IEA Bioenergy

Task42 Biorefining in a Future BioEconomy

Newsletter IEA Bioenergy Task42

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www.task42.ieabioenergy.com

Content

Intro

Biorefining, the sustainable processing of biomass into a range of marketable biobased products and bioenergy/biofuels, is an innovative and efficient approach to use biomass resources for the synergistic co-production of power, heat and biofuels alongside food and feed ingredients, pharmaceuticals, chemicals, materials, minerals and short-cyclic CO_2. Biorefining is one of the key enabling technologies of the Circular Economy, closing loops of raw biomass materials, minerals, water and carbon. Biorefining is the optimal strategy for large-scale sustainable use of biomass in the BioEconomy.

New Work Programme 2019–2021 - Request for input

Early 2018, Task42 will draft a first work programme for the 2019-2021 triennium. All stakeholders, e.g. SMEs, industry, policy makers, NGOs, research institutes, universities, etc., active in the biorefinery/BioEconomy sector are invited to come-up with specific ideas for this new work programme.

Questions we have are:

- What biorefinery/BioEconomy data are you looking for?
- What kind of assessment tools are still lacking?
- What type of reports or papers provide added-value for your activities?
- Do you need any biorefinery/BioEconomy based training?
- Do you want to be involved more closely to the activities of Task42?

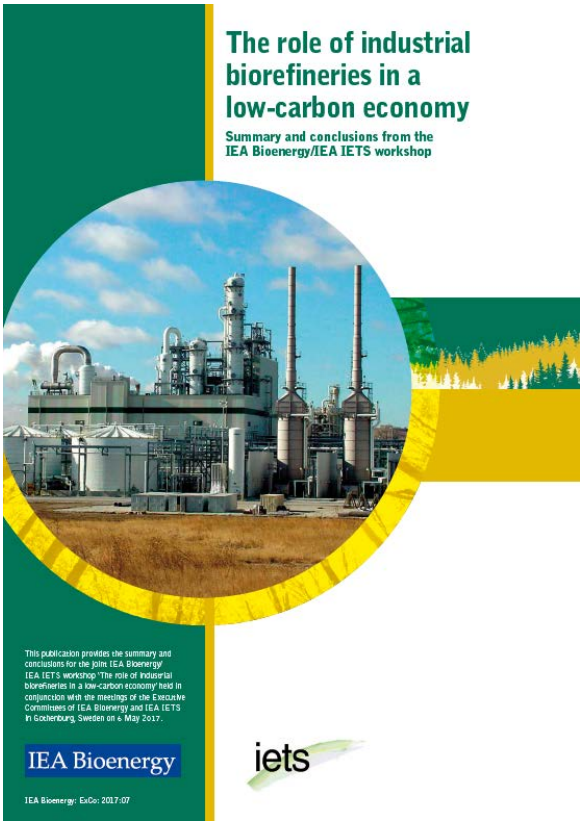
So please send us your ideas, input and requests before the end of January 2018 by e-mail to secretariaat.bbp@wur.nl, stating in the subject line: 'IEA Bioenergy Task42 – Input 2019-2021 Work Programme'.

The Role of Industrial Biorefineries in a Low-carbon Economy – Summary and Conclusions from the Joint IEA Bioenergy / IEA IETS Workshop

A workshop in collaboration with the IEA IETS TCP was held in conjunction with ExCo79 in Gothenburg, Sweden on the 16th May 2017. With more than 60 participants, the theme of the workshop was *The role of industrial biorefineries in a low carbon economy.* There were two plenary sessions during which eight invited speakers gave presentations interposed with two interactive discussion sessions:

- Biorefinery developments – plenary presentations
- Interactive workshop on strategic biorefinery developments
- How to overcome deployment barriers for biorefineries
- Interactive workshop on deployment barriers and actions

The workshop concluded with a short summary and conclusions. The power-points and summary/ conclusions can be found here.



23rd Task42 Progress Meeting – Vienna, Austria

From 23-25 October 2017 Task42 organised its 23rd Progress Meeting in Vienna, Austria. This Progress Meeting was coupled to both an Austrian Biorefining Stakeholder Workshop (see pages 8-12) and an excursion of the NTLs to the Algae Demo Plant of ECONUNA-AG.

Participants Task42 Meeting (left to right): Tobias Stern (AT), Bart Bonsall (IR), Henning Jorgensen (DEN), Michael Mandl (AT), Eric Soucy (CAN), René van Ree (NL), Franziska Hesser (AT), Geoff Bell (AUS), Heinz Stichnothe (GER), Borka Kostova (US), Julia Wenger (AT), Bert Annevelink (NL)

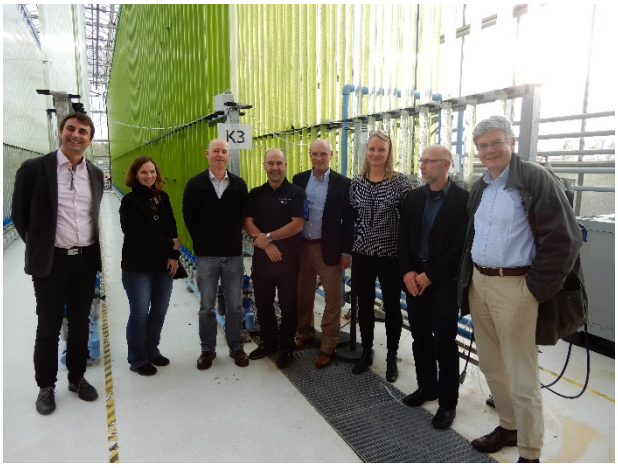
During the **Task42 Progress Meeting** the following issues were discussed: development status of the biorefinery assessment tool and related factsheets (AT), the monitoring activities on international standardisation/certification developments (GER), status distribution, analysis and reporting questionnaire on Bioenergy and Biorefining in a Circular BioEconomy (NL on behalf of IT), roundtable presentations on progress biorefinery activities in participating countries (see page 12 onward), the status of the Biobased Fibrous Materials Report (AT) – this report will become available for downloading at the T42 website in Q1 2018, the status of the Biobased Chemicals Report (NL) – this report will become available for downloading at the T42 website in Q4 2018, set-up of the new Task42 Work Programme for 2019-2021 (see request on page 2), and the date/location of the next Task42 Progress Meetings.

Task42 Progress Meeting

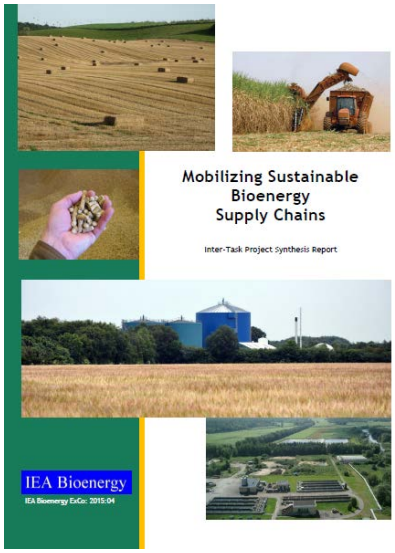
Austrian Biorefining Stakeholder Workshop: see pages 8-12.

Excursion to the Algae Demo Plant of ECONUNA-AG

ECODUNA-AG has a running Pilot Algae Photo-Bioreactor. Currently they are building a 1ha glass house fitting algae bioreactor for commercial algae production (100 t dry matter/ year).

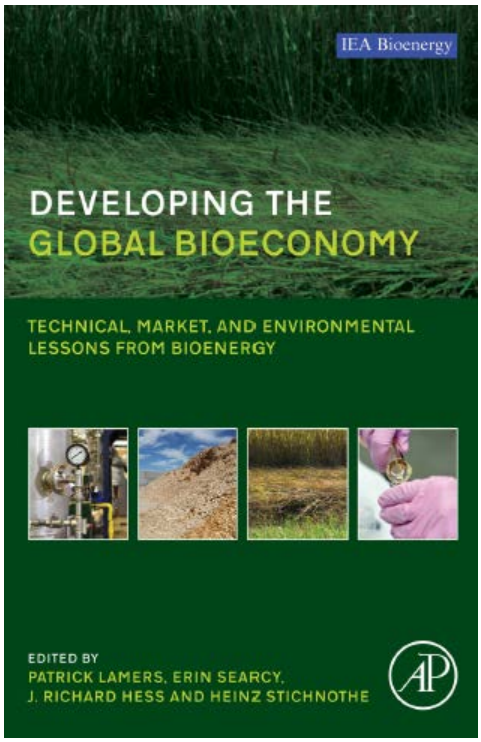


Contributions to Inter-Task Projects (ITPs)



In the last triennium Task42 contributed to the Inter-Task Project "**Mobilizing sustainable bioenergy supply chains**". The project analysed sustainable bioenergy production systems to determine the factors critical to their mobilisation through a series of case studies. This work focused on five globally strategically significant bioenergy supply chains representing major global biomass and potential primary and residue supplies, viz.: 1) forest biomass from temperate and boreal ecosystems; 2) agricultural crop residues in Denmark, Canada and the USA; 3) regional biogas production from municipal solid waste (MSW), oil palm residues and co-digestion of municipal and agricultural wastes; 4) integrating lignocellulosic crops into agricultural landscapes, and 5) pasture and grassland cultivation in Brazil. The results of this activity are reported in:

- Synthesis Report
- Summary Report



Earlier this triennium, a joint analysis brought together expertise from three IEA Bioenergy Tasks, namely Task34 on Pyrolysis, Task40 on International Trade and Markets, and Task42 on Biorefineries. The underlying hypothesis of the work was that **BioEconomy Market Developments** potentially can benefit from lessons learned and developments observed in modern bioenergy markets. The question was not only how the BioEconomy can be developed, but also how it can be developed sustainably in terms of economic and environmental concerns. The results of this analysis resulted in the book "Developing the Global BioEconomy". Both the conclusions and book ordering details can be found here.

Currently Task42 is involved as observer (GER NTL) to the ITL "**Measuring, governing and gaining support for sustainable bioenergy supply chains**". More info on this running activity can be found here.

Biorefinery news from Australia

Government Policy

There has been no change in Government policy at either the State or Federal level with respect to bio-refining or biofuels over the last six months.

Bio-refinery and Bio-economy updates – Australia

- Bio-butanol as an aviation fuel. Over the last 6 months there has been considerable work carried out in Southern Queensland between Virgin Airlines, Gevo and the Queensland Airport amongst others to consider how bio-butanol could be incorporated into aviation fuels in Queensland. Testing and logistical work has commenced with a potential view to considering how an industry may be developed in the State.
- North Queensland Bio-Energy continues work on its sugar cane project to produce both sucrose sugar and bio-ethanol for transport fuel. The company was recently awarded some funding from the Queensland Government.
- At the Northern Oil refinery pilot work continues to optimise both process and selection of biomass for the production of crude oil. It is hoped that sometime next year both a process and type of biomass can be selected as the basis for future commercial deployment in Queensland.
- Renewable Developments continues to progress towards funding of its multi-product sugar cane and bagasse bio-refinery project in the Burdekin region of Queensland.
- Considerable public discussion has been ongoing in Australia with respect to the Federal Government's Northern Infrastructure Fund and its potential billion dollar funding for the world's largest new coal mine – the Adani mine in Queensland. It appears that the Infrastructure Fund may be required to ensure the project is funded due to a reluctance by the large Australian banks to support the project. Many in the Australian community have suggested that the Northern Infrastructure should not be supporting a large coal mine at a time when the Government should instead be supporting renewables.

Biofuel use in Australia

- There are currently only 2 States in Australia with mandates to include biofuels in the transport mix – Queensland and NSW.
- In July 2017, bio-ethanol represented 2.46% of the gasoline in the NSW supply compared to 2.48% in June 2017. The NSW mandate is currently set at 6% bio-ethanol.
- In July 2017, bio-ethanol represented 1.53% of the gasoline in the Queensland supply compared to 1.51% in June 2017. The Queensland mandate is currently set at 2% bio-ethanol.

Power-point Roundtable Vienna, dd. 24 October 2017

An update on the biorefinery situation in Australia can be found here.

Biorefinery news from Austria

On the 23rd of October, a networking event of IEA Task42 with Austrian stakeholders took place. This public event proactively initiated an interdisciplinary exchange of knowledge and experience between different stakeholders in the biorefinery sector. The guests were welcomed by Theodor Zillner from the Austrian sponsor bmvit. The Event was moderated by Michael Mandl, tbw research GesmbH. The Biorefinery Open Forum invited participants to present their projects or ongoing research activities in a short presentation. This year, the National Team Leaders of the Task42 participated and gave some keynote talks. A matchmaking session with the topic “how to boost biorefining” was included at the event.

Austrian Biorefining Stakeholder Workshop. Left: Theodor Zillner (bmvit), right: Michael Mandl (tbw research)

This event was co-funded by bmvit

Agenda Austrian Biorefining Stakeholder Workshop:

10:00	10:15	15min	**Opening and Greetings**	Organizers
10:15	11:00	45min	International Keynote **Status on Biorefining in USA** (framework & politics, biorefinery examples, further information); incl. discussion	Borislava Kostova (US Dep. Energy)
11:00	11:45	45min	**Biorefinery Open Forum - Part 1** Stakeholder pitches on biorefinery projects • 5 biorefinery pitches: 10 min each	Selected stakeholders
11:45	12:15	30min	**Presentation of IEA Bioenergy Task 42** (Scope IEA Bioenergy Task 42; what will it deliver)	René van Ree (IEA Bioenergy T42)
12:15	12:45	30min	Lunchbreak	
12:45	14:00	75min	**Matchmaking session** Participants interaction in smaller groups	All
14:00	14:45	45min	International Keynote **Biorefining in the Pulp & Paper Sector in Canada** (overview, examples & feasibility , how to push forward in the P&P sector); incl. discussion	Eric Soucy (CanmetENERGY)
14:45	15:00	15min	Coffeebreak	
15:00	15:45	45min	**Biorefinery Open Forum - Part 2** Stakeholder pitches on biorefinery projects • 5 biorefinery pitches: 10 min each	Selected stakeholders
15:45	16:00	15min	**Wrap up- Matchmaking: How to boost biorefining;** Input from national level to Task 42	All
		5min	Farewell	Michael Mandl
16:15	17:15		**OPTIONAL** Guided tour to visit labs & pilots at TU Vienna, Dep. of Chemical Engineering	TU Vienna staff

Overview presentations Open Forum 1+2

Open Forum 1			**Titel Kurzpräsentation**
Marlene Kienberger	Ass. Prof. DI Dr.	TU Graz	Bioenergy Train - A new masters program at Graz University of Technology
Markus Neureiter	DI Dr.	IFA Tulln/ BOKU	Valorization of by-products and wastes via the carboxylate platform within the projects ValorPlast and VOLATILE
Ortwin Ertl	Mag.	Annikki GmbH	Fossil chemicals are history
Ahmed Junaid Tahir	M.Sc.	AEE-Inst. Für Nachhaltige Technologien	Process Intensification in Biorefineries using Membrane Distillation MD
Matthias Steiger	Dr.	ACIB/BOKU	Metabolic engineering approaches to improve the production of organic acids
Open Forum 2			
Birgit Kamm	Prof. Dr.	Wood K plus	Biobased speciality chemicals
Anton Friedl	Univ. Prof. DI Dr.	TU Wien	Lignocellulose Biorefinery and Nanolignin also potential Products
Robert Mach	Univ. Prof. DI Dr.	TU Wien	Sweet straw - production of erythritol from wheat straw
Hannes Schwaiger	DI Dr.	JOANNEUM Research	TORERO-TORefying wood with Ethanol as a Renewable Output: large-scale demonstration
Sylvain Leduc	Dr.	IIASA (Intern. Inst. For Applied Systems Analysis)	Optimal use of biomass in Europe for biofuel production

Matchmaking session "How to boost biorefining?" – TOPICS discussed at the Austrian Biorefining Stakeholder Workshop

TOPIC 1: NETWORKING

What is important for linking of the different biorefinery stakeholders?

In the matchmaking session „Networking", the relevance of the topic was emphasized and challenges were discussed that arise in the development of networks for biorefinery research in Austria, Europe and worldwide. Networks are relevant at various levels: along value chains, for interdisciplinary research and research at various levels of technology,

but also for better co-operation between research and industry, and between different industrial sectors and stakeholders.
Possible measures that can further support the expansion of biorefinery networks include: networking and scientific meetings such as specific conferences, the creation of platforms that allow the exchange of information and experience, and the development of biorefinery clusters. Particular emphasis was placed on the need to map existing research groups and infrastructures in order to be able to set up new collaborations more efficiently. We would like to draw your attention to the ongoing H2020 project "European Research Infrastructure for Circular Forest BioEconomy" (ERIFORE), in which Wood K plus and 12 other research partners all over Europe join forces to build an open research infrastructure for the forest-based BioEconomy. The basis for this networking project is a comprehensive mapping of existing expertise and infrastructures in Europe. Further information about the project can be found on the homepage or on Twitter (ERIFORE EU Project). A specific network for open access pilot and demonstration facilities is currently developed in the BBI JU project "Pilots4U". In this context, the database of the BMWfW on Austrian research infrastructures is an interesting source of information.

TOPIC 2: TECHNOLOGY

Which development needs are required from the technological perspective to support the advancement of biorefining?

In the discussion on technological perspectives it turned out that biorefinery projects are considered high risk, as are all cutting-edge technologies. The future focus needs to be on projects that are technically sound, bear a high possibility of success and feature a broad range of technologies (biochemical conversion, thermochemical conversion, etc.), project scales (pilot, demonstration, commercial), feedstock inputs (woody biomass, agricultural residues, algae, etc.) and fuel products (renewable hydrocarbon). This variety is able to decrease marketplace risk and potentially will accelerate the overall development of the industry—reducing costs to consumers, and stimulating the Circular BioEconomy. Besides the needs of highly-qualified engineers, a strong collaboration between universities and industries, and investments in technological platforms, the discussion highlighted the following specific development needs from the technological perspective to support the advancement of biorefining in a general perspective:

- Mimicking of fossil refinery strategies to cascade limited biomass to the highest value in flexible processing plants and target premium product applications.
- Biorefinery technology development needs to focus on non-conventional feedstocks (non-food biomass resources like agricultural, forest, urban, and other wastes) including CO_2 as predominant carbon source.
- The upgrading of side streams and feedstocks that are currently gasified, burned or digested to higher value products should help to improve the economic performance of these CAPEX intense concepts, and subsequent scale up and roll-outs of integrated value chains.
- With the help of low-energy processing technologies and classical tools of process integration the performance indicators (conversion yields, product grades, etc.) need to be improved at all scales and technological maturity levels.

- Industrial players are requested to establish solid, long term cooperation and clearly communicate target product quantities and qualities to researchers.
- Research is challenged to provide applied expertise along the whole value chain from crude feedstock to standardized products "under one roof/institution".
- More radical innovations are desired concerning feedstock/inhibitor adapted biomass processing under mild conditions considering regional feedstock availabilities (e.g. via "non-conventional" microorganisms, marine water use substituting fresh water fermentation, new reactor designs, etc.).
- Intensifying the research efforts on downstream processing and separation of low product concentrations.
- Integration of food, feed, chemicals, fuels processing to reduce bottlenecks during scale-up and economic barriers, and initiate closed carbon and nutrient cycles based on the paradigm of an ideal Circular BioEconomy.
- Internationally harmonized sustainability criteria and policy frameworks are required for feedstocks, processes & products to stimulate technology development.

TOPIC 3: FUTURE:

What is needed to support the advancement of biorefining?

The discussions within this topic made apparent, what the stakeholders think it is needed to foster the development of biorefineries. In addition to a broad variety of ideas discussed, the fundamental role of consumers to promote biorefineries was repeatedly mentioned. While some stakeholders called for appropriate education measures, others favoured the opportunity to raise awareness or implement market regulations. It was argued that the biorefining community should pragmatically focus on economically feasible concepts. It is emphasized that the stakeholders equated the advancement of biorefineries with sustainable development during the discussion, which might explain why they put their hope on environmentally conscious consumers.

TOPIC 4: MATCHMAKING

The participants were given a time slot for a personal informal exchange of topics of interest and to identify possibilities to work together. We hope the stakeholders made good use of the opportunity to get in touch with the international guests and representatives of the Task42.

The slides of all presentations can be downloaded here.

They are also available in the member area of the Task42 website.

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Biorefinery news from Denmark

Re-launch of National Bioeconomy Panel

In August a new National Bioeconomy Panel was established. The first National Bioeconomy panel consisted of 27 members appointed by the Minister of Environment and Food. The panel was set up in 2013 and evaluated in 2016. The task was to provide input to the government that strengthens growth and employment while benefiting the environment and climate. One of the outcomes was a report pointing out four focus areas. Now the panel is re-launched with a strengthened business focus. The new panel consists of 15 members appointed by the Minister of Environment and Food. One of the first focus areas for the panel is to look at new values chains for green biomass.

New Center for Circular Bioeconomy

In May Aarhus University opened a new Center for Circular Bioeconomy (CBIO). The Center is organized across 8 departments and two National Centers at the university. The Center leader is Senior Researcher Uffe Jørgensen. The aim of the Center is to carry out research and develop bio-economy production systems and recirculation concepts. Activities at CBIO will include research within the entire value-chain from cultivation of biomass, logistics, refining, product development, recirculation and LCA. Among the facilities are the world largest biogas plant for research purposes, pilot scale facilities for refining of green biomass (protein from grass) and a pilot plant for hydrothermal conversion of biomass to fuel. More information is available here.

Public funding for development of green biorefinery

In June it was announced that a special call under the "Green Development and Demonstration Program" (GUDP) was opened for establishment of pilot facilities for a green biorefinery. This call was a result of the recommendations from the National Bioeconomy Panel and a recent report from the Advisory board for Circular Economy. A total of 1 M€ is available in the call.

Growth package

In November 2017, a new "Growth package" with initiatives to support private businesses and stimulate growth was agreed in the parliament. Very important in relation to the biorefining area, it was agreed to allocate funds to promote production of advanced biofuels. More specifically 20 mio DKK (2.6 mio €) will be available each year for a 7 years period. The final details regarding how the money will be used will be disclosed in first half of 2018. It is expected that this economical support together with blending mandates for advanced biofuels will enable the construction of a production plant for advanced biofuels in Denmark.

Power-point Roundtable Vienna, dd. 24 October 2017

An update on the biorefinery situation in Denmark can be found here.

Biorefinery news from Germany

Activities mainly embedded in existing chemical plants

In Germany there is a plethora of activities in the area. However, at the moment there is no new installation that is called a biorefinery. The activities are embedded in existing chemical plants, e.g. feed additives and new formulations. Unfortunately, it is difficult (impossible) to distinguish between new activities and ongoing activities concerning the bioeconomy in the chemical and pharmaceutical sector. There are various reports regarding specific issues, like biopolymers, wood pellets, bioeconomy etc. For more information please look here. In addition there are a number of "Success Stories".

Power-point Roundtable Vienna, dd. 24 October 2017

An update on the biorefinery situation in Germany can be found here.

Biorefinery news from Ireland

Power-point Roundtable Vienna, dd. 24 October 2017

An update on the biorefinery situation in Ireland can be found here.

Biorefinery news from Italy

Statistics on bioeconomy

The **green economy** is a formidable factor of competitiveness through which Italy has reacted to the crisis of recent years. Statistics are reported in the eighth GreenItaly Report 2017, issued by the Foundation Symbola and Unioncamere, under the patronage of the Ministry of Environment. From the analyses carried out, it appears that in Italy 355 thousand Italian companies (27.1% of the total) industry and services have invested, or will do, in technologies green to reduce environmental impact, save energy and contain CO_2 emissions. See article.

Biorefineries

In Ragusa (Sicily), **Eni has launched an experimental plant for production of algal bio-oil** that can be used by the new biorefinery of Gela for different productions ranging from biodiesel to nutaceutics. The experimental plant, once fully operational, will be able to capture about 80 tons a year of CO_2 and produce about 40 tons a year of algal flour from which to extract bio-oil to be used for Eni's bio-refineries, but also for products for the nutraceutical market.

Workshops on Bioeconomy

The International Forum on Industrial biotechnology (**IFIB**) was held in Rome the last 5 October 2017. IFIB is the only event in Southern Europe entirely dedicated to the bioeconomy, where scientific and industrial research is presented that can foster sustainable economic growth by responding to the challenges of the new millennium: the

search for alternatives to oil and to other fossil energy sources, an increase in the world population and climate change.

Some of the presentations of IFIB speakers are on line. You can find them here.

From 17 to 19 November the **International Exhibition of hemp** was held in Milan at "La Torniera Tortona". In this occasion, among the various initiatives, Federcanapa in collaboration with Fracta sativa organized two interesting events on "The rebirth of hemp in Italy"

The **best start-ups of the industrial biotech** and the bioeconomy were presented to Italian and international investors during the first edition of the Circular Bioeconomy Arena Meeting, which took place (Milan, 22 November 2017, Palazzo Besana).

The protagonists of the Circular Bioeconomy Arena Meeting were:

- **Mogu**: develops innovative green building products made from a new material coming from agro-waste and fungi;
- **Orange fiber**: creates sustainable fabrics for the fashion industry obtained from waste materials deriving from the production of citrus juices;
- **Bioerg**: focuses on the microbial production method to obtain dextran powder;
- Alga-Circle: supports the development of the Trebouxia microalgae on a special wool fabric and extracts its high-value components;
- **Nam**: silicon based airgel highly resistant to extreme temperatures obtained from rice husks;
- **Biofp**: develops an innovative bioprocess for the conversion of value-free substrates into biofuels and biopolymers;
- **Bebp**: aims to exploit biogas to produce biodegradable fuels and plastics.

Two of the major European Venture Capitals in the bioeconomy sector, namely the French Sofinnova Partners and the Dutch ICOS Capital, took part in the initiative

Scientific evidences

The first bi-stage biogas plant in Europe was recently opened in Soliera (Modena). This realization is different from the many traditional single-stage units already available for the innovative technology- patented by ENEA and CREA – that allows it to make significantly higher biogas yields (+ 20% approx.).

Power-point Roundtable Vienna, dd. 24 October 2017

An update on the biorefinery situation in Italy can be found here.

Biorefinery news from the Netherlands

Lignin Riches, a project for scaling up lignin crude

The aim of the InSciTe project Lignin Riches is to transform lignin into an intermediary product crude lignin oil (CLO) via a thermo-catalytic process. This CLO can be used as marine fuel. The company Vertoro plans to scale up the process at the Brightlands Chemelot Campus in Geleen. The pilot scale is a barrel (160 litres) of oil a day. Patent applications are still pending.

Bioasphalt made of lignine

The first bioasphalt bicycle path based on lignine was opened in June on the Campus of Wageningen University & Research. This is a result of research to replace the fossil adhesive bitumen in asphalt with lignine. The bioasphalt is produced according to a patented formulation of 50% lignine and 50% bitumen.

Some EU biorefinery projects with Dutch input

Dutch researchers are involved in several European projects:

- Macrocascade (2016-2020) - viability, and bioeconomic impact of processing cultivated seaweed to create a diverse range of high-value products - BBI JU
- Pulp2Value (2015-2019) - objective is to isolate more valuable products from sugar beet pulp – BBI JU
- Drive4EU (2014-2018) - dandelion rubber and inulin valorisation and exploitation for Europe – EU-FP7
- URBIOFIN (2017-2021) – the objective is to demonstrate techno-economic and environmental viability of an integrated and innovative biorefinery for the transformation of the organic fraction of municipal solid waste (MSW) into new marketable bioproducts, chemical building blocks, biopolymers and additives. - BBI JU

Power-point Roundtable Vienna, dd. 24 October 2017

An update on the biorefinery situation in The Netherlands can be found here.

Biorefinery news from the US

Introduction

The United States' biobased sector and its stakeholders continue to grow and adapt in response to new policy, market drivers, and funding. Recent policy news in the US includes a new bill that allows greater levels of ethanol blends in the United States.

The Bioenergy Technologies Office (BETO) recently announced eight new awards for negotiation focusing on Biorefinery Optimization. The Department of Energy's new pilot- and demonstration-scale biorefinery awards have kicked off. Two commercial scale biorefineries continue operation. The Defense Production Act (DPA) with Round I projects (Fulcrum, RedRock, and Emerald) will be soon expanding with the DPA Round II public announcement that is forthcoming. For fiscal year 2018 BETO has added non-competitive projects from the National Laboratories to its portfolio which will focus on Marine and High Performance Aviation fuels. It was also recently announced that Renewable Energy Group Inc. (REG) recently announced a land acquisition that will enable the expansion of its Geismar, Louisiana biorefinery. Shell and ExxonMobil have announced developments in their biofuels activities. Gevo will begin supplying its renewable ATJ fuel to the Virgin Australia airline. Gevo has also recently announced a collaboration with Los Alamos National Laboratory (LANL) to focus on conversion of Gevo's hydrocarbons to high energy density fuels.

The Bioenergy Technologies Office held its biennial Peer Review in March and hosted its annual conference Bioeconomy 2017 in July. Additionally, three bioenergy workshops were held this summer and another workshop is planned for November.

Recent bioenergy publications and reports include the second volume of the Billion-Ton Report, the Integrated Biorefinery Optimization Workshop Summary report, the Alternative Aviation Fuels Workshop report, and the Algae Cultivation for Carbon Capture and Utilization Workshop Summary Report. These workshops brought together stakeholders from government, industry, and academia to discuss challenges and opportunities currently facing IBR optimization, the growth of alternative aviation fuels, and the use of algae for carbon capture. A summary report from the recent Jet (Jet fuels & Engine co-opTimization) workshop is currently in production with an anticipated release in early 2018.

Policy News

A bill is currently under committee review in the U.S. House of Representatives that would extend waivers for ethanol-gasoline blends greater than 10 percent. H.R. 1311, aims to break down the current "blend-wall" that limits ethanol blended into gasoline to 10%.

The California Air Resources Board (CARB), in February 2016 granted key regulatory approvals to Ensyn Corp. for their Renewable Fuel Oil (RFO) pursuant to the Low Carbon Fuel Standard (LCFS). These approvals permit the production of gasoline and diesel from forest residues at Ensyn's facility in Ontario via RFO co-processing in specific California refineries. The resulting renewable gasoline and diesel were found to have a carbon intensity of ~70% less than petroleum-based fuels.

CARB also held a public meeting in March to discuss allowing alternative jet fuels to generate credits under the LCFS as an opt-in fuel. The potential amendment would be included in the subsequent rulemaking amendment process, and is proposed to go into effect on January 1, 2019. The staff presentation from this meeting is linked here.

The US EPA is proposing a change to the Renewable Fuel Standard (RFS) which would allow renewable fuel produced from biointermediates to generate RINs for existing approved pathways, supporting the growth of advanced biofuels. Under the proposed change, biointermediate producers would be subject to requirements similar to those for renewable fuel producers.

Biorefinery Updates

Department of Energy Secretary Rick Perry announced on September 20th that the Department of Energy (DOE) has selected eight projects for award negotiation up to $15 million in total DOE funding to optimize integrated biorefineries. The selections were made under the Integrated Biorefinery Optimization Funding Opportunity released in January. These projects will work to solve critical research and developmental challenges encountered for the successful scale-up and reliable operations of integrated biorefineries (IBRs), decrease capital and operating expenses, and focus on the manufacture of advanced or cellulosic biofuels and higher-value bioproducts. The eight projects were selected under one or more of the following topic areas:

- Topic Area 1: Robust, continuous handling of solid materials (dry and wet feedstocks, biosolids, and/or residual solids remaining in the process) and feeding systems to reactors under various operating conditions **– Thermochemical Recovery International Inc.**
- Topic Area 2: High-value products from waste and/or other undervalued streams in an integrated biorefinery – **Texas A&M Agrilife Research, White Dog Labs, and South Dakota School of Mines**
- Topic Area 3: Industrial separations within an integrated biorefinery (no projects have been selected from topic area 3**) – No project selected**
- Topic Area 4: Analytical modelling of solid materials (dry and wet feedstocks and/or residual solids remaining in the process) and reactor feeding systems **– National Renewable Energy Laboratory, Clemson University, Purdue University, and Forest Concepts**

BETO has also recently announced selections of projects under the PEAK, ABY 2, and MEGA-BIO funding opportunities.

The two pioneer-scale biorefineries in operation in the US; POET and DuPont continue to work towards production of fuel at commercial volumes.

DOE's six newly selected projects related to the manufacturing of advanced or cellulosic biofuels, bioproducts, refinery-compatible intermediates, and/or biopower have started work.

- **Pilot-Scale:** Global Algae Innovations and Thermochem Recovery International, Inc.
- **Demonstration-Scale:** AVAPCO and LanzaTech, Inc.
- **Pilot-Scale Waste-to-Energy:** Rialto Bioenergy, LLC and Water Environment & Reuse Foundation

Enerkem is moving forward with its plans for a $200M MSW to ethanol facility in Minnesota. The facility plans to use much of the 400,000 tons of MSW produced by Dakota County per year and could be online as soon as 2020.

Fulcrum BioEnergy plans to develop eight waste-to-energy facilities by 2022, including its first 11 million gallon plant currently in development in McCarran, Nevada. Fulcrum's first plant is expected to come online in 2019. The second round of the Defense Production Act has closed and a public announcement on selections is forthcoming.

In June, Shell signed an agreement with SBI Bio Energy Inc. that grants Shell exclusive development and licensing rights to SBI's biofuel technology. SBI has patented a process that is able to convert a variety of oils and greases to lower carbon drop-in fuels.

ExxonMobil and Synthetic Genomics have announced a breakthrough in their algae based biofuels work. They have modified an algae strain to produce up to twice as much oil without significantly inhibiting the growth of the algae.

REG announced in June completion of a $20 million land acquisition to expand their facility in Geismar, LA. REG plans to use the newly purchased land for future developments such as the support of existing nameplate capacity and other future expansion opportunities.
Applied Research Associates (ARA) have their ReadiJet drop-in jet fuel undergoing ASTM certification for commercial use and MILSPEC certification for operational use by the US Navy

GEVO have announced offtake agreement with Virgin Australia Group of Gevo's renewable alcohol-to-jet fuel (ATJ).It is currently expected that GEVO will ship the first gallons of ATJ to the Virgin Australia Group this month. GEVO also announced partnership with Los Alamos National Laboratory (LANL) to improve the energy density of some of GEVO's products such as its Alcohol-to-Jet (ATJ) fuel in order to meet product specifications for military fuels such as RJ-4, RJ-6, and JP-10. LANL was awarded funding in support of this project through the Department of Energy's consortium, ChemCatBio.

Conferences

BETO held its biennial Peer Review in Denver, CO in March. Approximately 192 projects in BETO's research, development, and demonstration portfolio were presented to and reviewed by more than 40 external subject matter experts from industry, academia, and federal agencies. The BETO 2017 Peer Review Report is currently in development. See the report from the 2015 Peer Review here.

Two stakeholder engagement workshops were held in June and one was held in September. The "Workshop on Moving Beyond Drop-In Replacements: Performance Advantaged Biobased Chemicals" was held on June 1 and the "Biofuels and Bioproducts from Wet and Gaseous Waste Streams: Market Barriers and Opportunities (Waste to Energy) Workshop" was held on June 6-7 in Denver, Colorado and Berkeley, California respectively.
The Jet fuels & Engine Co-Optimization (JET) Workshop was held on September 21-22 in Cleveland, Ohio and was focused on these four topic areas:

- High Performance Fuel (HPF) Options
- Engine and Combustor Options
- Aircraft On-Board HPF Considerations
- HPF Development to Deployment Considerations

BETO held its annual conference "Bioeconomy 2017: Domestic Resources for a Vibrant Future" on July 12-13 in Washington, DC. The conference engaged a diverse stakeholder community that spanned the entire bioenergy supply chain. The conference provided a forum to discuss critical issues such as:

- Innovative technologies for the emerging bioeconomy
- The economic opportunities of reliable American feedstock
- New and growing markets for the bioeconomy
- Bioenergy as part of the modern transportation future
- Leveraging the bioeconomy to create new jobs and address global challenges

BETO is planning a workshop to be held on December 12-13 in Golden, CO for its new Advanced Development and Optimization (ADO) program area (formerly Demonstration and Market Transformation). This workshop will solicit input from the stakeholders in order to determine how to best focus the ADO program to build on existing capabilities and create meaningful results that industry can take to commercialization, identify high priority efforts and generate new ideas.

Publications

Recent bioenergy publications include the 2016 Billion-Ton Report (BT16), Volume 2 and workshop summary reports from the Biorefinery Optimization Workshop, the Alternative Aviation Fuels Workshop, and the Algae Cultivation for Carbon Capture and Utilization Workshop. Forthcoming publications include the "2017 Peer Review Report" and the Jet fuels & Engine Co-Optimization (JET) Workshop Summary Report" A full list of recent publications can be found here.

Power-point Vienna Stakeholder Meeting, dd. 23 October 2017

An update on the biorefinery situation in the US can be found here.

Aim of IEA Bioenergy Task42 – Biorefining in a future BioEconomy

The aim is to facilitate the commercialisation and market deployment of environmentally sound, socially acceptable, and cost-competitive biorefinery systems and technologies, and to advise policy and industrial decision makers accordingly. Task42 provides an international platform for collaboration and information exchange between industry, SMEs, GOs, NGOs, RTOs and universities concerning biorefinery research, development, demonstration and policy analysis. This includes the development of networks, dissemination of information, and provision of science-based technology analysis, as well as support and advice to policy makers, involvement of industry, and encouragement of membership by countries with a strong biorefinery infrastructure and appropriate policies. Gaps and barriers to deployment will be addressed to successfully promote sustainable biorefinery systems market implementation.

IEA Bioenergy Task42 Work Programme 2016 – 2018

The priority of the Task42 activities for the 2016 – 2018 triennium all have the objective to further contribute to the market deployment of sustainable biorefineries. The focus will be on international and national networking activities, standardisation and certification of biobased products, policy advice, and the role of industrial and SME stakeholders from the bioenergy and biofuel sectors in the transition to a BioEconomy.

The Work Programme 2016 – 2018 is divided into four main Activity Areas (AAs), viz.:

- Biorefinery Systems – Analysis and assessment of biorefining in the whole value chain
- Product Quality – Reporting on related biobased products/bioenergy standardisation, certification and policy activities at national, European and global levels
- Evolving BioEconomy – Analysing and advising on perspectives of biorefining in a Circular BioEconomy
- Communication, Dissemination and Training – Knowledge exchange by stakeholder consultation, reporting and lecturing

In this Triennium Task42 will deliver several results, which include among others: biorefinery expert system & biorefinery factsheets; biorefinery country reports; three background reports: i) proteins for food/feed and industrial applications (2016), ii) biobased fibrous materials (early 2018), biobased chemicals (end 2018); training activities, thematic stakeholder workshops

Publications IEA Bioenergy Task42 in 2016–2018

Please visit the Task42 website for links to these publications

Bell, G. & E. de Jong, 2016. IEA Bioenergy Task42 – Biorefining in a Future BioEconomy. Webinar and Participation Group Meeting, Bioenergy Australia, 25 May 2016.

Bell, G. & E. de Jong, 2016. What is Australia's biofuel future? Ecogeneration, 28 October 2016.

Bell, G., 2016. Second Generation Bio-Refineries – Implications for Australia. Presentation at Irish Stakeholder Meeting combined with Task42 Progress Meeting, Dublin, Ireland, 19 April 2016.

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Diaz-Chavez, R., H. Stichnothe & K. Johnson, 2016. Sustainability considerations to the future bioeconomy. In: Lamers, P., E. Searcy, J.R. Hess & H. Stichnothe (eds), Developing the global bioeconomy: technical, market, and environmental lessons from bioenergy. Amsterdam; Boston; Heidelberg: Elsevier, pp 69-90.

Hess, J.R., P. Lamers, H. Stichnothe, M. Beermann & G. Jungmeier, 2016. Bioeconomy strategies. In: Lamers, P., E. Searcy, J.R. Hess & H. Stichnothe (eds), Developing the global bioeconomy: technical, market, and environmental lessons from bioenergy. Amsterdam; Boston; Heidelberg: Elsevier, pp 1-9.

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IEA, 95 p, IEA Bioenergy TR2016:04Bell, G. & E. de Jong, 2016. IEA Bioenergy Task42 – Biorefining in a Future BioEconomy. Webinar and Participation Group Meeting, Bioenergy Australia, 25 May 2016.

Mandl, M. & R. van Ree, 2017. Biorefineries in a Future BioEconomy – Activities and Current Results of IEA Bioenergy Task42. Presentation at 4th Central European Biomass Conference, Graz, Austria, 18-20 January 2017.

Mandl, M.G., 2016. Green Biorefining: Grass for Generating Products and Bioenergy. Presentation at Irish Stakeholder Meeting combined with Task42 Progress Meeting, Dublin, Ireland, 19 April 2016.

Mulder, W., 2016. Protein-driven Biorefining: Sustainable Biomass Use for Food and Non-food. Presentation at EUBC&E-2016, Amsterdam, the Netherlands, 6 June 2016.
Ree, R., 2017. The Role of Biorefining and Bioenergy in the Circular Economy. BIOECONOMY POLICY DAY – Session DG ENER, Brussels, Belgium, 16 November 2017.

Ree, R., 2017. IEA Bioenergy Task42, Austrian Biorefining Stakeholder Workshop, Vienna, Austria, 23 October 2017.

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Stichnothe, H., 2016. Palm oil residues for biogas production. In: Mobilising sustainable bioenergy supply chains: opportunities for agriculture : summary and conclusions from the IEA Bioenergy ExCo77 Workshop. Wageningen: IEA, pp 19-20.

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Stichnothe, H., H. Storz, D. Meier, I. de Bari & S. Thomas, 2016. Development of second-generation biorefineries. In: Lamers, P., E. Searcy, J.R. Hess & H. Stichnothe (eds), Developing the global bioeconomy: technical, market, and environmental lessons from bioenergy. Amsterdam; Boston; Heidelberg: Elsevier, pp 11-40.

List of upcoming IEA Bioenergy Task42 events

24th Task42 Progress Meeting Montreal

- Date: Monday 5 – Thursday 8 February 2018
- Place: Fairmont Queen Elizabeth Hotel, Montreal, Qc, Canada
- Monday: Task42 Progress Meeting
- Tuesday-Thursday: BIOFOR – The *International Conference for the Forest-based* BioEconomy (incl. additional ½ day Progress Meeting); participation in IEA Bioenergy panel and oral presentation Ed de Jong @ conference; excursion potentially linked to conference

Task42 Cooperation Opportunities in the 2019-2021 Triennium

- Date: Part of a day during 14-18 May 2018
- Place: Copenhagen, Denmark
- Linked to EUBCE-2018 Conference
- Targeted public: Other Tasks IEA Bioenergy, IEA IETS, FAO, OECD, IRENA, EC DG JRC, ETIP & EERA Bioenergy, DOE, BBI/BIC

Biorefinery Summer School "Zero-waste Biorefineries"

- Date: Early September 2018
- Place: Wageningen, the Netherlands
- Co-organised by Wageningen UR (NL) and INRA (Fra) within framework European BBI ZELCOR project. Task42 potentially will contribute by providing one/more lectures.
- Targeted public: PhD students and young scientists

25th Task42 Progress Meeting San Francisco

- Date: Monday 5 – Friday 9 November 2018
- Place: Hotel Nikko, Masson Street, San Francisco, US
- Monday: Task42 Progress Meeting
- Tuesday: IEA Bioenergy ExCo Meeting; potentially excursion for NTLs T42
- Wednesday: IEA Bioenergy EoT Conference, incl. T42 Session
- Thursday: ABLCNext 2018 Conference
- Friday: US DOE Annual Bioenergy Conference

IEA Bioenergy

Task42 Biorefining in a Future BioEconomy

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