



European Technology and Innovation Platform Bioenergy – Support of Advanced Bioenergy Stakeholders 2016 - 17

Report about facts and figures in bioenergy from the European Biomass Conference and Exhibition 2018

Deliverable Number: 3.8
Due date: 30.06.2018
Submission date: 31.08.2018
Work package 3
Task: 3.2

Lead beneficiary for this deliverable: ETA

Authors: Maurizio Cocchi, Sara Momi, Sophie Kruse

Dissemination level: Public

Grant Agreement No.: 727509

Call identifier: H2020-CE-2016-ETP

Information submitted on behalf of ETIP Bioenergy-SABS

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 727509.



Report about facts and figures in bioenergy from the European Biomass Conference and Exhibition 2018

FINAL

PROJECT PARTNERS

<p>FNR – Fachagentur Nachhaltende Rohstoffe e.V., Germany</p>	
<p>BE2020 – BIOENERGY 2020+ GmbH, Austria</p>	
<p>INCE – CEI – Iniziativa Centro Europea, Italy</p>	
<p>ETA – Energia, Trasporti, Agricoltura Srl (ETA) Florence, Italy</p>	

Table of Contents

- Project Partners..... 1
- 1. Introduction 3
- 1. Biomass resources 4
- 2. Conversion technologies for electricity, heating, and cooling 5
- 3. Conversion technologies for fuels..... 6
- 4. Biomass policies, markets, and integration into the energy system 7
- 5. Workshop Bioenergy Towards 2030 - Needs and opportunities for research and innovation to meet the targets for the next decade 8
- 6. Conclusions.....11

1. Introduction

This deliverable is part of the activities of work package 3 – Bioenergy Sector Monitoring, of the project ETIP Bioenergy SABS. Under this work package the Consortium monitors the development of bioenergy technologies and aims to provide relevant information to the bioenergy community on the website of ETIP Bioenergy, in a structured way. The monitoring of the Consortium targets eight topics: biomass resources, supply systems, conversion technologies, biorefinery concepts, end products, policy and sustainability, market analysis from the demand side and regional information. A special focus is put on the main focal bioenergy areas for ETIP Bioenergy, that is advanced bioenergy conversion pathways and their implementation. These topics are extensively addressed in the programme of the annual European Biomass Conference and Exhibition (EUBCE). The EUBCE is an annual event organized by ETA-Florence, whose technical programme is shaped by a scientific committee of over 140 experts and is coordinated by the European Commission, Joint Research Centre. The 26th edition of the European Biomass Conference and Exhibition was held in Copenhagen from 14 to 18 May 2018. The event featured 811 presentations, 4 parallel events and 8 workshops.

In this framework, this report offers a selection of the main findings about the topics relevant for the terms of reference of ETIP Bioenergy, with a short summary for each presentation and the link for direct download of the relative paper and slides, or poster. Most of these findings derive from the official highlights of the conference which were presented by the Technical Programme Chairman, during the closing session of the conference. Only the highlights for which a paper and the related slides were available in the proceedings are mentioned in this document.

The findings are organized according to the following five topics: 1) biomass resources; 2) conversion technologies for electricity, heating and cooling; 3) conversion technologies for fuels; 4) markets, policy and bioenergy integration into the energy system.

In addition to these highlights, a section of this report is dedicated to introducing the results of the workshop “Bioenergy Towards 2030” that was organised by ETA and FNR in the framework of the ETIP Bioenergy SABS project. as side event of the EUBCE.

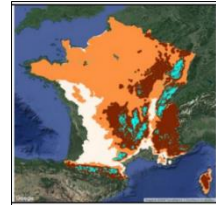
The official conference highlights, and all the slides and papers mentioned in this document are available with open access in the [Proceedings of the 26th European Biomass Conference and Exhibition](#).

The report complements Deliverable 3.7, which had summarised the key outcomes of EUBCE 2017.

1. Biomass resources

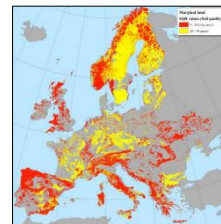
Climate change might impact the future availability of feedstock for biomass plants

This paper presents the results of a study on potential effects of global warming on the distribution and the productivity of five forest tree species used in France for the supply of feedstock to biomass plants. The assessment of the potential distribution of these trees in 2050, by using the IPCC RCP6.0 scenario, indicates an average decrease of 22% of the plots where these species could grow compared to the present time, except for mountain areas which would maintain high probability of development of these species. The scenario finds that the Net Primary Productivity (NPP) of the species could also decrease by 2050 for 93% of the plots while increasing in mountain areas. [Link](#)



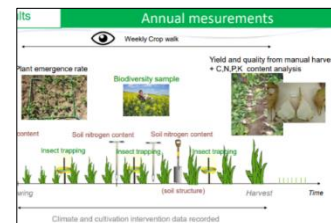
GIS tools for available for the spatially explicit assessment of marginal lands in Europe

This paper presents some of the results of the SEEMLA project, which has developed an algorithm and a set of tools to support the explicit identification and mapping of marginal lands in Europe, as well as the assessment of their potential for biomass production. Alternative exploitation scenarios are developed for each class of marginal land, based on climatic zone and crop suitability. [Link](#)



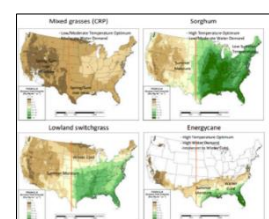
Integrated food and non-food bioeconomy oriented cropping systems are emerging

This paper describes the status and the preliminary results of the French project *Demonstrating Sites Network*, which aims to demonstrate how it is possible to produce sustainable and efficient bioresources in the current cropping systems of Northern France. The growth of the bioeconomy in Europe requires the production of biomass for a wide range sectors, innovation in production systems is required to produce sustainable and efficient bioresources, while preserving agro-ecosystem performances. In this project eighteen different cropping systems are being tested in long-term field experiments and a regular monitoring of the agro-ecosystem performances is performed. The expected output of these experiments is to provide references about performances, impacts and ecosystem services of bioeconomy oriented cropping systems, as well as tools and methods to optimize biomass production and mobilization. [Link](#)



Accurate mapping of the biomass yields for various energy crops confirms a 1 billion tons biomass potential in the US

These slides present the results of the multi-year Sun Grant Regional Feedstock Partnership started in the US in 2007 with the goal of supporting the realization of the biomass potential envisioned in US DOE's 2005 Billion Ton Report. The partnership sought to increase the knowledge of bioenergy through coordinated feedstock research across the lower 48 states and Hawaii with partners in academia,

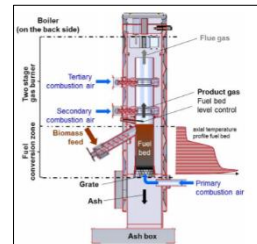


government, and private industry. Results confirmed the availability of a theoretical biomass potential above one billion tons annually in the United States. [Link](#)

2. Conversion technologies for electricity, heating, and cooling

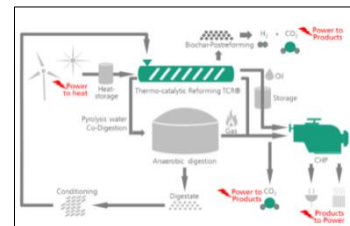
Ultra-low emissions and fuel-flexible residential biomass heating becoming possible thanks to innovative air staging technology

This paper describes the encouraging results obtained in the development of fuel-flexible and low-emission boilers for space heating. The PuroWIN technology described here allows for the utilization of softwood pellets and high-quality wood chips in small-scale boilers, with almost zero CO, OGC and PM emissions. FlexiFuel-CHX, an ongoing Horizon 2020 project is developing solutions to broaden the fuel range applicable to PuroWIN, as well as to improve its efficiency by the implementation of a novel flue gas condenser concept. [Link](#)



Integrated process based on intermediate pyrolysis, gas cleaning and catalytic reforming ready for industrial applications

This paper shows the development and the operation of a plant based on the Thermo-Catalytic Reforming process (TCR®), a technology which converts bio-residues and solid organic wastes into hydrogen-rich gas, and storable high-grade liquid fuels, which can be directly used for power production. An industrial plant was designed for a throughput of 300kg/h and an electrical output of 250 kW. [Link](#).



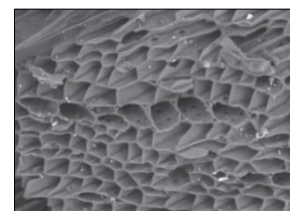
New open source gasifier control unit developed

This study describes a novel instrumentation and control system which was developed for measuring gasification parameters such temperature, pressure, mass flow and gas composition. The Gasifier Control Unit (GCU) system is low cost and with an open source protocol, allowing other developers to benefit and expand the core of this research. Robust instrumentation systems were installed on a downdraft gasifier system to allow real-time monitoring and automated optimization of the gasification process using feedback control systems. The results from preliminary runs are also presented. [Link](#)



Gasification char used for hot gas filtration in micro-scale power plants

Char is a carbonaceous gasification by-product often used as soil amendment due to its high porosity and recalcitrant structure. This paper investigates an alternative use of gasification char as a filtering medium for producer gas in small-scale gasifiers. Two metallic candle filters filled with about 1 kg of gasification char each were fabricated and tested under different temperature conditions, with encouraging results. [Link](#)



3. Conversion technologies for fuels

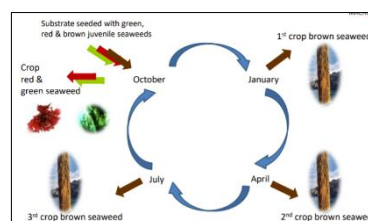
Innovations in pre-treatment and fermentation technologies for lignocellulosic butanol production and other results of ButaNext

This paper presents the results of the ButaNext project which demonstrated the techno-economic feasibility of the conversion lignocellulosic feedstocks into biobutanol through the integration of different technologies. The project achieved several industrially exploitable results, such as the construction and operation of a micronizing prototype for controlled biomass particle size production; the development of a flexible fractionation process based on the combination of the micronizing prototype with a continuous thermochemical pre-treatment; a tailored enzyme cocktail to facilitate the hydrolysis of pre-treated biomass to monosaccharides; a Clostridial strain able to ferment cellulosic sugars effectively, and other results. [Link](#)



The cost drivers of seaweed-based biofuels

These slides present the technical achievements and an economic model developed by the MacroFuels project, which aims to produce sustainable biofuels from seaweed. Based on reliable field data, the major cost drivers of two seaweed to biofuels pathways are described. [Link](#)

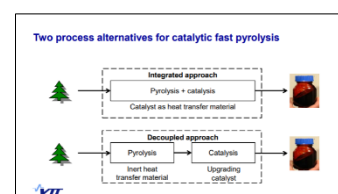


Valorisation of lignin-rich ethanol co-products by hydrothermal carbonization and activation

The study reported in this paper aims to valorise lignin-rich co-product from 2G ethanol processes as precursor in activated carbon manufacturing. In particular, hydrothermal carbonization (HTC) was investigated as a pre-treatment step for producing suitable AC precursor. [Link](#)

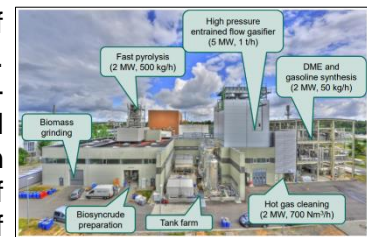
Steel industry slags applied as novel cost-efficient catalysts in the fast pyrolysis of biomass

Slags from metallurgical industry are cost efficient alternatives to acidic zeolites as catalytic materials in fast pyrolysis. This paper presents the results of a study of slag from the steel industry which was desulphurized in a blast furnace and then used in the fast pyrolysis of pine sawdust. Results of analytical pyrolysis indicate that slags can modify product distribution. In the bench scale run, the use of modified slag led to oxygenated bio oil compared to fast pyrolysis with sand. However, bio oil yield decreased simultaneously as typically in catalytic fast pyrolysis. [Link](#)



Technical Modifications Improving Operational Stability at the Bioliq® Fast Pyrolysis Plant

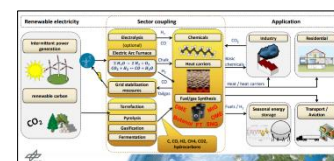
The Bioliq® process developed at KIT aims at the conversion of lignocellulosic biomass into synthetic biofuels and chemicals. The process follows a two-stage concept combining decentralised pre-treatment of biomass by fast pyrolysis and centralised large scale gasification and synthesis. Completed in 2008, the fast pyrolysis plant at KIT underwent a series of technical modifications in 2013, which improved the stability of operation and the relevance of results. This paper presents the modifications performed in more detail along with their effects on the plant. [Link](#)



4. Biomass policies, markets, and integration into the energy system

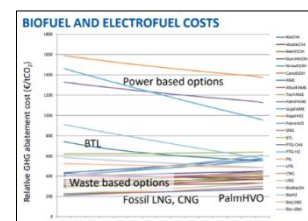
Prospects of biofuels in the transport sector and in aviation in particular

The decarbonization of the transport sector requires the transition from fossil to renewable energy sources. While electric vehicles may become a viable option for individual car traffic, aviation, shipping and heavy-duty transportation will continue to rely on liquid fuels. Biofuels can replace a large share of fossil fuel in these sectors. However, the usage of biofuels within transportation is only reasonable with significantly reduced Greenhouse gas (GHG) emissions compared to fossil fuels and lower GHG abatement costs compared to other carbon mitigation technologies. In this paper a detailed discussion of biofuels prospects in Europe is presented. [Link](#)



Modelling Least-Cost Deployment of Biofuels for Achieving Climate Targets in Germany under the Renewable Energy Directive II-Proposal

This work assesses the competitiveness of all relevant options for achieving greenhouse gas (GHG) abatement targets in the scenario of the RED II, and it compares all types of biofuels with other competing solutions such as electrofuels, which are considered as necessary for the achievement of the 2030 targets, although still not cost competitive. [Link](#)



Regional and landscape-based approaches to facilitate bioenergy development

This work provides new insights on which regional and landscape-based approaches are more legitimate and effective in measuring and documenting sustainability of bioenergy and biomaterials supply chains, compared to traditional governance systems. The results provide insights into the criteria and the elements that can

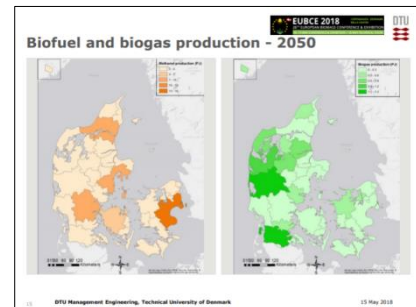


define an effective and legitimate regional governance system. [Link](#)

A holistic approach for integrated bioenergy solutions in future energy systems

In this paper bioenergy is modelled as an integrated part of the future energy system of Denmark. The results of this study show that biomass plays a key role in particular when transforming the transportation sector to a renewable-base sector. Other results indicate positive systems benefits from the extensive production of biofuel, such as an efficient utilisation of excess heat in the Danish district heating network, and flexible production of hydrogen, which can help to balance the power system.

[Link](#)



5. Workshop Bioenergy Towards 2030 - Needs and opportunities for research and innovation to meet the targets for the next decade

In the framework of the 26th European Biomass Conference and Exhibition held in Copenhagen, ETIP Bioenergy with the support of ETA and FNR organized the workshop “**Bioenergy towards 2030 - Needs and opportunities for research and innovation to meet the targets for the next decade**” on the 16th May, 2018.



The event provided an overview on the current policy, market trends and expectations for the future of the bioenergy sector in European Union. Speakers presented their analysis on several aspects of renewable fuels and bioenergy, from the policy framework to research funding, from the technologies currently available to the final products. The agenda addressed several EU initiatives, such as the implementation of the EU Energy Union, the status of SET-Plan Action 8 – Renewable fuels and bioenergy as well as the scenario for the adoption of Horizon Europe, the new framework programme for research and innovation 2021 – 2027. The event provided a clear picture on how all those aspects are already interacting together and what can be achieved at EU technology and market level, considering the high competition worldwide. Experts from relevant EU-level institutions, academies, companies and associations dealing with the bioenergy sector intervened. Here are highlights and take-home messages from their presentations:

Patrik Klintbom, Chair of ETIP Bioenergy Platform, chaired the first session. He introduced the work done by ETIP Bioenergy Platform with the technical Working Groups and dedicated activities tailored to EU stakeholders. He underlined the need to catch all the possibilities offered by the EU framework in terms of policy and market. **“We need to set a higher pace**

in the implementation of bioenergy. We can do so much with bioenergy. There is so much out there” he said.

Maria Georgiadou (European Commission DG RTD) presented the opportunities and needs for research, development and innovation offered by the European Union. Policy pillars for bioenergy are: Energy Union, SET-Plan and Horizon 2020 Framework Programme. For all, **bioenergy is a relevant asset to put Europe at the forefront of innovation in sustainable energy production.**

Birger Kerckow (FNR - Fachagentur Nachwachsende Rohstoffe e. V.) provided the context in which the update of the Strategic Research and Innovation Agenda (SRIA) of Bioenergy is under preparation. The current version of the SRIA (2016 ed.) contains still valid insights (i.e. on considered value chains) which can partially feed the **updated SRIA expected in 2018.** Decision should be taken on the SRIA scope and the opportunity to broaden it, including large-scale/commercial systems, while considering what has been done by other EU platforms (i.e. the Heating and Cooling Platform) and avoiding the doubling of efforts among EU platforms.

Relevant inputs for advanced biofuels potentials were provided by Thomas Schleker (European Commission DG RTD) presenting the DG RTD study “Research and Innovation perspective of the mid- and long-term potentials for advanced biofuels in Europe” Beyond scientific evidences, encouraging results are the following:

- **R&I measures can significantly increase the availability of biomass by 2050** – by up to 120% as compared to the reference to the reference scenario in 2020;
- R&I measures are estimated to lead to more biomass being available from agricultural and forestry sectors at lower costs;
- Advanced biofuels can help achieve the EU climate and energy goals;
- Through targeted R&I policies for feedstock utilization and conversion technologies, **advanced biofuels could to meet around 50% of the EU transport sector’s energy demand;**
- Even if both advanced biofuels and electrification are necessary to cover overall demand in passenger transport, **advanced biofuels can be considered as the main alternative for aviation, maritime, and heavy-duty road transport.**



Wolter Elbersen (Wageningen UR), spoke about the relevance for bio-commodities to link the available biomass potential to the European feedstock and fuel needs in the coming decades. Lignocellulosic biomass for Non-Food applications (bio-based products, biofuels and bioenergy) is expected to grow significantly in the coming decades A solution for all the needs around biomass and its multiple use is to have “**bio-commodities**” and a related international trade market (where characteristics such as fungibility, standard, sustainability etc. are respected). Focus should be on **full biomass-to-products value chains** tackling both technical and non-technical bottle-necks and involving full chain stakeholders.

Jeffrey Skeer (IRENA International Renewable Energy Agency) gave insights on biofuel innovation from IRENA’s patent database. He showed that data regarding patents on

cellulosic bioethanol products are reporting a **growing trend**; more than half a million patents in renewable energy, 15% are for bioenergy and 9% specifically for biofuels; the bulk of patents have been filed for grain bioethanol, **cellulosic bio-ethanol, bio-diesel, and bio-pyrolysis**.

Juan Carrasco (EERA European Energy Research Alliance) presented the Joint Research and Development Program for the alignment of research activities with industrial priorities in Europe. The main and priorities are: the increase of biomass availability, the minimization of the net carbon used for the production of agricultural biomass, and the evaluation of the impact of non-food crops biomass production in representative farms context.

Kees Kwant (BESTF/ERA-Net Bioenergy) explored the ERA-NET Calls in the bioenergy and alternative fuels sector. Results from such initiatives are important in terms of creation of valuable demonstrations pathways, but for having good projects there is a need to leverage on national research through EU collaboration. There is also a need for greater participation of SMEs; it could be not an easy scheme for funding agencies.

Rainer Janssen (WIP Renewable Energies and president of the Association of European Renewable Energy Research Agencies) transmitted views coming from EU research centres and universities working in renewable energy sector on next Framework Programme for research and innovation (FP9/Horizon Europe). He emphasized the **important role of the official platforms such as ETIP Bioenergy and other platforms in next Horizon Europe** since their representative composition equips them well to suggest R&D priorities to EU institutions and citizens.

A panel debate with a discussion open to the audience was moderated by **Antti Arasto**, Vice Chair of ETIP Bioenergy Platform, about the topic: *what outlook and which priorities for bioenergy in the European research and innovation agenda towards 2030?*



The main take-home lesson of this workshop is that Research and Innovation support and political framework need to go hand in hand for getting advanced biofuels (products and technologies) an established reality in the market. All technologies with a potential confirmed by evidence (e.g. decentral biomass conversion units at a scale compatible with regional biomass supply, on integration with fossil refineries) have to be fully exploited, as a strategic asset of the European Union in the sector.

The slides of the presentations, the agenda and the full event report are available [here](#).

6. Conclusions

Although this report can show only a partial representation of the global trends in bioenergy, it provides an indication of the recent progresses achieved in the various segments of the biomass sector and especially in research and innovation activities. Some main conclusions can be drawn:

- There is an increasing amount of data, whose level of detail is also increasing, about the theoretical and economically exploitable biomass potential in Europe and globally;
- Results of several modelling studies about biomass potentials are being validated by field data, and they indicate that there are significant margins for sustainable biomass production from both arable land and marginal land;
- There is a growing number of research activities aimed at developing and demonstrating effective systems for the integration of food and non-food crops for bioenergy and the bioeconomy;
- Thanks to the technological progress in small-scale biomass combustion, it is becoming possible to diversify the range of feedstock usable for heating, while minimizing emissions from biomass boilers;
- Several research initiatives are targeting the valorisation of co-products from biomass conversion pathways for use in other industrial processes;
- Both research and industrial demonstration activities are achieving progresses in the increase of resource efficiency and in the optimization of conversion processes for advanced biofuels.

Finally, this overview confirms the importance of maintaining a continued effort in research and innovation and highlights the results that can be achieved by national and international collaborative projects, involving research organizations, industries and SMEs, for the continuous improvement of the bioenergy sector.