the highest share of renewable kerosene and the highest GHG savings of 35% compared to fossil JET A-1.

The dedicated cost considerations for renewable kerosene confirm that, in the future, even large-scale production of renewable kerosene alone will not be sufficient to bring costs closer to conventional kerosene costs. The same applies to the life cycle costs of the multiblend JET A-1, which were examined in the different supply chains.

Various sustainability frameworks and certification systems have been established for biofuels in recent years. These systems differ, in some cases significantly, in terms of the criteria they contain and their target markets. Within the DEMO-SPK framework, the sustainability documentation could be traced as the basis for a comprehensive sustainability certification for all investigated alternative aircraft fuels. Sustainability certification from existing systems and structures can thus also be presented for renewable kerosene and does not represent a fundamental obstacle to its market implementation. The work in DEMO-SPK also showed that the sustainability requirements and standards differ significantly on a global scale.

PTL is regarded as an important renewable kerosene for the aviation of the future and has already been approved in principle in ASTM via the Fischer-Tropsch synthesis route. The proof that intermediates from the Fischer-Tropsch synthesis of CO2 and electrolytically produced hydrogen from renewable electricity can be processed to FT-SPK on a pilot plant scale could be provided for the first time in DEMO-SPK.

The research and demonstration project on the use of renewable kerosene at Leipzig/Halle Airport (DEMO-SPK for short) was initiated as a model project of the Mobility and Fuel Strategy (MKS) and financed by the German Federal Ministry of Transport and Digital Infrastructure (BMVI) during 11/2016-06/2020.



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CHALLENGES AND PERSPECTIVES OF BIO-WASTE RECYCLING IN A LATIN AMERICAN METROPOLIS – THE CASE OF BOGOTÁ, COLOMBIA



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By 2050, an estimated 68 % of the world's population will live in urban areas (UN Environment 2018). This is a trend that particularly confronts cities in prosperous developing and emerging countries, where urbanisation processes are both a cause and a consequence of economic development (BBVA Research 2017). However, with increasing population, rising urbanisation rates and growing economies, waste generation in urban centres is increasingly causing problems for adequate waste management (Hettiarachchi u. a. 2018). It is estimated that waste generation in the LAC (Latin America and Caribbean) region will increase by at least 25 % by 2050 (UN Environment 2018).

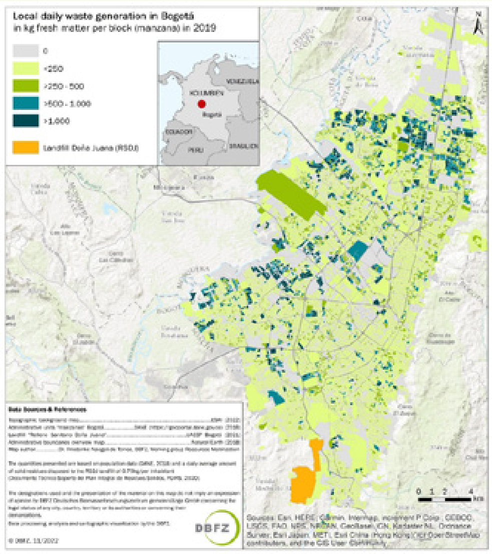
In Bogota, Colombia, one landfill exists that receives the city's waste since 1988. Given the current daily volume of unused waste from regular collections of approx. 5,700 Mg (UAESP 2020) and an estimated share of organic waste of 50 %, new disposal paths are urgently needed here, which ideally also include the material and energetic use of the organic residues. To this end, the Gesellschaft für Internationale Zusammenarbeit (GIZ), in cooperation with the municipal organisation for public services of the city of Bogota Unidad Administrativa Especial de Servicios Públicos (UAESP) and the DBFZ Deutsche Biomasseforschungszentrum gemeinnützige GmbH (DBFZ), initiated a project at the end of 2020 that deals with this problem and initially attempts to clarify two essential questions. On the one hand, spatial analysis and quantification of various waste streams provide an overview of which areas of the city have the greatest amount of organic waste. Secondly, based on the quantities of organic waste collected, various technological alternatives to the current disposal path are to be identified, which also include decentralised solution approaches in order to optimise logistics.

Objectives of the project

The first objective of this project is therefore to develop a concept for reducing the amount of organic waste disposed at the landfill, especially the organic fraction by 1,000 Mg per day. The aim is to divert organic waste from the existing linear economy to a circular economy.

At present, Bogotá (or Colombia in general) does not have a (comprehensive) waste separation system – neither for households, nor for markets or other waste sources – despite corresponding laws (Ministerio de Ambiente y Desarrollo Sostenible – República de Colombia 26.12.2019). All concepts and especially the implementation of the separate collection are still under development. Because the quality of the biological fraction of the waste is not sufficiently known, it is not clear yet if the biological waste can be used for composting– especially since high energy expenditures are incurred for composting. For this reason, energetic exploitation of the material flow should be envisaged before a material utilisation path.

In the first phase of the project existing information on the qualities and quantities of the waste streams is consolidated and, supplemented with missing parameters. In addition, a sampling plan is developed, that may serve as a basis for the establishment of a future monitoring system. In the course of the project, data is collected and used to create GIS-based maps of the material flows, which can support the UAESP in optimising collection routes and identifying suitable locations for treatment plants. Relevant sources considered include households, shopping centres and markets. A methodological approach for mapping the waste streams is further elaborated so that it can be used as a basis for establishing a perspective monitoring system.



For the identified amounts of organic wastes, a rough material and energy balance will be drawn up.

The developed concepts are expandable, so that they can be replicated or expanded in a modular and/or decentralised way in the case of established waste separation. With the above-mentioned approx. 50 % organic share, there is theoretically a further approx. 1,850 Mg of organic waste per day (approx. 675,000 Mg per year) available as potential.

Assuming an average value of 100 m^3 Mg–1 of the characteristic values published by the Kuratorium für Technik und Bauwesen in der Landwirtschaft (KTBL), the initial target of 1,000 Mg per day results in a methane yield of approx. 60,000 m^3 per day. With an assumed efficiency of 38 % in the case of conversion to electricity in a CHP (combined heat and power) plant, this corresponds to an energy quantity of about 0.82 terajoules (227.3 MWh) of electricity per day, i.e. an average available power plant capacity of about 9.5 MW.

Probably even more interesting would be an application in the transport sector: due to the similar efficiency of a gas engine compared to a stationary CHP plant, about the same amount of energy of about 0.82 TJ per day would be substitutable here. With at least desulphurised biogas (CBG, compressed biogas) or biogas purified to natural gas quality as CNG (compressed natural gas), the collection fleet could, for example by substituting diesel fuel, make the transport of waste significantly more environmentally friendly than is currently possible (BSR 2020).

Alternatively, or additionally, up to 741 public transport buses could be fuelled with CNG or CBG obtained from the waste. Both concepts would have the side effect of reducing air pollution in the urban area of Bogota and thus have a direct positive impact on the quality of life. The UAESP sets decentralised waste treatment as a long-term goal. Accordingly, there is no need to set up a gas network, as the treatment plants could simultaneously serve as filling stations for public transport if they are distributed favourably throughout the city.

Based on Bogotá and the project specifications, 365,000 Mg of biowaste per year would be treated in the first project stage. This could be converted (conservatively estimated) into about 40 million m^3 of biogas (about 24 million m^3 of methane). In view of the new introduction of 741 EURO 6 buses by Transmilenio S.A. (MARÍA CAMILA HUÉRFANO SUAREZ 2020; Scania 2018; GNV Magazine June 26, 2020), the use of biogas as a fuel for public urban transport would be a possible utilisation scenario. Based on the results of this project, follow-up projects in the areas of technology transfer and capacity building are conceivable. Due to the many years of experience and know-how of German companies in the field of waste collection and treatment, there is also great potential for economic cooperation.

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New members

ASSOCIATE MEMBERS

YTU – YILDIZ TECHNICAL UNIVERSITY

Prof. Dr. Didem Özçimen
Faculty of Chemical and Metallurgical Engineering
Department of Bioengineering
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Inheriting a century-old outstanding understanding of science, technology, and culture, Yildiz Technical University (YTU) has been a keen pioneer of academic research, technology, and the arts, with the quality of being the 3rd oldest university in Turkey with its roots dating back to 1911. As one of the leading government institutions, the university is situated in Istanbul spread over two great historical campuses. YTU, with the vision of being a leading institution of international standing, represents a unique milieu of education, research, and culture in Turkey. Being one of the most well-known universities in Turkey, it is conducive to the achievement of the goal of the development and welfare of society.

In line with the 21st-century entrepreneur university model, while making contributions to Research and Development activities in our country, YTU commenced operations in certain technological development zones and founded Yildiz Technopark in 2003.

Since 2020, Yıldız Technical University has been setting new targets for YTU by revealing the breakthroughs required by the 21st century and rapidly implementing the relevant projects. As the first university in Turkey to receive a Zero Waste Certificate, Yıldız Technical University draws attention with its Barrier-Free University, Sustainable Campus, Smart Campus projects, and activities for the use of clean water and clean energy.

Many academic studies and projects are carried out in the fields of sustainability, biofuel, biomass and bioenergy in the Departments of Chemical Engineering, Bioengineering, Environmental Engineering and Economics at YTU. Relevant to EERA Bioenergy subprogrammes, several research groups such as Energy and Materials Laboratory, Algal Biotechnology and Bioprocess Laboratory, Fuel Technologies and Environment Laboratory, Energy and Materials Laboratory and Bioprocess Research Laboratory are involved with biofuel production and sustainability studies. Many important research projects are carried out in these departments on microalgae production, biodiesel, bioethanol, biogas production from different raw materials, fuel cell production, biochar production by thermochemical conversion, biohydrogen production and sustainability studies.

More information on Yildiz Technical University can be found through their main website at: https://yildiz.edu.tr/

Algal Biotechnology and Bioprocess Laboratory

In the Algal Biotechnology and Bioprocess Laboratory (Fig 1), which was established with the infrastructure provided by the ministry of industry and ministry of agriculture projects carried out by Prof. Dr. Didem Özçimen, biofuel production from lignocellulosic materials, micro and macroalgae is carried out. In recent years, microalgae isolated from samples obtained from the poles, and the potential of these microalgae to be used in health, biotechnology and energy fields are being investigated. Studies for the production of microorganisms such as microalgae and bacteria and optimization of algal bioprocesses are carried out in specially designed and patented bioreactors at different scales in the laboratory. Studies on the biotechnological application areas of microalgae and their conversion into products of medical, industrial and bioeconomic importance continue, and valuable products are evaluated from algae and various biomass to be used in the fields of energy, environment and agriculture. And projects, with the scope of valorization of waste biomass for biofuel production in zero waste concept, are carried out.

Figure 1. Algal Biotechnology and Bioprocess Laboratory

Supported by the Istanbul Development Agency affiliated with the Ministry of Development, a project titled "New and Efficient Microalgae Growing System Design and Biofuel Production Using Different Wastewater Sources" was conducted by our research group. In this project, experiments and studies related to production optimization for the sustainability, efficiency and economic improvements of production were carried out. In this context, wastewater from YTU biotechnological greenhouse and Istanbul water and sewerage administration (ISKI) were utilized for microalgae production in different scales of photobioreactors (pyramid and solar bioreactor) to be used in biofuel production (Fig 2). By putting the zero waste concept into practice, biodiesel production was carried out from microalgal oil and the oil extracted microalgal biomass was valorized by anaerobic digestion to obtain biogas. Moreover, microalgae cultivated in ISKI wastewater was also investigated for bioethanol production and it was put forth that this can be a remarkable solution for waste utilization. For detailed information, you can access our paper: https://www.sciencedirect.com/science/article/abs/pii/S0959652617304158

Fig.2 Pyramid photobioreactor located in YTU Davutpasa Campus (left); Solar bioreactor located in YTU Davutpasa Campus (right)

Macroalgae accumulations in coastal areas are an environmental problem. City councils in coastal areas are required to remove them to maintain appropriate conditions for tourism. As for the utilization of wastes for biofuel production, our research group also investigated bioethanol and biochar production from macroalgae collected from the coastal areas of the Marmara Sea.

By using thermochemical conversion, different types of biomass wastes such as agricultural wastes, plant-based food wastes, algae wastes and sewage sludge were valorized to be used for energy, environment and agriculture applications (Fig 3). For the first time, biochar obtained from these wastes was utilized as a hydroponic growing medium for tomato seedlings in a hydroponic greenhouse (Fig 4). For detailed information you can access our paper: https://www.sciencedirect.com/science/article/abs/pii/S016523701630821X

Currently, collaborations between our research group and different groups working on sustainable biofuel production such as Institut de Combustion Aérothermique Réactivité et Environnement (ICARE) – CNRS continue.

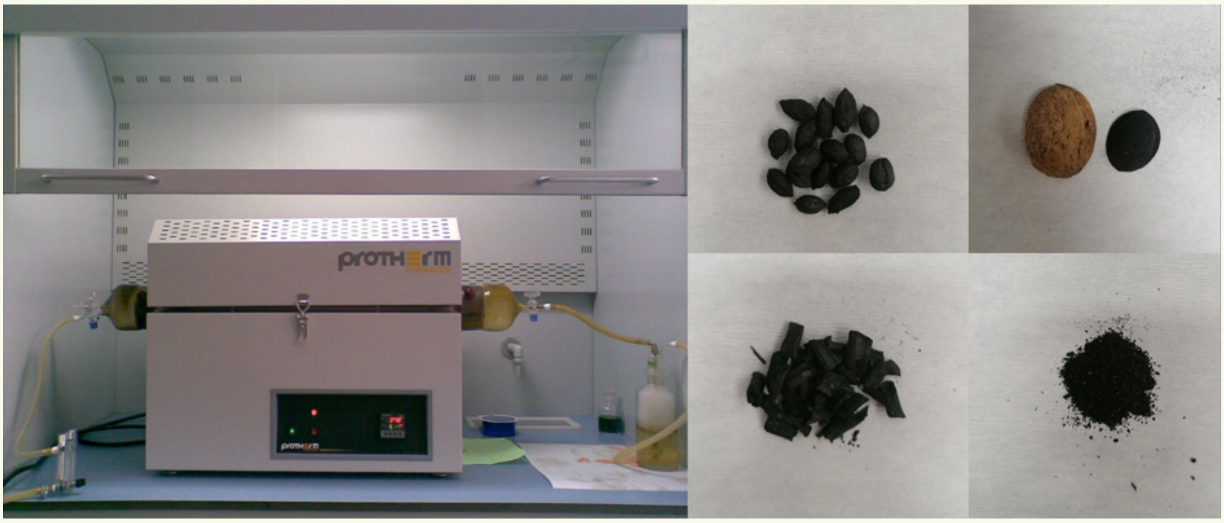


Figure 3. Carbonization studies carried out by our research group

Figure 4. Tomato seedlings supplemented with biochar as solid media materials

Useful information

Five Cross-cutting Barriers to Bioenergy Deployment and How to Address Them

Bioenergy – solid biofuels, biogas, biomethane and liquid biofuels – already make a significant contribution to the world's energy supply, but half of the deployment currently takes the form of traditional uses of bioenergy for cooking and heating, mainly in developing countries. The situation needs to change. Inefficient applications of biomass must be replaced by modern and clean energy solutions, since they harm people's health, damage the environment and reduce social well-being.

Modern forms of bioenergy are increasingly being used to generate electricity, for heat in buildings and industry, for transport fuels and as an industrial feedstock. For example, biomass-based aviation fuel is the most promising renewable option in the near and medium term.

However, increasing bioenergy deployment and realising its wider socio-economic benefits presents its own difficulties. Five major challenges across all end-uses that urgently need to be addressed:

1. **Policy uncertainty and complex institutional structures** are major barriers to most renewables, including bioenergy. Currently, bioenergy development is not receiving enough policy attention. Bioenergy policymaking usually involves various government departments and cross-sectoral actors. Governments should set a long-term bioenergy strategy, with clearly defined targets and cross-sectoral coordination, to build confidence for investors and project developers. Mandates for bioenergy consumption and a ban on fossil fuel use can also be used to increase market demand.

2. **Financial and economic barriers** include fossil fuel subsidies, high costs and lack of access to affordable finance. Without measures accounting for the negative impacts of fossil fuel burning, most bioenergy options have a higher cost than fossil fuels. Financial and fiscal support measures can ensure that the production and use of bioenergy are profitable for enterprises and affordable for final consumers. Measures include the phase-out of fossil fuel subsidies and the introduction of carbon pricing policies to fix energy market distortion, a lower tax burden or grants and subsidies to raise its competitiveness, and measures to facilitate affordable financing.

3. **A low level of technology readiness** remains another major barrier to novel bioenergy technologies, such as biomass-based aviation fuels and biomass for high-temperature industrial processes. A lack of infrastructure adds to the challenge, such as the need for onsite biomass storage and the ability of natural gas grids to accommodate biomethane. Policy support for innovation through research, development and demonstration can raise technology readiness and accelerate commercialisation.

4. **Weak supply chains** are one of the most dominant barriers. These include unstable feedstock supply, lack of qualified workers and sustainability risks. Regulations on quality control and standardisation can improve product quality and operational efficiency. Training, education and capacity building can improve workers' skills in the design, installation, operation and maintenance of bioenergy systems. Most importantly, a context-based sustainability policy framework, containing appropriate measures, is urgently needed to ensure sustainable good practices.

5. **A lack of awareness of bioenergy products** and their benefits can also affect the engagement of stakeholders. Public campaigns and information-sharing activities raise public and business awareness. Accessible information on the availability and location of bioenergy resources (e.g. agricultural and forestry residues, organic waste) and infrastructure can also help project developers identify bioenergy feedstocks and the best project locations.

SOURCE: IRENA

Bioeconomy strategies in EU regions. Where are we?

Mapping and analysis undertaken for the Commission's Knowledge Centre for Bioeconomy show there's a growing number of regional bioeconomy strategies, fully focused or relevant to the bioeconomy. Their deployment has accelerated following the launch of the revised EU Bioeconomy strategy in 2018.

Regional bioeconomy strategies are crucial for improving livelihoods in rural and coastal areas, managing natural resources sustainably and making the most of the availability of biological resources as well as the geographic, climatic, economic and political specificities of the EU regions.

The mapping exercise contributes to the action plan of the EU Bioeconomy strategy to monitor the deployment of local bioeconomies across the EU. It compiles the currently existing regional bioeconomy strategies at various levels of regional classification. These include NUTS1, NUTS2 and NUTS3 regions: major, basic and smaller regions respectively.

The study finds that 194 regions in EU27 have a strategic framework for bioeconomy in place or are in the process of doing so. Overall, there are 359 bioeconomy-relevant strategies at the regional level in the EU. Of those, 334 frameworks are published in the form of documents such as strategies, action plans, roadmaps, and the rest are under development.

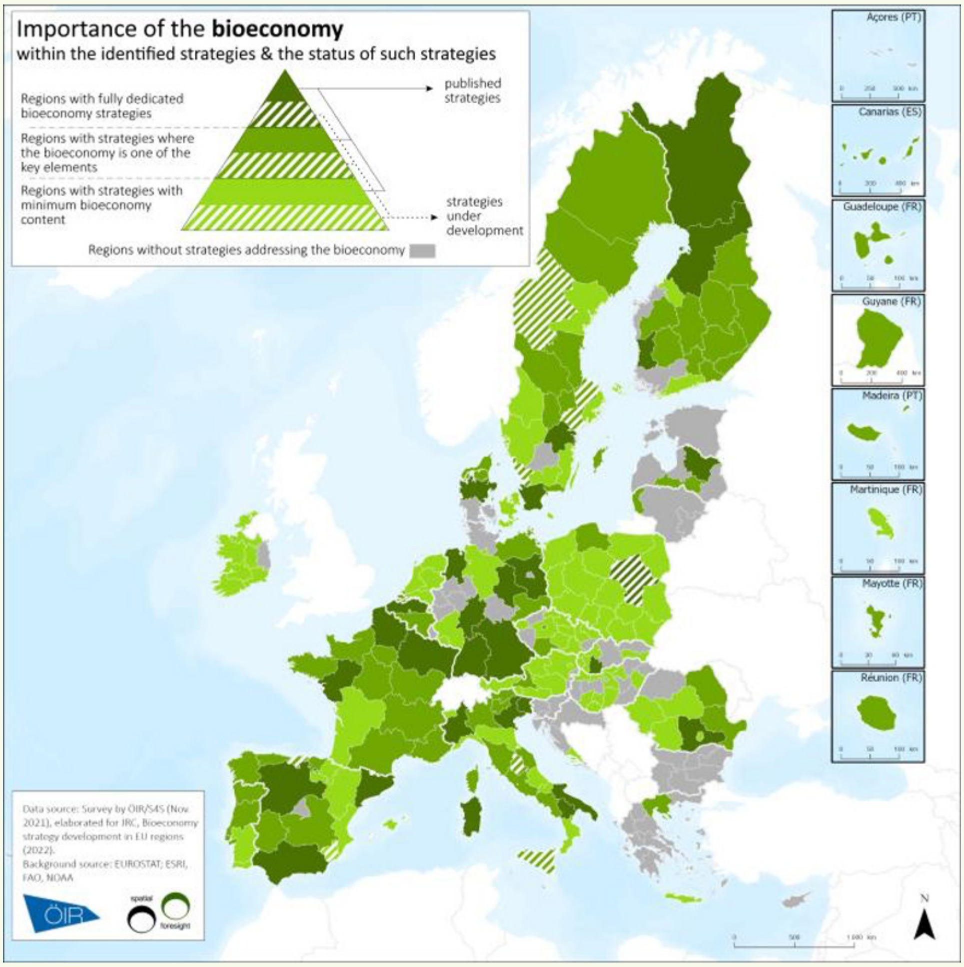


Figure 1. Some regions have multiple strategies related to the bioeconomy. On this map, regions appear only with the strategy that is ranked highest in the strategy pyramid (see map legend) © EU, 2022

Analysis and patterns

Some regions have several strategies in place at the same time, addressing various sectors, ranging from bio-based energy production or organic waste recycling to the processing of agricultural residues, to name a few.

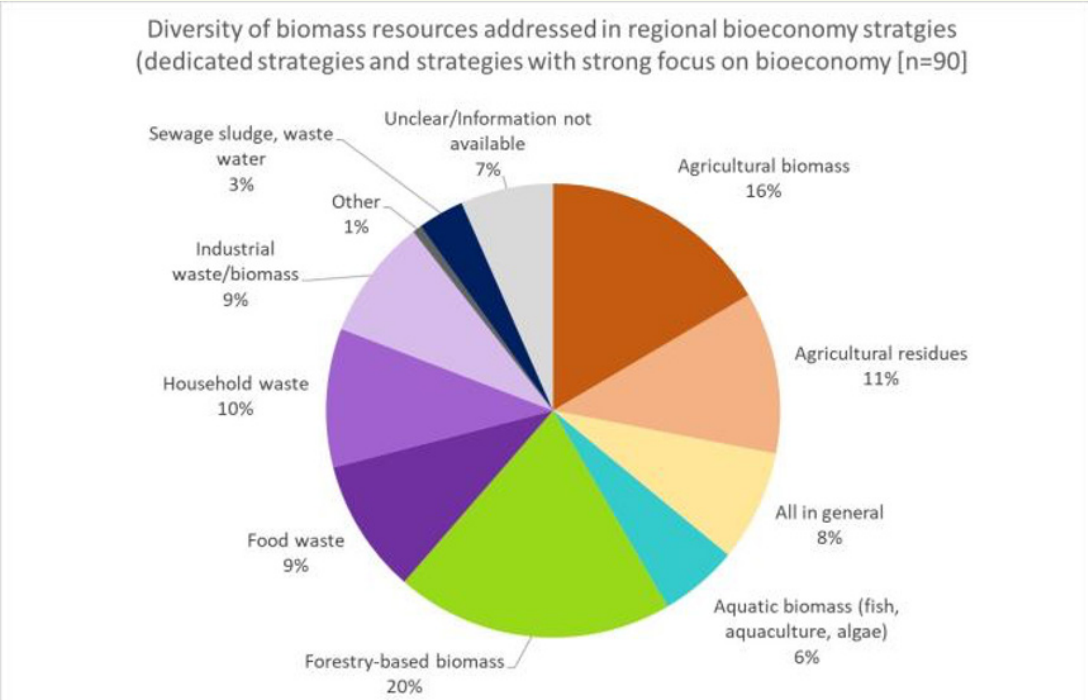


Figure 2. Diversity of biomass resources addressed in dedicated and regional strategies where the bioeconomy is a key element. A single strategy may address multiple types of resource © EU, 2022

The existence of regional bioeconomy strategies mainly depends on two factors. First, if the country is large and decentralised, it is likely that strategies related to the bioeconomy exist at a regional level. Second, where a strategy for bioeconomy exists at national level, it can also apply to regional and local action and so, consequently, there may be fewer (dedicated) strategies at a regional level. In this case, bioeconomy at the sub-national level may be predominantly embedded in wider strategic frameworks. However, even if a national strategy exists, there may still be regional frameworks to further specify actions and to focus on the specificities of the regions.

Commission proposes action to fully harness the potential of algae in Europe for healthier diets, lower CO_2 emissions, and addressing water pollution

On 15th November 2022, the European Commission adopted the Communication ‘Towards a strong and sustainable EU algae sector’, a pioneering initiative to unlock the potential of algae in the European Union. The Communication proposes 23 actions to create opportunities for the industry to help it grow into a **robust, sustainable and regenerative sector capable of meeting the growing EU demand.** The EU is **one of the biggest importers of seaweed** products globally, and the demand is expected to reach €9 billion in 2030, especially in food, cosmetics, pharmaceuticals, and energy production.

The Commission identifies 23 actions, which aim to improve business environments, increase social awareness and acceptance of algae and algae-based products by consumers, and close the knowledge, research, and technology gaps. Some key actions include:

- Developing a new algae farmers' toolkit.
- Facilitating access to marine space, identifying optimal sites for seaweed farming and including seaweed farming and sea multi-use in maritime spatial plans.
- Together with the European committee for standardisation (CEN), developing standards for algae ingredients and contaminants, as well as for algae biofuel.
- Assessing the market potential, efficiency and safety of algae-based materials when used in fertilising products.
- Examining the algae market and proposing market-stimulating mechanisms to support the transfer of technology from research to market.
- Funding pilot projects for career reorientation and supporting innovative SMEs and projects in the algae sector.
- Conducting studies and discussions to gain better knowledge, amongst others, on seaweed climate change mitigation opportunities and the role of seaweed as blue carbon sinks, define maximum levels of contaminants and iodine in algae.
- Supporting, through horizon Europe and other eu research programmes, the development of new and improved algae processing systems, novel production methods and algae cultivation systems.
- Promoting awareness-raising actions and analyse the availability of algae-related data.

SOURCE: European Commission

European biomethane production increased 20% in 2021

The 2022 edition of the EBA Statistical Report shows that the biogas and biomethane sector is already providing 18.4 bcm of renewable gas to Europe. In the mid-term, our sector is a key pillar of the REPowerEU strategy, including the deployment of 35 bcm of sustainable biomethane a year by 2030 to mitigate climate change and strengthen the EU's strategic autonomy. By 2050, it could provide up to 167 bcm and cover 62% of the gas demand.

The demand for biomethane for all final uses is strong: last year, the growth of the sector was unprecedented, with a 20% increase in biomethane production and a total of 3.5 bcm produced in 2021. An even greater expansion is expected in 2022, as a record number of new biomethane plants (184) started production last year and will become operational within 2022.

The deployment of renewable gases entails a substantial contribution to climate targets, but also to the EU's independence from natural gas imports. 82% of the natural gas consumed in 2021 came from external supplies (338 bcm), with 15 Member States importing over 90% of their gas. Russia was the main source of supply and represented 33% (137 bcm) of the EU's natural gas consumption in 2021.

The need for higher energy independence is combined with falling biomethane production costs, which are already significantly below the expected average TTF gas price for 2022 (80 €/MWh as opposed to 134 €/MWh). It is thus clear that speeding up biomethane production and accelerating the clean energy transition are of high importance to stabilize gas prices and ensure energy security.

The deployment of biomethane can also increase the availability and affordability of organic fertilisers for food production. Natural gas is at the moment the main feedstock and energy source to produce synthetic fertilisers. According to the EBA Statistical Report 2022, Europe could already save today 0.6 bcm of natural gas consumption by replacing 5 – 6% of synthetic nitrogen fertilisers with digestate. This could have already avoided 1,096 ton CO_2 equivalent in 2021, as the production of mineral fertilisers is highly energy-intensive.

The overall expansion of the sector will also boost the deployment of a resilient European bioeconomy. The biogas industry in EU-27 had a turnover of € 5.75 billion in 2020, relatively higher to the hydropower industry (€ 4.65 billion).

More info

Gasification-based biorefineries – technical, economic and environmental (TEE) assessment for specific case studies

IEA Bioenergy Task42 (Biorefining in the Circular Economy) aims at enhancing the commercialisation and market development of biorefinery systems and related technologies while considering environmental, social and economic aspects. Integrated assessment (technical, economic and environmental – TEE assessment) of integrated biorefineries is performed to provide quantitative, scientifically sound, and understandable data on the technical, economic and ecological added-value of biorefining to co-produce bioenergy and bio-products in a sustainable way.

The report Technical, Economic and Environmental (TEE) Assessment of Integrated Biorefineries is focused on case studies for gasification-based biorefineries and is developed in cooperation with members of IEA Bioenergy Task 33 (Gasification of biomass and waste).

Gasification is not a new technology, however, gasification of biomass (or waste) and all of the subsequent scaling up can be considered novel. Especially the different flue gas composition is deemed a challenge. In the report, 10 gasification technologies ranging from commonly found two stage-gasification to more exotic technologies including plasma, were analysed and TRL levels were awarded accordingly. In principle, there are applications with high TRLs such as 7-8 covering a wide variety of feedstock, e.g., classic input materials such as wood chips, pellets, sawdust, and perennial crops, but also extending into municipal solid waste, SRF and RDF with lower TRL technology. But not only the generation of heat, power and syngas (and their subsequent use for the production of biofuels and/or biochemicals) are of interest, multiple technologies are also working on recovering minerals such as phosphorus in order to further improve efficiency. Factsheets were included for 4 specific gasification-based biorefinery systems, with the main difference being the way the synthesis gas if further processed to advanced biofuel.

Case 1 & 2: Gasification & methanol/DME-to-gasoline biorefinery

These case studies analyse possibilities for the integration of gasification systems with further processing and upgrading processes for the production of synthetic biofuels. The woody biomass feedstock is first converted to a biocrude through a fast pyrolysis process. The biocrude is then gasified with steam to produce producer gas which must be cleaned and conditioned to get a mixture of CO and H2 (synthesis gas/syngas). The syngas is then converted to methanol (case 1) or dimethyl ether (DME) (case 2) via a catalytic reaction system (methanol synthesis / DME synthesis). The final high-quality synthetic gasoline is obtained through refinery upgrading. Butane, propane & polypropylene are valuable side products.

The overall energy efficiency of the DME pathway is 67%; 34% of the energy input is contained in the gasoline product.

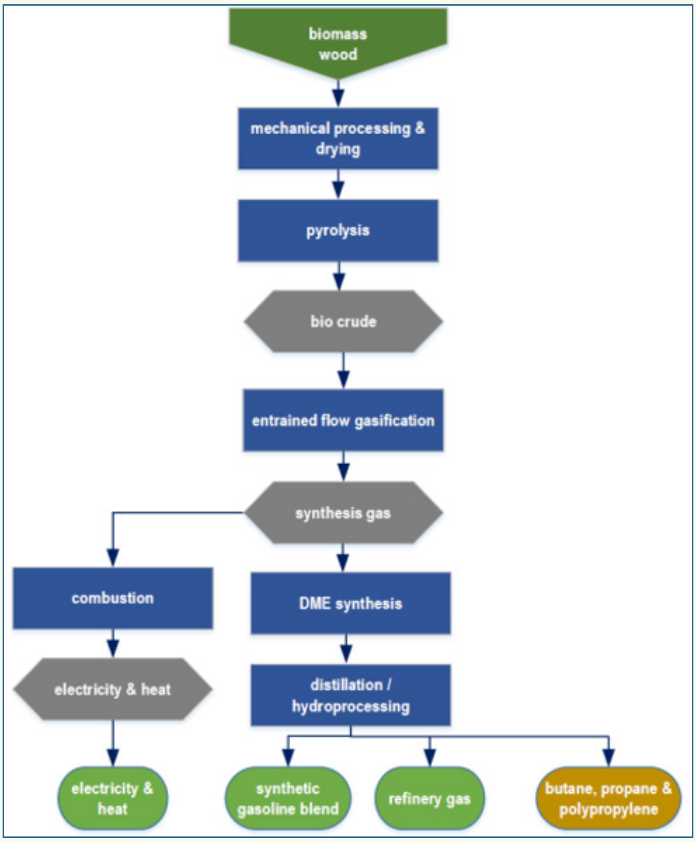


Figure 1. Basic flow chart of gasification and DME processes for high-quality gasoline

The methanol pathway achieves a higher overall efficiency of 87% (from gasification to final products), but only 29% of the energy input is contained in the gasoline product.

Both systems achieve >95% GHG savings compared to the reference fossil-based system providing the same fuel and product outputs, under optimal technology set-up conditions and sustainable feedstock sourcing.

Case 3 & 4: Gasification & Fischer-Tropsch synthesis to produce gasoline and diesel substitutes

These case studies analyse possibilities for the integration of gasification systems with further processing and upgrading processes for the production of synthetic biofuels. The woody biomass feedstock is first converted to a biocrude through a fast pyrolysis process. The biocrude is then gasified with steam to produce producer gas which must be cleaned and conditioned to get a mixture of CO and H2 (synthesis gas/syngas). The syngas is then converted to raw FT products via a catalytic reaction system (Fischer-Tropsch synthesis). The final high-quality synthetic gasoline and diesel are obtained through refinery upgrading of these FT products via catalytic cracking (FCC) reactions (case 3) or a hydrocracker (HG) reaction system (case 4).

The overall energy efficiency of both pathways is around 79% (from gasification to final products). In the FCC case, 46% of the energy input is contained in the gasoline and diesel products; in the GH case, this is 42%.

Both systems achieve around 97% GHG savings compared to the reference fossil-based system providing the same fuel and product outputs, under optimal technology set-up conditions and sustainable feedstock sourcing.

SOURCE: [IEA Bioenergy]

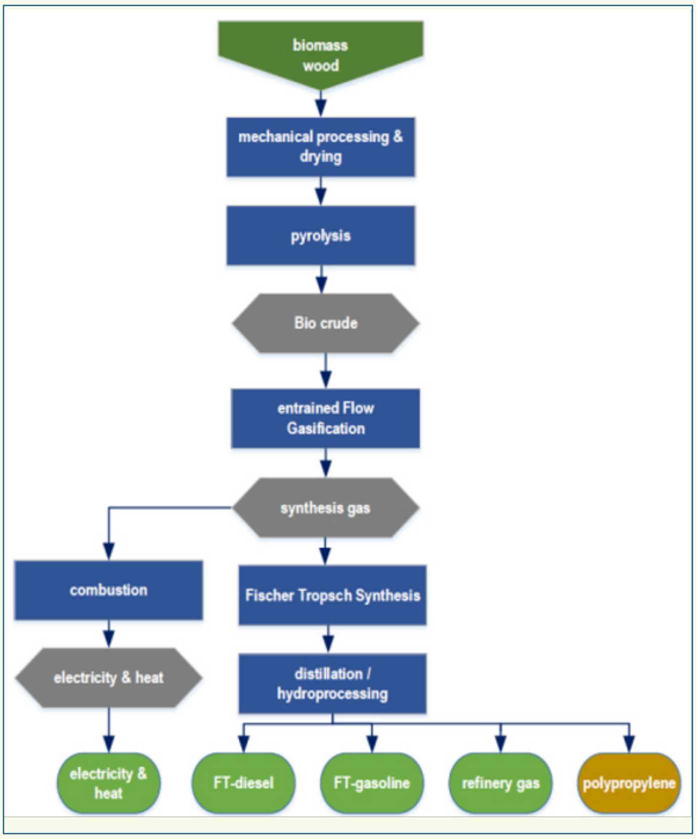


Figure 2. Basic flow chart of gasification and FT processes (with FCC processing) for high-quality gasoline and diesel

The bioenergy sector employed 3.44 million people Worldwide in 2021

The renewable energy sector employed 12.7 million people, directly and indirectly, in 2021[1] according to the report [Renewable Energy and Jobs – Annual Review 2022] released by the International Renewable Energy Agency (IRENA) on September 2022. The number continued to grow worldwide over the past decade, with most jobs in the solar photovoltaic (PV), bioenergy, hydropower and wind power industries.

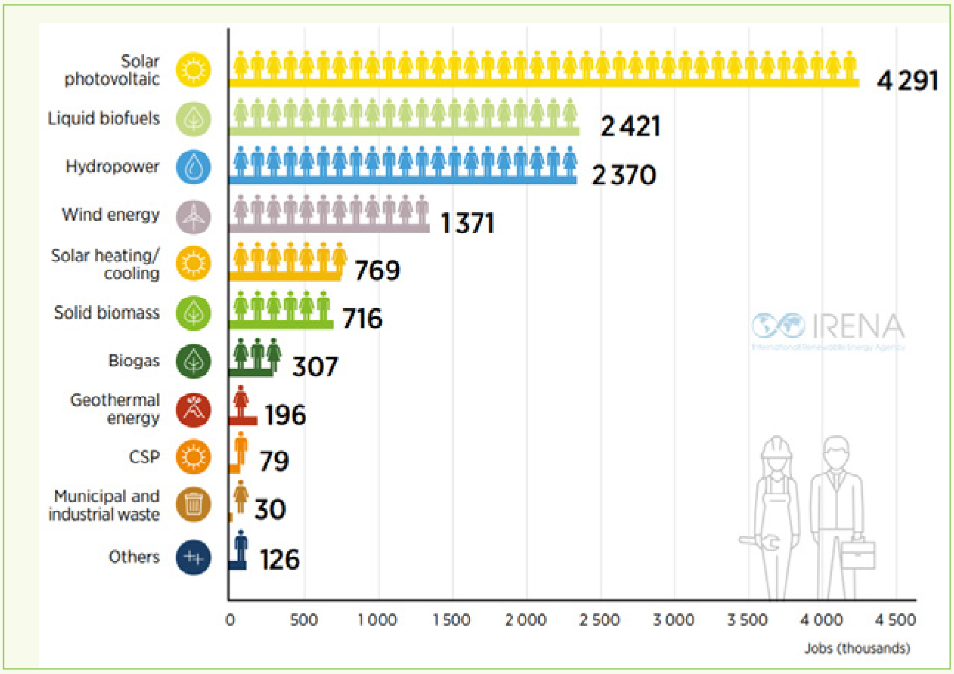


Figure 1. Global renewable energy employment, by technology, 2021 (source: IRENA)

Liquid biofuels, solid biomass and biogas accounted for a combined 3.44 million, or roughly 27 percent, of those jobs, down from 3.52 million jobs in 2020.

IRENA estimates worldwide biofuel employment in 2021 at 2.4 million. The vast majority of jobs are in planting and harvesting feedstock; fuel processing employs relatively few people, but typically pays higher wages.

Latin America accounts for 44% of all biofuel jobs worldwide and **Asia** (principally Southeast Asia) for 36%. The more mechanised agricultural sectors of **North America** and **Europe** translate into smaller employment shares (14.0% and 6.4%, respectively). The top ten countries together account for about 93.5% of global estimated employment (Figure 2).

Highly mechanised operations in the United States required a direct and indirect labour force of about 322,600 people in 2020. In the 27 member states of the European Union, biofuel employment was estimated at about 141,600 jobs in 2020, the most recent year for which data are available (EurObserv'ER, 2022).

[1]Data are principally for 2021, with some dates for 2020 and a few instances in which only earlier information is available. The data for hydropower include direct employment only and for other technologies include both direct and indirect employment wherever possible.

Other producing countries have more labour-intensive feedstock operations. With about 863,000 jobs, Brazil remains the world's biggest liquid biofuel employer, although the balance between ethanol and biodiesel production continues to shift in favour of the latter. Other countries with large numbers of workers in the sector, often employed informally and seasonally, include Indonesia (555, 900), Colombia (187, 500), Thailand (133, 900), Malaysia (61, 400) and the Philippines (34,300).

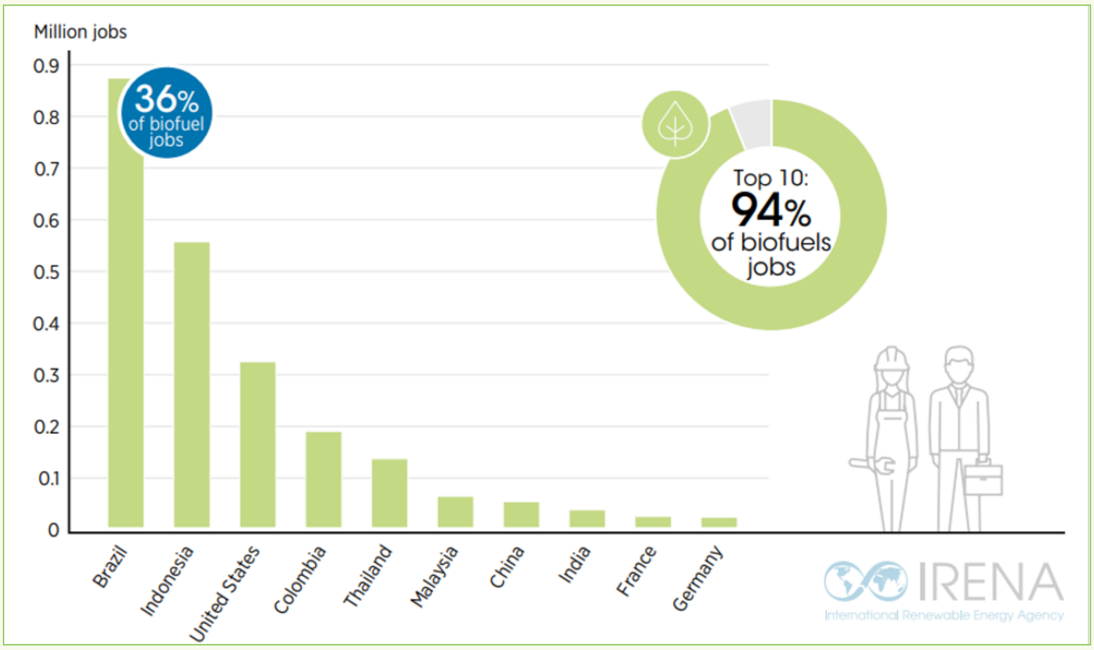


Figure 2. Liquid biofuels employment in 2021: Top ten countries (source: IRENA)

The bioenergy sector is the largest renewables employer in Europe

Countries in Europe were home to a total of 1.5 million renewable energy jobs, approximately 1.2 million of them in the 27 Member States of the European Union (EU-27). The bioenergy sector is the largest renewable employer on the continent. Solid biomass (for heat and electricity) leads, with approximately 360 000 jobs (of which 314,000 are in the EU-27), followed by biofuels with 155,000 jobs (142,000 in the EU-27) and biogas with 67 000 jobs (64,000 jobs in the EU-27).

	World	China	Brazil	India	United States	European Union (EU27)[o]
Solar PV	4 291[e]	2 682	115.2	217[h]	255[i]	235
Liquid biofuels	2 421	51	874.2[g]	35	322.6[j]	142
Hydropower[a]	2 370	872.3	176.9	414	72.4[k]	89
Wind power	1 371	654	63.8	35	120,2	298
Solar heating and cooling	769	636	42	19		19
Solid biomass[b, c]	716	190		58	46.3[l]	314
Biogas	307	145		85		64
Geothermal energy[b, d]	196	78.9			8[m]	60[d]
CSP	79	59.2				5.2
Total	12 677[f]	5 368	1 272	863	923[n]	1 242[f]

Note: The figures presented here are the result of a comprehensive review of primary national entities, such as ministries and statistical agencies, and secondary data sources, such as regional and global studies. Empty cells indicate that no estimate is available. Columns may not add up to totals due to rounding.

Table 1. Estimated number of direct and indirect jobs in renewable energy worldwide, by industry, 2020–2021 (thousand jobs) (source: IRENA)

a. Direct jobs only.

b. Power and heat applications.

c. Traditional biomass not included.

d. Includes 7 400 jobs for grouns-based heat pumps in EU countries.

e. Includes an estimate of 342 000 jobs in off-grid solar PV in South Asia and in East, West and Central Africa.

f. Includes 39 000 jobs in waste-to-energy.

g. Includes about 168 400 jobs in sugarcane cultivation and 167 800 in alcohol/ethanol processing in 2020, the most recent year for which data are available. Figure also includes a rough estimate of 200 000 indirect jobs in equipment manufacturing and 326 900 jobs in biodiesel in 2021.

h. Includes 137 000 jobs in grid-connected and 80 400 in off-grid in solar PV. Also see note e.

i. Includes jobs in all solar technologies, principally PV but also solar heating and cooling and concentrated solar power.

j. Includes 258 700 jobs for ethanol and about 63 900 jobs for biodiesel in 2021.

k. US DOE (2022d) estimate, including 53 029 jobs in traditional hydro and 11 485 jobs in low-impact hydro. An estimated 7 901 jobs in pumped hydro (energy storage) are not included in the US total.

l. Includes woody biomass fuels (33 898 jobs) and biomass power (12 388 jobs).

m. Figure is for direct geothermal power employment.

n. Includes 98 932 jobs in technologies not separately broken out in the table, such as solar heating and cooling, geothermal heat, heat pumps and others. Solar heating and cooling are also included (but not reported separately) in the Solar Foundation´s estimate for all solar technologies, so there is a small amount of double counting.

o. Solar PV and wind jobs are for 2021; hydropower figures for 2020 and 2021; other technologies are for 2020.

Source: IRENA jobs datebase.

Source: Renewable Energy and Jobs – Annual Review 2022 (IRENA, September 2022)

Signatories call for climate-smart forestry and for circular use of woody biomass residues

Scientist Letter regarding the need for climate-smart forest management

Over 550 scientists have signed a letter addressing to the presidents of the three main European institutions, alerting them of the deteriorating state of European forests and calling for climate-smart forestry practices – including wood harvesting for bioenergy – to consolidate their resilience to global warming.

The letter highlights the important role that woody biomass from sustainably managed forests can play in climate change mitigation, delivering a fossil fuel-free energy future, and maintaining healthy forests.

"With proper forest management, the use of wood for energy is a co-product of harvest and of the processing of wood for products. The use of wood for energy can substitute fossil energy and is a significant part of climate protection policy in all European countries" the scientists write, saying there are sufficient volumes of by-products such as tree tops, residues and recycled wood available to secure renewable energy supply.

This initiative is in line with the action of the ETIP Bioenergy Platform in supporting the use of forest biomass for energy purposes. A high number of signatories are involved in the ETIP Bioenergy Platform at various levels.

Read the full letter
Source: ETIP Bioenergy

More than 70 EU signatories call for efficient, circular use of woody biomass residues

More than 30 additional signatories endorsed the declaration issued on the 10th of November, bringing the total number of supporters over 70 European organizations, companies and utilities.

Ahead of the technical trilogue on the 2nd of December, the signatories renewed their concerns that the European Parliament's proposal for a new definition of "primary woody biomass" in REDIII would prevent the efficient and circular use of woody biomass residues, and put EU energy security at risk. Bioenergy and, in particular, woody biomass are Europe's most prominent local and sustainable energy source, it represents 10 % of the total energy we consume, with over 96% of biomass produced domestically.

The undersigned companies, local authorities and utilities have renewed their support for ambitious sustainability criteria, which include the prioritization of biomass uses for high-efficiency cogeneration, supplying efficient district heating and industrial applications. However, they point out that the definition currently proposed by the European Parliament does not reflect the reality of sustainable forest management and bioenergy. Rather than promoting a sustainable and resilient framework, it prevents the use of circular and sustainable wood resources, threatening the future of a sector which is critical to decarbonize and ensuring energy security for many cities and rural areas across Europe.

Full document: Joint stakeholder statement on woody biomass

Source: Euroheat & Power

Scientists and academics unite to defend the Spanish forest biomass

After the approval by the Plenary of the European Parliament on the last 14th of September 2022 of the agreed text to present to the final phase of the negotiations of the Renewable Energy Directive between the European Parliament, the Commission and the European Council (trilogues) regarding to forest (woody) biomass, the Spanish forest science community notes with concern a possible limitation to its use for energy purposes.

To explain concepts and shed light from a scientific point of view, 109 Spanish scientists, researchers, and professors publish the manifesto on forest biomass in the update of the European Directive on Renewables that was addressed to the Third Vice-President of the Government of Spain and Minister for Ecological Transition and Demographic Challenge, Mrs. Teresa Ribera, in which the following fundamental aspects are justified:

Source: Euroheat & Power

1. The European forestry reality is very diverse. This reality doesn't coincide with the Spanish one in forestry or the development of the biomass sector.

2. There is a lack of management in Spanish forest masses. Conservationism is confused with abandonment.

3. Sustainable forest management as an integrating solution.

4. Protection of Spanish forests. There are guarantor regulations.

5. Circular bioeconomy contemplating all its uses, including energy.

6. The lack of consideration for Mediterranean forests in the European Renewables Directive (RED III)

Read the full manifesto (in Spanish)

Source: BIOPLAT – Spanish Technology and Innovation Platform 'Biomass for Bioeconomy'

Publications

EurObserv'ER RES in Transport barometer 2022

EurObserv'ER

The gradual lifting of lockdown restrictions during 2021 naturally led to increases in energy consumption in transport and with it the corresponding renewable biofuel or electricity shares. Preliminary estimates suggest that EU-27 biofuel consumption rose by about 4.3% between 2020 and 2021 at over 17 Mtoe (million tonnes equivalent of oil). The bioethanol share of this growth (11.0%) was stronger than that of biodiesel (2.2%). Biofuel consumption was boosted by the new Renewable Energies Directive (RED II), which devised a new computing method for measuring renewable electricity consumption in transport. This new methodology establishes this consumption at 21.9 TWh in 2021, equivalent to 1.9 Mtoe.

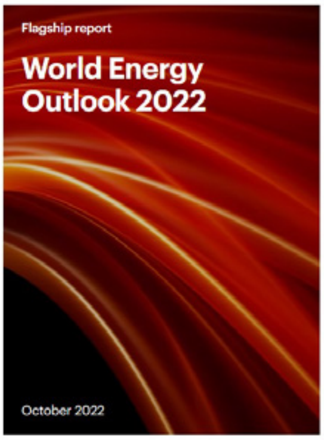
PDF

An overview of the algae industry in Europe

European Commission's Knowledge Centre for Bioeconomy

Enhanced EU production and use of algae can help ensure sustainable food and farming systems, economic circularity and bio-based products. This potential of algae to provide viable and sustainable alternative food and feed materials and to produce other bio-based products is recognised in the Sustainable Blue Economy Communication and other policy instruments. The updated JRC algae industry database provides an improved overview of the algae industry sector in Europe based on information from 548 enterprises, based in 20 EU Member States as well as in Iceland, Norway, Switzerland, and the UK operating at different steps of the algae value chain: producing, processing, and services (which includes technology providers, R&D enterprises, consultancy enterprises, and traders/ exporters).

PDF



World Energy Outlook 2022

IRENA – International Renewable Energy Agency

With the world in the middle of the first global energy crisis – triggered by Russia's invasion of Ukraine – the World Energy Outlook 2022 (WEO) provides indispensable analysis and insights on the implications of this profound and ongoing shock to energy systems across the globe.

PDF

Bioenergy Europe Statistical Report 2022

Bioenergy Europe

Bioenergy Europe's 2022 Bioheat report highlights the key role that biomass plays in the production of renewable heat and provides the reader with detailed data in this regard. These cover a range of indicators such as consumption by member states, fuels used, the role of biomass in industrial heat production and decentralised heating systems.

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.

web

Pellets Statistical Report 2022

Bioenergy Europe's 2022 Pellets Report gathers data from the members of the European Pellet Council in order to describe the current state of the pellet market in the best possible way. The report explores different aspects of the market, such as production, consumption, prices, imports, exports, sales of heating appliances, etc.

Indeed, after a COVID-19 recovery, the market is currently facing an unprecedented crisis due to the European geopolitical situation. The sharp increase in fossil fuel prices, coupled with a disruption of pellet import flows from Russia and Belarus, are leading to a significant increase in pellet prices and shortages in several national markets. This report, therefore, provides data directly from our national contributors, to help develop strategies to address this crisis and continue the development of the pellet market - as one of the key solutions to decarbonising energy production for homes, businesses and industries worldwide.

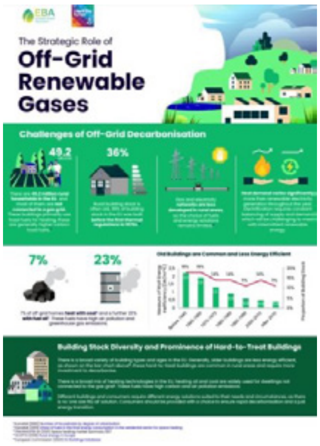
web

Biomass Supply Statistical Report 2022

This report provides readers with accurate and up-to-date information on the current state of play of biomass supply, forest and land management, and the potential of agricultural biomass for the coming years.

The EU27 had an average annual increase of 262.000 ha between 2010 and 2020, and in 2020 forests and other wooded land represented nearly half (45%) of its total land area. In addition to the increased forest area, forest density has also been rising in Europe. In 1990, the average forest density was 133 m3/ha, and by 2020 that number had increased by more than 30% to 173 m3/ha.
worldwide.

web



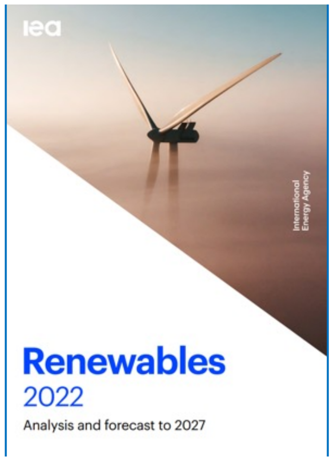
The strategic role of off-grid renewables gases

European Biogas Association (EBA) & Liquid Gas Europe

The joint publication with Liquid Gas Europe outlines renewable gas options, such as BioLPG, Biogas, BioLNG and rDME, suitable for rural buildings which could facilitate rapid progress towards greenhouse gas emission reductions in Europe.

The EU has a target of a 55% reduction in greenhouse gas emissions by 2030 and a net zero ambition by 2050. The legislative frameworks and associated policies must enable a Just Energy Transition where no one is left behind. Solutions that are available, easily deployable, cost-effective and socially acceptable will be needed to achieve ambitious climate targets, and in view of rising energy security concerns, it is equally important to consider solutions that ensure supply security and energy system resilience. The role of off-grid renewable gases is critical in this respect as they can facilitate the sustainability journey of communities in rural areas that often do not have the luxury to choose from many sustainable and cost-effective alternatives, as well as lower carbon.

PDF



IEA Renewables 2022

International Energy Agency (IEA)

Renewables 2022 is the IEA's primary analysis of the sector, based on current policies and market developments. It forecasts the deployment of renewable energy technologies in electricity, transport and heat to 2027 while also exploring key challenges to the industry and identifying barriers to faster growth.

The current global energy crisis brings both new opportunities and new challenges for renewable energy. Renewables 2022 provides analysis of the new policies introduced in response to the energy crisis. This year's report frames current policy and market dynamics while placing the recent rise in energy prices and energy security challenges in context.

PDF

IEA Energy Efficiency 2022

International Energy Agency (IEA)

Energy Efficiency 2022 is the IEA's primary annual analysis of global developments in energy efficiency markets and policy. It explores recent trends in energy intensity, demand and efficiency-related investment, innovation, policy and technology while also discussing key questions facing policymakers.

This year record-high consumer energy bills and securing reliable access to supply are urgent political and economic imperatives for almost all governments. In response to the energy crisis, countries are prioritising energy efficiency action due to its ability to simultaneously meet affordability, supply security and climate goals.

PDF

Save the date! International bioenergy events

JANUARY 2023

18 – 20 January 2023
7th Central European Biomass Conference
Graz, Austria
link

18 January 2023
European Pellet Forum 2023
Graz, Austria
link

23 – 24 January 2023
20th International Conference on Renewable Mobility 'Fuels of the Future'
Berlin, Germany
link

FEBRUARY 2023

1 – 2 February 2023
Nordic Pellets Conference 2023
Stockholm, Sweden
link

8 – 9 February 2023
Lignofuels 2023
Helsinki, Finland
link

8 – 9 February 2023
Bio360 Expo
Nantes, France
link

15 – 16 February 2023
European Biomass to Power
London, United Kingdom
link

MARCH 2023

28 Feb – 2 March 2023
International Biomass Congress & Expo 2023
Georgia, US
link

28 Feb – 3 March 2023
World Sustainable Energy Days
Wels, Austria
link

1 March 2023
European Pellet Conference
Wels, Austria
link

APRIL 2023

18 – 20 April 2023
Waste Management Europe
Bergamo, Italy
link

25 – 26 April 2023
Value of Biogas East Conference
Toronto, Canada
link

MAY 2023

10 – 11 May 2023
World Bio Markets 2023
The Hague (Amsterdam), The Neteherlands
link

15 – 16 May 2023
REGATEC 2023
Berlin, Germany
link

16 – 17 May 2023
International Biomass Congress & Expo
Brussels, Belgium
link

International Biogas Congress & Expo
Brussels, Belgium
link

Biofuels international Congress & Expo
Brussels, Belgium
link

JUNE 2023

5 – 8 June 2023
31st EUBCE – European Biomass Conference & Exhibition
Bologna, Italy + Online
link

12 – 14 June 2023
Biodiesel Summit: Sustainable Aviation Fuel & Renewable Diesel
Omaha, Nebraska
link

EERA Bioenergy in Europe

Table 1: Full and Associate members of the EERA Bioenergy Joint Programme.

Aalborg University
Department of Energy Technology
(Denmark)
web

Agricultural University of Plovdiv
(Bulgary)
web

BERA
Belgian Energy Research Aliance
(Belgium)
web

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

BOUN
Boğaziçi University
(Turkey)
web

CAMPUS IBERUS
Campus de Excelencia Internacional del Valle del Ebro
(Spain)
web Campus / web Universidad

CEA
French Alternative Energies and Atomic Energy Commission
(France)
web

CENER
National Renewable Energy Centre – Biomass Deparment (Spain)
web

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

CIRCE
Centro de Investigación de Recursos y Consumos Energéticos
(Spain)
web

CNR
Istituto Motori del Consiglio Nazionale delle Ricerche (Italy)
web

CNRS
Centre National de la Recherche Scientifique (France)
web

CRES
Center for Renewable Energy Sources and Saving
(Greece)
web

CoLAB BIOREF
Collaborative Laboratory for the Biorefineries
(Portugal)
web

CREA
Italian Council for Agricultural Research and Economics
Location (Italy)
web

CSIC
Agencia Estatal Consejo Superior de Investigaciones Científicas
(Spain)
web

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

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

ETA-Florence Renewable Energies
(Italy)
web

FCiências.ID
Associação para a Investigação Desenvolvimento de Ciências
(Portugal)
web

IEN
The Institute of Power Engineering (Poland)
web

IFK Stuttgart
Institute of Combustion and Power Plant Technology (Germany)
web

IIASA
International Institute for Applied Systems Analysis (Austria)
web

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

LNEG
Laboratório Nacional de Energia e Geologia (Portugal)
web

NIC
National Institute of Chemistry (Slovenia)
web

NTNU
Norwegian University of Science and Technology (Norway)
web

NTUA
The National Technical University of Athens (Greece)
web / web

PSI
Paul Scherrer Institut (Switzerland)
web

RE-CORD
Renewable Energy Consortium for Research and Demonstration (Italy)
web

SINTEF
(Norway)
web

TNO
(Netherlands)
web

TÜBITAK
Scientific and Technological Research Council of Turkey (Turkey)
web

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

UNIBO
Universitá di Bologna (Italy)
web

UNICT
Università degli studi di Catania (Italy)
web

UNIMORE
University of Modena and Reggio Emilia (Italy)
web

UNIPD
Università degli Studi di Padova (Italy)
web

UNITO
Università di Torino (Italy)
web

UNL
Universidade NOVA de Lisboa, Faculdade de Ciências e Tecnologia (Portugal)
web

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

VŠB
Technical University of Ostrava (Czech Republic)
web

VTT
Technical Research Centre of Finland Ltd (Finland)
web

WIP
WIP Renewable Energies (Germany)
web

WUR
Wageningen University & Research (The Netherlands)
web

YTU
Yıldız Teknik Üniversitesi (Turkey)
web

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

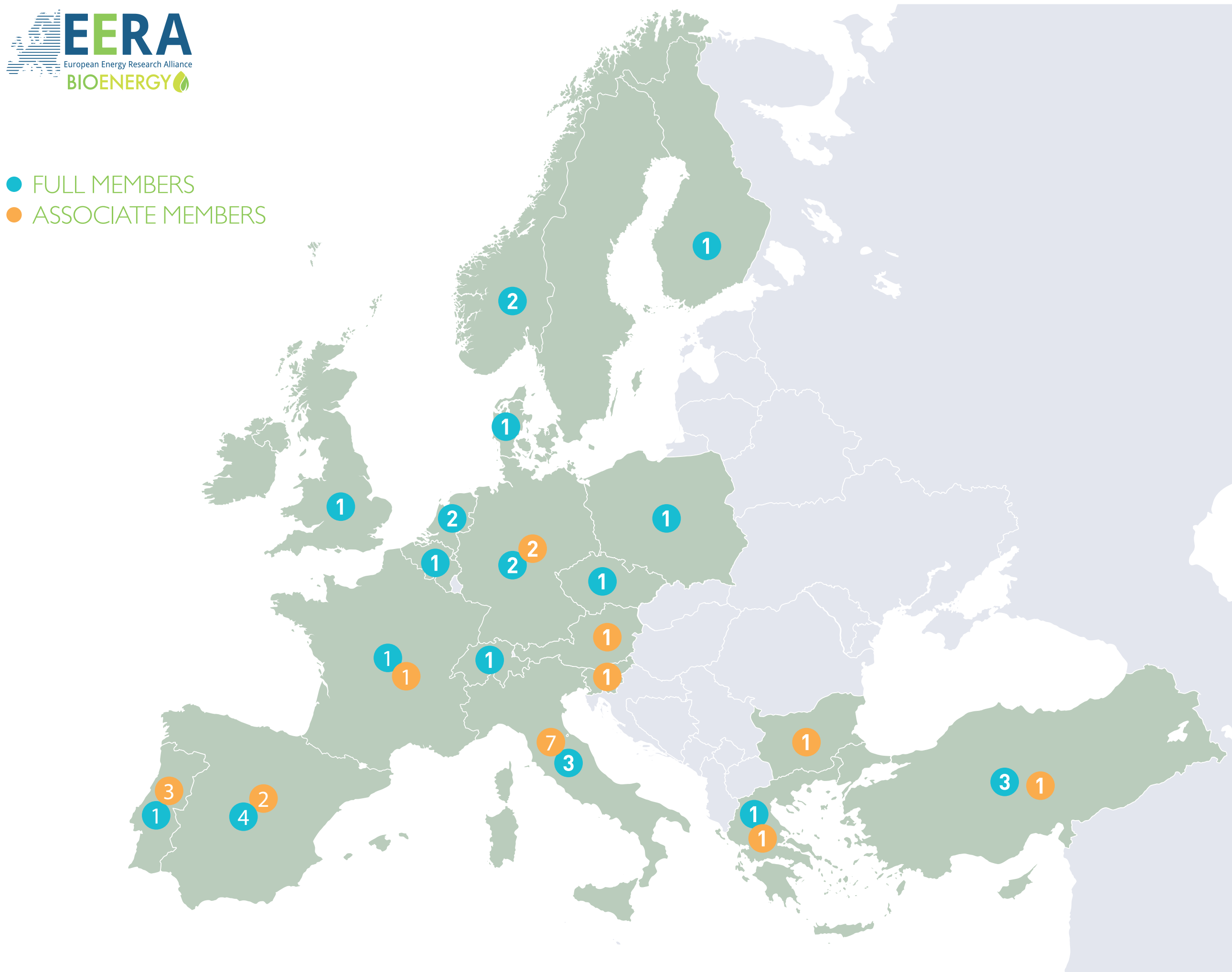


Figure 1: The EERA Bioenergy Joint Programme consists of 46 members (26 Full members and 20 Associate members) from a total of 19 countries. Link

www.eera-bioenergy.eu

Contacts

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