Technology Collaboration Programme

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Opportunities of bioenergy and biofuels in developing economies

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IEA Bioenergy held its biannual workshop on 22-23 May 2023 in conjunction with its Executive Committee meeting (ExCo91). The workshop on 'Opportunities of bioenergy and biofuels in developing economies' was held in virtual form and was organised in collaboration with the United Nations Industrial Development Organization (UNIDO).

The workshop consisted of three separate sessions:

- Supporting clean energy transitions and improved energy access in emerging economies
- Biomass supply opportunities and sustainability of supply
- Sustainable biofuel production

Each session consisted of keynote presentations, followed by a panel discussion. Over 560 unique participants in total from all over the globe followed one or more sessions of the workshop.



Figure 1. Stove training in Zanzibar, Tanzania. Credits: UNIDO.



Figure 2. Sugar cane field. Credits: UNIDO

Key messages from the workshop

For developing economies, sustainable bioenergy fits within the overall goal to restore landscapes, fight energy poverty, increase energy security and ensure energy access, which is preferentially broadly based on local renewable energy sources.

Replacing traditional use of biomass with more efficient and clean bioenergy solutions more than offsets rising energy services demand in developing economies. In other words, a more efficient use of biomass means that much less biomass is needed to provide the same energy services.

Given the unique features of biomass supply and bioenergy systems - which go much beyond the sole aim of producing energy - it is important to take a holistic approach and consider options that target multiple climate and development goals and benefits at the same time, in terms of clean energy access, development opportunities and avoiding environmental consequences of the current fate of biobased waste and residues.

Residues which would otherwise decompose or be burned in the field – which now leads to important air quality problems – can be utilised, invasive plants that disturb ecological functions can be removed, or abandoned and degraded agricultural land can be revitalised, providing new sources of incomes for farmers, and improving and diversifying their livelihoods.

A great potential exists for biofuels in emerging economies of Latin America, the Caribbean region, Africa, and Asia as these regions have a growing demand for sustainable energy, plentiful local resources, and substantial amounts of degraded, abandoned and underutilised land which can be revitalised to produce both food and biofuels. Sustainable intensification in agricultural land use also has great potential, e.g., under climate-smart agroforestry approaches.

The main challenges in implementing bioenergy projects in developing economies are related to the policy and regulatory framework, financing, feedstock supply, capacity building and communication. It is important to make best use of experiences from different regions around the world. The demonstration of real business cases needs more attention in the Global South.

An enabling policy environment, good prospects for market offtake, and improved access to finance in developing economies are key for the required investments in biofuels production. Viable business models / cases are key to mobilize investment, in particular from the private sector. Stable, supportive government policies are essential to provide the right investment signals. Successful bioenergy deployment also necessitates cross government coordination.

The international community can help developing countries in their transition to clean energy and seize the opportunities they have. International programmes supporting clean energy access, as well as international climate financing are important tools to support these transitions. It is important to exchange international experiences and share key learnings from the past decades.

Presentations, recording, highlights, and workshop report are available <u>here</u>.



Accelerating to Net Zero

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From the Secretariat



Andrea Rossi ExCo Secretary

In line with the recommendations to reduce the carbon footprint of IEA Bioenergy, the ExCo9I meeting was held virtually. The meeting consisted of three sessions, which took place on IIth, 15th and 17th May 2023, with Dina Bacovsky as Chair, Mark Brown and Birger Kerckow as Vice-chairs and Andrea Rossi as Secretary.

Changes to Executive Committee

For Brazil, a new Member was Mr Marlon Arraes Jardim Leal, and a new Alternate Member was Ms Laís de Souza Garcia; a new Alternate Member for Canada was Mr Andrew Klain; a new Alternate Member for the European Commission was Ms Biljana Kulišić; a new Alternate Member for Finland was Mr Ilkka Hiltunen; and a new Member for the Netherlands was Mr Bas Heukels.

Progress with current Initiatives

Inter-Task project - Synergies of Green Hydrogen and Bio-Based Value Chains Deployment

The objective of this project is to identify and assess synergies in the deployment of green hydrogen and bio-based value chains that can enhance the use of both energy carriers and the energy system under different conditions. The focus is on value chains directly linked to bioenergy, i.e., biomass as a source of hydrogen and bio-based processes consuming electrolytic hydrogen. The project comprises six working packages, with three reports, two webinars and a series of factsheets foreseen as key outputs. It was kicked-off in June 2022 and it will end in November 2024.

The main achievements since the ExCo90 meeting (October 2022) include: an expert workshop in Berlin in March 2023, to collect expert opinions from different stakeholders from academia and industry on the assessment framework, and to gain insight into promising synergy value chains for case studies; development of a case study collection template and identification of case study ideas; and engagement with other TCPs, including Advanced Motor Fuels (AMF), Hydrogen, and Energy Technology Systems Analysis Program (ETSAP).

Inter-Task project – Management of Biogenic CO₂: BECCUS Inter-task Phase 2

This project, which comprises eight working packages, aims to: facilitate cross-Task, cross-TCP and cross-sector learning on bio-CCUS; shed light on (bio)energy system integration of bio-CCUS; and address CO_2 mitigation potential of bio-CCUS. It will allow for a more systemic consideration of how to take different BECCUS applications to deployment, thereby building upon, but going beyond, the first BECCUS Intertask project described above. The project was kicked-off in June 2022 and it will run until Q4 2024. The main outputs will include four reports, two workshops and one webinar.



Figure 3. Screenshot from Session 1 of the ExCo91 Virtual Meeting.

The main achievements since the ExCo90 meeting (October 2022) include: development of a template for collecting case studies, selection of case studies, and identification of a preliminary set of indicators (technical, economic and system); establishment of a technology overview team and of a modelling team; collaboration with the Industrial Energy-Related Technologies and Systems Technology Collaboration Programme (IETS TCP) on a meeting on Industry-Based Biorefineries for Sustainability, and an exchange on technology pathways towards net-zero/ negative emission biorefineries and industrial concepts.

Communication Strategy

The Communications Team has continued with regular online meetings to oversee communications' activities and review progress with ETA Florence. Three IEA Bioenergy webinars have been presented since ExCo90 and these can be viewed along with all previous webinars here. The social media statistics showed increased numbers of followers especially on LinkedIn. Recently, a WeChat account has been set up for the Chinese audience. Regarding the website, statistics show that website users are relatively stable, highlighting the need for continued efforts in terms of outreach. The transfer of the Tasks' websites to the new IEA Bioenergy design is now complete. In January 2023, the Bioenergy Review 2023 was launched, including through a dedicated website and specific promotion actions on social media. Up to 31 July, over 2400 individual users, 8000 page views and 600 downloads of the full report had been recorded.

Building upon the recommendations provided by the Communication Specialist MFM, and based on feedback and guidance from ExCo, the Communications Team is currently in the process of operationalizing a number of priority actions to improve the effectiveness and impact of IEA Bioenergy's communication.

Collaboration with other International Initiatives

Collaboration with the International Energy Agency (IEA), other IEA Technology Collaboration Programmes (TCPs) and International Organisations has continued. Regarding TCPs, exchanges were held with the Advanced Motor Fuels (AMF), Hydrogen, and Energy Technology Systems Analysis Program (ETSAP) in relation to the Inter-Task project on 'Synergies of Green Hydrogen and Bio-Based Value Chains Deployment'; and with the Energy-Related Technologies and Systems Technology Collaboration Programme (IETS TCP) concerning the other ongoing Inter-Task project ('Management of Biogenic CO₂: BECCUS Inter-task Phase 2'). IEA Bioenergy collaborated with UNIDO on the organization of the ExCo91 Workshop themed 'Opportunities of biofuels/bioenergy in developing economies' (see section 1). The IEA Bioenergy TCP also continues to work closely with FAO, the Global Bioenergy Partnership (GBEP), the Clean Energy Ministerial (CEM) Biofuture Platform Initiative and the Mission Innovation (MI) Integrated Biorefineries, to implement collaborative activities in the field of bioenergy, with a focus on biofuels and biorefineries. Finally, synergies are being explored with the Council on Ethanol-based Clean Cooking (CECC), which was recently launched under UNIDO's leadership.

Improved Governance

Following an extensive consultation process with ExCo Representatives and Task Leaders, revised Guidelines for Task Management were approved at the ExCo91 Virtual meeting. The Guidelines were updated and integrated based on lessons learned from their implementation during the previous triennium, and in light of relevant ExCo decisions, such as the revised Implementing Agreement of IEA Bioenergy and the Carbon footprint reduction proposal. The revised Guidelines, which were complemented with a set of good practice suggestions, aim to enhance the effectiveness and efficiency of task management activities. A streamlined review process of Task reports to ExCo was also approved, with a view to make this process more thorough and efficient, with the active engagement of all ExCo Representatives.

Preparation of Work Programme 2025-2027 and Stakeholder Survey

The work of IEA Bioenergy is structured in a number of Tasks, which have well defined objectives, budgets, and time frames. Work programmes are defined for three-year periods (triennia). Currently, the programme for the next triennium (2025-2027) is being prepared. Feedback from external stakeholders is extremely important in this process. This feedback is being sought through a survey that may be accessed <u>here</u>. The survey, which should take 10 minutes to complete, will be open until 1 September 2023.

IEA bioenergy.com



TAKE THE SURVEY

Task Focus:

Opportunities for the biobased industries and biorefineries from the development of the hydrogen economy at a local level

A. Giuliano*, N. Pierro, A. Giocoli, I. De Bari¹ (Task 42)

Electricity production trajectories from RES in the coming years

As part of the Renewable Energy Directive (RED II), the European Commission set ambitious targets for 2030 and beyond in FIT for 55. Table 1 shows the forecasted penetration of Renewable Energy Sources (RES). The overall strategy implies a strong increase in the production of electricity from RES, mainly photovoltaic and wind until 1'102 GWe (46% wind and 54% photovoltaic) installed before 20301. On the whole, despite the benefit of RES like wind and photovoltaic in the pathway to decarbonization some limits to the implementation remain mainly lying to the integration of non-programmable RES into the power system and their non-constant productivity. As a result, in some hours, the produced electricity could be larger than the demand thus causing a surplus of energy. When overgeneration occurs, electricity must be recovered in short-term or long-term storage, converted into different energy forms, or curtailed.

	RED II	Fit for 55
Total RES share 2030	32 %	42.5%
RES-Electricity share	59%	64-67%
RES Heating & Cooling share	33%	39-42%
RES-Transport share	14%	29%

Table 1: Electricity production trajectories from RES in the coming years.

Need/opportunity for green hydrogen production/use of green hydrogen as an energy carrier

As reported in many studies², hydrogen storage appears to be the most favorable technology because it offers a much larger potential for storing surplus renewable electricity, compared to other technologies such as compressed air storage, hydro pumps and batteries. This opens the opportunity to use hydrogen as an energy carrier. In the context of green hydrogen (G- H_2) production, the fluctuations of the capacity factor (namely the ratio of the actual electrical energy output over a daily and seasonal basis to the theoretical maximum electrical energy output over that period) can significantly impact the required scale and cost of the G- H_2 . The need for low-cost electricity to produce $G-H_2$ through electrolysis could offer an option to use the surplus of renewable electricity at a local level. Identifying and locating these surpluses is important as it would allow to assess the most suitable position of hydrogen production plants to minimize:

- losses caused by the distance between RES plants and electrolyzers;
- the need to build new dedicated RES plants;
- and the non-profitable loss in the power network.

G-H, production

One of the main challenges in utilizing hydrogen as an energy carrier is current the technical limits of its storage and long-distance transportation, primarily due to its low boiling point (<-250 °C) and low density compared to other fuels. To address this, the concept of Power-to-X has emerged, which involves converting renewable hydrogen into various forms denoted as 'X.' This approach is increasingly favored by green hydrogen producers, as it provides a more viable solution for overcoming storage and transportation challenges³. On the other side, hydrogen can be a reactant in many processes for the production of fuels and chemicals. Table 2 shows the current G-H, production costs by matching the renewable energy source and the electrolyzer technology. The average current G-H2 cost is in the range of 2-5 €/kg to which further storage and transportation costs must be added.

	1	
	Solar	Onshore wind
Alkaline	1.7	2.8
PEM	3.2	4.8
SOEC	14.4	17.9

Table 2: Average G-H2 production costs (€/kgH2)4

Selecting the best location to install electrolyzers for the production of $G-H_2$ through electricity surplus deriving from RES, is essential for the whole process to be as efficient as possible. Currently, the $G-H_2$ production cost through water electrolysis is the limit for its wide diffusion and utilization. Another possibility to supply $G-H_2$ is represented by Waste-to-H2, where thermochemical routes can convert solid materials to syngas and then to pure green hydrogen by carbon capture. Against



the advantage of enabling continuous $G-H_2$ production, the main disadvantages consist of higher CO_2 production as a by-product. Obviously, $G-H_2$ can in principle be used in the same sectors as other sources of hydrogen while ensuring a more positive carbon footprint. Using $G-H_2$ in bio-based systems and biorefineries would have the advantage to allow a local integration avoiding costs and environmental impacts due to storage for long times and transportation. In fact, a common characteristic of $G-H_2$ and biomass consists in the huge territorial dispersion (e.g. in the rural areas), leading to a potential opportunity for a green matching between them.

Biomass availability

Biomass availability was recently surveyed in the JRC report "Biomass production, supply, use and flows in the European Union"5, which includes domestic production and net imports, in the EU-27 in 2017 amounting to approximately 1 billion tons of dry matter (tdm). Of these availabilities, almost 70% of the biomass supply is from the agricultural sector, which includes food, residues collected, and grazed biomass, the 27% of remaining biomass sources are from forestry and less than 1% is from aquaculture. A recent study of the Imperial College⁶ has provided an estimation of the sustainable biomass potential availability in the EU 27 + UK by 2030 and 2050. The sustainable biomass availability will be from 0.98 to 1.2 billion dry tons in 2030 and from 1 to 1.3 billion tons in 2050. However, to realize this potential, additional R&D would be required as well as the implementation of improved management strategies (e.g., the supply chain would need to be developed to mobilize all these resources, etc..). On the other hand, the specific local availability depends on a series of factors. This makes often major biomass availability dispersed in the rural lands, with a biomass density of about 50 - 60 t/km2 per year7. On the other hand, the specific local availability depends on a series of factors. This makes often major biomass availability dispersed in the rural lands, with a biomass density of about 50 - 60 t/ km2 per year7.

Green matching between G-H₂ and bio-based processes

Many bio-based processes for biofuels and/or chemicals precursors include hydro-treating steps and hydrogen use as a chemical reactant. One expression often used in the biobased economy is "high-added value compounds". This

¹ Affiliation, address: ENEA, Italian National Agency for New Technologies, Energy and Sustainable Economic Development, S.S. 106 Ionica, km 419+500, Rotondella, MT, Italy. *Corresponding author. E-mail: aristide.giuliano(at)enea.it sentence refers to a precise technical definition, namely the difference between the final product market price multiplied by the process yield and the Raw Material (RM) supply cost as displayed below:

Added value = Product market price*process yield – Raw Material market price

The added value quantifies how much economic value is added to the initial raw material through the specific conversion process. In the case of hydro-treatment, low added values can be convenient when the hydrogenation process serves to produce large volumes. When the added value is high, lower volumes can be economically convenient. This latter case coincides with the typical characteristic of biomass, especially biomass residues, and G-H₂ through the overproduction of renewable electricity. Figure 4 provides a draft classification of the hydrogen using processes in terms of hydrogen volumes needed and added value of the final products.

dimension is proportional to the data variability ranges. Overlaying this distribution with a TRLs classification a preliminary feasibility of the technologies integration can be achieved. Highadded value products typically have low TRLs, while technologies with higher TRLs typically produce products with lower added values. Obviously, the current cost of G-H, makes its use economically sustainable for processes in which the added value is high even if it currently coincides with low TRL technologies, still far from the market implementation. In particular, biobased plants requiring hydrogen amounts lower than 1'000-2'000 tG-H_/y (about 30 - 40 MW of RES installed) can be feasible in terms of local G-H, through the overproduction of renewable electricity. Plant sizes higher are possible only through dedicated installed facilities for the production of renewable electricity. When the added value is in the range of 100 - 200 €/tRM, the cost of supplying green hydrogen cannot exceed 1-2 € per kg, namely about one-third or half the

current cost (i.e.

When the added

is

and the quantity of

hydrogen per unit

of raw material is

low (i.e. lower than 100 kaH2/tRM), the

cost of supplying

reach 3 € per kg.

Plants/technologies

requiring more than

2-3'000 t/y of G-H₂

imply an installed

overall photovoltaic

energy of 150-

200 MW capacity

(roughly 2-300 ha of

consumption)

G-H, can

arev

value

than 300

hydrogen)⁸.

higher

€/tRM

even



Figure 4. Biobased processes using green hydrogen through the overproduction of renewable electricity.

The technologies were mapped based on preliminary assessment using scientific references and review papers. The box

or wind more than 100 MW capacity (roughly 10-20 ha of soil consumption) and this could be feasible only through dedicated facilities.

soil

Toward developing criteria to evaluate the most profitable power to 'X' approach

On the whole, the data indicated that case studies need to be developed to assess the optimal integration of $G-H_2$ with biobased value chains. As part of the IEA bioenergy task 42 triennium 2022-2024, specific case studies based on regional data will be developed with the scope of assessing the feasibility of using $G-H_2$ through the overproduction of renewable electricity for bio-based processes. The aim is to develop criteria to evaluate the most profitable power to 'X' approach.

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Notice board

Task 32 - Biomass Combustion

In February 2023, Task 32 published a report titled "Low emission operation of automatic wood boilers operated in cascades" (link). This report concerns installation of cascades of three or more usually identical serial devices of smaller wood boilers as an alternative to industrial boilers, and how their operation affects emissions. Cascades of smaller boilers can be used where space is more limited, and they will allow for production to be less affected by periodic maintenance, as not all boilers will need to be shut down for this. Conversely, they allow for variation in the total heat production in a wide load range, e.g., by operation of one single boiler during the summer period. The report is based on a research study carried out in Switzerland.

Another key report was published in January 2023, with the title "Nitrogen flows in biomass combustion systems - A parametric scoping study aimed at optimising nitrogen flows in biomass combustion" (link). The release of reactive nitrogen in the form of ammonia and nitrogen oxides from a wide variety of sources in society such as combustion processes and agricultural activities rises concerns due to its direct and indirect (as precursor) harm to environment and public health. This has led to several legal regulations aiming at reducing the release of reactive nitrogen to the environment. Only little research has been done so far on the quantification of reactive nitrogen flows along the whole biomass combustion cycle, including biomass growth and harvesting. This scoping study aims to identify the key parameters that influence nitrogen balances for a broad diversity of biomass combustion plants based on different technologies and fuels with varying nitrogen contents.

Concerning events, Task 32 organized a seminar on the topic of bioenergy and GHG balances, in collaboration with the Association of Danish Engineers (IDA). The event, which was held in Danish, took place in Copenhagen on 29 March 2023.

Task 33 – Gasification of Biogenic Residue and its Applications

Task 33 organised the first semi-annual meeting of 2023 in Edmonton, Canada. The program consisted of an overview of the gasification status in all participating countries, followed by a workshop on hydrogen production from gasification or utilization in gasification processes. On the third day, there was a very interesting site visit to the Enerkem waste gasification facility in Edmonton. Highlights from this meeting are available here.

The second semi-annual meeting will be held on 18-20 October 2023 in Lyon, France, in conjunction with the ExCo92 meeting. There has been a joint workshop in Berlin with respect to the Inter-task project on Synergies,



and the collaboration with IEA Hydrogen TCP has been strengthened.



Figure 5. Site visit at Enerkem, Edmonton, Canada

Task 33 was also invited to a H2 and e-mobility event, to present its preliminary results on gasification towards hydrogen were. Some of the highlights were that with gasification you can produce between 60-105 gram/kg of feedstock and the CO_2 abatement potential is 15-20 kg/kg of H2 produced.

Progress has been made on the look and content of the new Task website, which should go live in September.

Task 34 - Direct Thermochemical Liquefaction

One challenge in terms of market introduction of bio-oils produced by direct thermochemical liquefaction (DTL) is the regional regulatory framework for the permission of new DTL oils represent chemicals/substances. such new chemicals, and to support market implementation Task 34 has published a report titled "Registration of DTL products and derivatives", which summarizes the current status of fast pyrolysis bio-oil (FPBO) permission in the European Union and the experience gained in this process (link). It includes a specific FPBO and also fractions derived thereof, which are good reference cases for future applications, e.g., for new fractions with specific purposes and biocrude produced from hydrothermal liquefaction (and fractions thereof). This includes compliance with GHS standards, which is also covered in the report.

Due to the dynamic evolutions in the field of DTL process development, there now is an update available on the "Commercial status of direct thermochemical liquefaction technologies" (link).

Next to this condensed update on relevant projects at scale, there have also been more detailed country reports published for New Zealand and The Netherlands (<u>link</u>).

Task 34 met at the end of January 2023 in India, which is the latest member country joining Task 34. The meeting was kindly hosted by the Hindustan Petroleum Green R&D Centre in Bengaluru. It included one day to meet Indian stakeholders active in the field of DTL and also a visit to the IH2 demonstration unit from Shell.

Task 36 - Material and Energy Valorisation of Waste in a Circular Economy

Task 36 prepared an article on "Material and Energy Valorization of Waste as Part of a Circular Model" (link), which has recently been published as part of the IEA Bioenergy Annual Report 2022 (link). The article sheds light on the role energy from waste and material recycling can have in a circular economy, and it identifies technical and non-technical barriers and opportunities needed to achieve this vision.

Another key report was published in March 2023, with the title "Review of Waste-to-Energy Policies in South Africa and International Comparisons" (link). In addition to a review of the Waste-to-Energy (WtE) policy in South Africa, drivers and barriers in the implementation of WtE solutions in selected counties (i.e., Germany, Ireland, Italy, Norway, Sweden and United States of America) are presented and discussed. This report provides countries with inspiration and support in implementing suitable policies and solutions in the waste-to-resources management and WtE sector that would facilitate their transition towards circularity.

Regarding events, on 25 July 2023, Task 36 hosted its second regional workshop on sustainability indicators pertaining to waste resource and energy recovery. The purpose of this workshop was to convene experts on the various pillars of sustainability and explore how sustainability priorities are driving different decision-making across the world. The recording is available <u>here</u>.

The third and last regional workshop will take place in October 2023, with Ireland on focus.

Task 37 - Energy from Biogas

Task 37 has recently published a Position Paper titled "The role of biogas and biomethane in pathway to net zero" (link). Biogas is produced as the main product of anaerobic digestion (AD) of wet biomass. Biogas can be used locally for heat purposes or for power and heat production (CHP); as an alternative, biogas can be upgraded to bio-methane to replace natural gas. As such, it is one of the means to reduce the consumption of fossil fuels and contribute to the transition towards a net zero energy system. This position paper – developed by members of IEA Bioenergy Task 37 ("Energy from Biogas") - provides a holistic perspective on the roles of biogas and biomethane. The main conclusion is that biogas and biomethane have a range of options which can be employed in pathways to net zero. They provide sustainable flexible systems that play essential roles in circular economy, energy, and environmental systems.

Task 37 publishes a monthly Newsletter, which provides an overview of the latest scientific, technical and policy developments in the biogas sector worldwide. You may download the latest issues of the Newsletter and subscribe to it on the Task 37 website (link).

Regarding events, Task 37 held a meeting at the R&D Centre of the Hindustan Petroleum Limited Corporation in Bangalore, India. A workshop was organized back-to-back with this meeting. Three speakers from Task 37 presented on the topic of economics and three speakers from India introduced the Indian situation of biogas and biofuels. As emerged from the workshop, reducing costs and establishing a functioning value chain (including the organisation of access to the substrate) are - under varying conditions and details - challenges all over the world. Agricultural structures need to be changed in order to achieve sustainable cultivation practice and higher yields. Biogas can play a role in turning residues in energy and recirculating organic material and nutrient back on the land. The workshop presentations can be found here.

Task 39 - Biofuels to Decarbonize Transport

In February 2023, Task 39 published a report titled "Biofuels in Emerging Markets - Potential for Sustainable Production and Consumption" (link). The report offers an evaluation of policy frameworks and biofuel mandates across the Global South. A methodology was developed to evaluate the sustainability of biofuels production, which included an Attributional Life Cycle Assessment (LCA) to verify reductions in greenhouse gas (GHG) emissions and a Technoeconomic Analysis to verify economic feasibility. The report presents the results for biofuels produced at scale, in large commercial quantities (High Technology Readiness Level) in Argentina, Brazil, Colombia and Guatemala, Biofuels included in the analysis were ethanol and biodiesel from corn, sugarcane, soybean, and oil palm.

In addition, Task 39 recently launched it

Newsletter #62 (link), which includes a feature article by Marco Buffi and Nicolae Scarlat (Joint Research Centre) on "Biofuels production and development in the European Union". The design of the Newsletter has been completely revamped to look more like a magazine. The Newsletter now also has an ISSN number, recognizing and identifying it as a serial scientific publication. You may access the Newsletter and subscribe to it on the Task 39 website (link).

Task 40 - Deployment of Biobased Value Chains

In January 2023, Task 40 published a report titled "Deployment of BECCUS value chains in the United States – A case study of sequestering CO_2 from ethanol production" (link). This is part of a series of case studies carried out under the Inter-task Project 'Deployment of BECCS/U Value Chains' (link), which was led by Task 40, as the ongoing follow-up project 'Management of Biogenic CO_2 : BECCUS Inter-task Phase 2'. The case studies provide valuable insights for companies that are in the process of setting up value chains for capture, transportation and sequestration or utilization of biogenic CO_2 .

Under the Inter-Task project on 'Synergies of green hydrogen and bio-based value chains deployment', Task 40 (in collaboration with other Tasks) led the organization of an expert workshop, which took place as a hybrid event at the Federal Ministry of Food and Agriculture in Berlin on March 29, 2023. The goal of this workshop was to discuss the status and the deployment perspective of concepts and case studies on 1) green hydrogen from biomass and 2) green hydrogen use in biobased processes. The outcome served as input for developing an overview and an assessment of promising concepts for deployment within the aforementioned Inter-Task project. The presentations and a summary of the workshop are available <u>here</u>.

The Task Project 'Circular Bioeconomy Synergies 20 – biobased value chains for resource efficiency and system reliability' was successfully kicked-off in May 2023. The project aims to design adequate value chains. A novel planning framework that opts for both resource efficiency and system reliability throughout the value chain will be developed and tested. This shall enable a better understanding of actions that trade-off resilience with efficiency and such that provide synergies.

In June 2023, Task 40 published its Newsletter (link), which provides an overview of recent Task activities and outputs.

Task 42 - Biorefining in a Circular Economy

In April 2023, Task 42 published two new country updates, which provide relevant insights into recent biorefinery-related projects and policy developments in Austria (link) and the Netherlands (link). In addition, an overview of recent biorefinery developments in the US is available on the Task 42 website (link).

Regarding events, the Mission Innovation Integrated Biorefineries, which collaborates closely with Task 42, held its inaugural webinar on 1 June 2023. The event was hosted by the Dutch Ministry of Economic Affairs and Climate Policy, which also serves as Operating Agent for Task 42. It provided an overview of Integrated Biorefineries, discussed Mission goals and priorities, and fostered connections between industries, researchers, and policymakers. Mission co-leads India and the Netherlands, and Mission members Canada, Brazil, European Commission and United Kingdom also presented local policies and funding, as well as an outlook on future investments in integrated biorefineries. The recording is available on the Task 42 website (link).

Task 43 - Biomass Supply in Sustainable and Circular Economies

In March 2023, Task 43 published an article titled "Collecting technologies and methods of forest harvesting residues" (<u>link</u>), which was published in the Journal Silva Balcanica. The article reviews research reports/articles published in the last five years (from 2017 to 2022) to collect the latest information on supply chain management methods of forest harvesting residue recovery. Information was collected from case studies in Canada, USA, Japan, Austria, Czech Republic, Romania, Sweden, Australia and New Zealand.

On 28 June 2023, Task 43 held a workshop and a webinar.

The workshop was organized jointly with Natural Resources Canada, with the title "Business Model for Bio-hubs in Canada". Bio-hubs serve as storage, loading, and processing facilities for biomass transportation to industries. They streamline processing, storage, and transportation, reduce administrative costs, offer a variety of biomass types at one location, and provide opportunities for year-round biomass production. The workshop aimed to enhance biohub implementation in Canada, focusing on the following key objectives:

- Present a "theoretical" bio-hub business model using the business model canvas template.
- Explore specific components of the business model and suggest improvements.
- Gather insights from a focus group and document them in an action matrix.
- Share information on the requirements for engagement in bio-hubs to enhance the "theoretical" business model.

Thirty-two individuals from across Canada participated, primarily operating in the forestry and bioenergy sectors. During the workshop, Biljana Kulisic presented the business model canvas, facilitating discussions on bio-hub deployment. Participants provided insights and votes on various components of the biohub, including key partners (such as the woodbased industry, tenure holders, and Indigenous People), activities, resources, and propositions. The joint Task 43 and Natural Resources Canada workshop provided valuable insights for biohub implementation in Canada and will inform subsequent workshops in other countries.

The webinar held on 28 June 2023 was titled "Understanding Indirect Land-Use Change (ILUC) and Why Reality is a Special Case" (link). Indirect land-use change (ILUC) continues to be a controversial and challenging issue when trying to verify the effects of biobased production systems on climate and the environment. In this webinar, findings were shared from a recent report (link) evaluating approaches used to estimate the international impacts of increases in production and use of biofuels on commodity markets and land use. The research identified two distinct narratives which generate divergent results based on how questions are framed and corresponding modelling assumptions: the "Trade and Market Response" narrative asserts that biofuel markets create a shock in demand and in response to this shock, capital and land markets adjust (other variables are typically assumed to be held constant); under the "Internal Adjustment Response" narrative, the production system responds to the biofuel demand as it does to other simultaneously changing demands. The differences between modelling parameters and site-specific conditions were examined as one means key to better understand and address ILUC concerns related to land use for renewable energy systems. As discussed during the webinar and in the related report, as more data accumulates since the introduction of U.S. biofuels policies, evidence increasingly questions key relationships assumed in the Trade and Market Response models.

Task 44 - Flexible Bioenergy and System Integration

Task 44 started 2023 by co-organizing an IEA-Cross-TCP workshop titled "Towards a flexible, cross-sectoral energy supply" (link), together with IEA DHC and IEA SHC. The workshop was part of the 7th Central European Biomass Conference (CEBC



Figure 6. Presenters of IEA-Cross-TCP Workshop in Graz, Austria on 18 January 2023.

2023) in Graz, Austria. As a sustainable energy supply requires a flexible, cross-sectoral energy system utilizing the specific advantages of the various renewable technologies, the possible roles of different technologies were discussed in the workshop. A special focus was given on the flexibility provision via the heating sector. The workshop provided a holistic discussion by bringing together different users, representing municipal and industrial energy supply, and technological experts from different IEA TCPs.

Task 44 leads an Inter-Task project on 'Synergies of green hydrogen and bio-based value chains deployment' (link), which aims to create a better understanding of synergy value chains and their benefits. Currently, the focus is on the collection of case studies on hydrogen from biomass and hydrogen use in bio-based processes, and on the development of an assessment framework for the case studies. Task 40, in collaboration with other participating Tasks, organized a hybrid expert workshop on "Deployment perspective of areen hydroaen from biomass and use in biobased processes" (link). The workshop was held in March in Berlin, hosted by the German Federal Ministry of Food and Agriculture. Based on the outcome of the discussions, promising concepts will be identified, described, and assessed in more detail throughout the Inter-Task project.

In June 2023, several Task 44 members attended the European Biomass Conference and Exhibition (EUBCE) in Bologna, Italy. Task 44 contributed to the programme with a presentation titled "Defining the value of bioenergy system services for accelerating the integration of bioenergy into a low-carbon economy" (Link).

Two Task 44 meetings have been held so far in 2023, one physical in Graz in January and one virtual in April. In these meetings, among other topics, the status and expectations of flexible bioenergy in member countries, technical developments, and assessment of the value of flexibility were discussed.



session 'European biomass production to support the EU bioeconomy', contributed by Task 44

Task 45 - Climate and Sustainability Effects of Bioenergy within the broader Bioeconomy

Task 45 has recently published a report titled "Approaches to sustainability compliance and verification for forest biomass" (link). The global demand for biobased products and bioenergy is continuously increasing. One of the consequences of this increased demand is the development of a wide range of sustainability certification schemes and labels, aiming to verify compliance with sustainability requirements in biobased value chains for bioenergy and biobased products. To better understand the methodological differences between the existing approaches to demonstrate sustainability compliance, Task 45 has analysed a number of existing certification schemes and the frameworks they employ for compliance and verification. Main conclusions and take away messages can be found here, along with the links to the full report and to a summary of it.

Regarding events, on 9 May 2023, Task 45 and the Global Bioenergy Partnership (GBEP) coorganized a workshop on "Wood Energy and Carbon Accounting". The workshop was held as a hybrid event, at FAO headquarters in Rome and online. The overarching objective of the workshop was to provide a platform for discussion amona various stakeholders on carbon accounting for wood energy to contribute to achieving a common vision in this area. To facilitate the above-mentioned goal, the workshop entailed one session dedicated to support understanding of the various carbon accounting methodologies for wood energy, and another session to showcase practical examples of how these methodologies are applied in practice and policies. Data requirements and gaps were also discussed. The workshop was attended by GBEP Partners and Observers, as well as external experts. The workshop report can be found here, while the presentations can be found here.

Publications

Towards an improved assessment of indirect land-use change – Evaluating common narratives, approaches, and tools

This report - produced by experts involved in IEA Bioenergy Task (biomass supply) and 43 Task 45 (sustainability) evaluates approaches used to estimate the international impacts of increases in production and use of biofuels.



Read more

Collecting technologies and methods of forest harvesting residues

This article, which was published in the Journal Silva Balcanica and developed in the frame of IEA Bioenergy Task 43 (biomass supply), reviews research reports/articles published from 2017 to 2022 to collect the latest information on supply chain management methods of forest harvesting residue recovery.



Read more

IEA Bioenergy Annual Report 2022

The IEA Bioenergy Annual Report 2022 includes the summary of a special feature article 'Material and Energy Valorization of Waste as Part of a Circular Model' prepared by Task 36 (full article available here).



Material and Energy Valorization of Waste as Part of a Circular Model

Circular economy principles and emeraina technoloay pathways will see waste management and resource recovery transcend the traditional areas of waste, heat, and power, and intersect more with the manufacturing, construction, and transport sectors.



Press Release - Modern bioenergy provides opportunities for developing countries

For developing economies, sustainable bioenergy fits within the overall goal to fight energy poverty, increase energy security and ensure energy access, which is preferentially broadly based on local renewable energy sources.



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Read more

Approaches to sustainability compliance and verification for forest biomass

To better understand the methodological differences between the existing approaches to demonstrate sustainability compliance, this project - carried out in the frame



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of IEA Bioenergy Task 45 (climate and sustainability) has analysed a number of existing certification schemes and the frameworks they employ for compliance and verification.

Read more

Registration of DTL products and derivatives

A very important and sometimes underestimated step in commercialization of new chemicals and substances is mandatory registration of the new products, and its related cost. This report provides further information and guidance on the registration of DTL products and derivatives.





Bioenergy in remote Indigenous communities - Utilising woody waste from mine clearing in northern Australia

This report explores the potential for woody biomass sourced through integrated forestry operations before bauxite mine clearing to support the energy needs of the remote Indigenous community of Aurukun and two nearby potential bioenergy hubs in western Cape York Peninsula in northern Australia



Read more

Sugarcane contributed to removing carbon from the atmosphere in the last 20 years in Brazil

The scientific study indicates that sugarcane cultivation over the last 20 years in Brazil, contrary to expectations, was responsible for removing (and not emitting) significant amounts of carbon from the atmosphere. The study is a combination of precise land use mapping and processing carbon

accounting models at the Brazilian microregion scale.

Read more

Biofuels in Emerging Markets – Potential for sustainable production and consumption in Argentina, Brazil, Colombia and Guatemala

This report presents the results for biofuels produced at scale, in large commercial quantities (High Technology Readiness Level) in Araentina, Brazil, Colombia and Guatemala, Biofuels included in the analysis were ethanol from sugarcane and corn, and biodiesel from soybean and oil palm.

Read more



Recent progress in the production of low carbon intensive drop-in fuels

This IEA Bioenergy Task 39 report provides an update of previous work and describes progress in the commercialization of stand-alone refineries and the increased adoption of co-processing by refineries.



Read more

Feedstock to Biofuels Opportunities for advanced biofuel

IEA Bioenergy Task 39 (transport biofuels) commissioned India to lead a study on "Feedstock-to-biofuels". especially a biomass supply chain assessment for the production of 2nd Generation (2G) ethanol, to help understand the developments in India and other groups/member countries.



Read more

Review of Waste-to-Energy Policies in South Africa and International Comparisons

This report is a review of the Wasteto-Energy (WtE) policy in South Africa. carried out within the framework of IEA Bioenergy Task 36 (waste valorisation). Drivers and barriers in the implementation of WtE solutions in different counties (i.e. Germany, Ireland, Italy, Norway, Sweden and United States



of America) are also presented and discussed.

Read more

Multifunctional landscapes coupling low carbon feed and bioenergy production with restorative agriculture: Economic deployment potential of grass-based biorefineries

In this paper, a flexible modeling framework is developed to analyze the deployment options for green biorefineries that use grass-clover to produce protein feed and feedstock for bioenergy. A case study showed that green biorefinery systems could support biomethane and protein



Read more

respectively,

BECCUS value chains - from concept to commercialization

feed production corresponding to 5-60 and 13-154%

In the past few years, a consortium of IEA Bioenergy Tasks collaborated in a project called Deployment of BECCUS value chains. The objective of the project was to improve the understanding of the opportunities for, and obstacles to, deployment of bioenergy combined with carbon



capture and utilization or permanent storage (BECCUS).





BECCUS case study: sequestering CO₂ from ethanol production in the United States

Inter-task project Deployment of **BECCUS Value Chains strives to provide** insights about the opportunities and challenges pertaining to take BECCUS from pilots to full-scale projects. Case studies provide deeper insights into the key aspects that come into play for companies that are in the process of setting up BECCUS value chains.



Read more

Low emission operation of automatic wood boilers operated in cascades

This report concerns installation of cascades of three or more usually identical serial devices of smaller wood boilers as an alternative to industrial boilers (in the range of 200 kW to 2 MW), and how their operation affects emissions



Nitrogen flows in biomass combustion systems - Full cycle perspective

This scoping study - produced in the frame of IEA Bioenergy Task 32 (biomass combustion) - aims to identify the key parameters that influence nitroaen balances for a broad diversity of biomass combustion plants based on different technologies and fuels with varying nitrogen contents



Read more

Technology advances in liquid biofuels and renewable gas – WS28 Summary Report

EA Bioenergy held its biannual workshop on 17 October 2022 in Vienna, in conjunction with its Executive Committee meeting (ExCo90). The workshop on 'Technology advances in liquid biofuels and renewable gas' was held in hybrid form and was organised in collaboration with the Austrian Ministry BMK and BEST.



Read more

Overview of Thermochemical Liquefaction activities in New Zealand and The Netherlands

This report provides an overview of research activities, demonstration activities and commercial applications of Direct Thermochemical Liquefaction of biomass in New Zealand and The Netherlands.



Read more

Assessment of individual compounds for DTL oil safety aspects – Considerations for R&D work

This Technical Note provides examples of possible hazards in conjunction with DTL oils and how they are influenced by chemical compositionThe aim is to guide towards critical compounds reported in literature and also to keep track of single chemical compounds during R&D activities.



Read more

Mass balances for Direct Thermochemical Liquefaction (DTL) processes - Considerations and best practice

This technical note - developed in the frame of IEA Bioen-

ergy Task 34 (Direct Thermochemical Liquefaction) - aims at summarizing potential sources for inconsistencies and providing guidelines so that the reported values can be evaluated efficiently.



Read more

Press Release – How bioenergy contributes to a sustainable future

The IEA Bioenergy Review Update 2023 presents an evidence-based assessment of the status of bioenergy around the world. The assessment is based on work conducted by over 200 experts, active within the Tasks of the IEA Bioenergy Technology Collaboration Programme (TCP).





Read more

Review of policy frameworks to promote sustainable biofuels with low GHG emissions

The objective of the analysis in this report is to better understand how existing compliance and verification approaches for feedstock-to-biofuel

supply chains differ, and to improve comprehension of the implications of those (regional) differences.



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IEA Bioenergy Events

Executive Committee

ExCo92 will be held on 17-18 October 2023 in Lyon, France

ExCo workshop WS30 "Bioenergy in a Net-Zero Future" will be held on 19 October 2023 in Lyon, France

Task Events

 Task 32 will hold an online workshop on "Biomass

 Combustion and CCUS" on 21 September 2023

 Task 36 will co-organize the <u>19th International</u>

 Symposium on Waste Management, Resource

 Recovery
 and

 Sustainable
 Landfilling

 from 9 to 13 October 2023 in Cagliari, Italy.

Task 33 will present an overview of its activities at the <u>4th International Symposium on Biomass/</u> <u>Wastes Energy and Environment (BEE 2023)</u>, 21-23 September 2023, Nanchang, China. Task 32 will hold a side event on strategies forreducing emissions from wood combustion atthe Alaska-Canada Wood Energy Conference,3-5 October 2023, Fairbanks, Alaska, USA.

Task 36, as part of its Regional Sustainability Workshop Series, will hold a workshop on "Ireland – Food Waste", to be held in October 2023 in Ireland (exact date and location tbd)

Task 43 and the Université Laval will hold a workshop on "Wildfire Resilience and Biomass Supply", to be held on 4 or 5 October 2023 in Québec, Canada (exact date and location tbd)

Task 37 is organizing a workshop on methane slip from upgrading facilities and mitigation measures, to be held in the last week of October in Southwest Germany (exact date and location tbd)

Webinars

A hybrid seminar titled "Assessment of Successes and Lessons Learned for Biofuels Deployment" will be held on 21 September, online and in Gothenburg, Sweden, in the framework of the <u>Advanced Biofuels Conference</u>.

Other Events

07 August 2023 <u>11th World Congress and Expo on Green</u> <u>Energy</u> Toronto, Canada

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

06 - 08 September 2023 European Bioeconomy Scientific Forum 2023 Vienna, Austria

11 September 2023 <u>NSW Bioeconomy Summit</u> Sidney, Australia

11 - 13 September 2023 Industrial Net Zero Conference 2023 Sidney, Australia

18 September 2023 6th Doctoral Colloquium BIOENERGY Göttingen, Germany

20 September 2023 Advanced Biofuels Conference 2023 Gothenburg, Sweden

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

21 - 23 September 2023 4th International Symposium on Biomass/ Wastes Energy and Environment (BEE 2023) Nanchang, China 24 - 29 September 2023 <u>11th International Freiberg Conference on Cir-</u> <u>cular Carbon Technologies</u> Rotterdam, The Netherlands

25 - 27 September 2023 International Conference on Renewable and Sustainable Energy (RENEWABLEENG-2023) Barcelona, Spain

27 - 28 September 2023 <u>Biogas Power ON 2023</u> Hamburg, Germany

27 - 28 September 2023 <u>Transport Biofuels</u> Łochów, Poland

28 - 29 September 2023 IFIB - International Forum on Industrial Biotechnology and Bioeconomy Florence, Italy

03 - 05 October 2023 2023 Wood Energy Conference Fairbanks, Alaska, USA

04-06 October 2023 Bioenergy Pavilion at Renewable Energy India Expo 2023 Noida, India

09-13 October 2023 SARDINIA 2023 – 19th International Symposium on Waste Management, Resource Recovery and Sustainable Landfilling Cagliari, Italy

09-14 October 2023 4th International Conference on Recent Advances in Bioenergy Research (ICRABR) Kapurthala, Punjab, India 11 October 2023 <u>Biomass Power ON</u> Stockholm, Sweden

12-13 October 2023 <u>4th International Conference on Biofuels and Bioenergy</u> London, United Kingdom

16-18 October 2023 <u>USGC Global Ethanol Summit</u> Washington DCy

24-26 October 2023 European Biogas Conference Brussels, Belgium

24-25 October 2023 EFIB – European Forum For Industrial Biotechnology & The Bioeconomy 2023 Rotterdam, The Netherlands

24 - 27 October 2023 <u>10th GBEP Bioenergy Week</u> Bangkok, Thailand

26-28 October 2023 2nd Global Conference on Biofuels and Bioenergy Boston, USA

05-08 November 2023 International Bioenergy & Bioproducts Conference (IBBC) Atlanta, USA

See the full calendar of events here.

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