

EERA Bioenergy NEWS

Issue 5 December 2015

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Review and the Way Forward

**Juan Carrasco,
Joint Programme
Coordinator**



We are approaching the end of the first year of the European Energy Research Alliance (EERA) Bioenergy Joint Programme (JP) 2015-2017 and now is a good time to look back on the work we have undertaken during the past year to help us achieve the expected objectives to increase the level of activity and, in particular, to improve the level of integration of the various activities within our JP.

The year 2015 kicked off with an excellent start for our JP, when the pilot project presented to the



EERA ExCo call, which was launched in November 2014, was finally selected as one of the three higher ranking projects presented by the various EERA Joint Programmes. Even though, funding for the pilot project by the Strategic Energy Technology (SET) Plan Steering Committee did not finally materialize, the above mentioned selection can be taken not only as a very positive indication of the quality of the work presented, but also of the strategic importance of bioenergy within EERA AISBL (International Non-Profit Organization).

Continued on next page



Reviews of two of the EERA Bioenergy workshops can be found on pages 4-6.





Figure 1: During 2015, EERA Bioenergy held seven workshops around Europe.

During 2015, a total of seven EERA Bioenergy workshops were held, and at least two additional ones have been postponed to the first few weeks of 2016. These workshops represent about half of the original 15 foreseen to be organized at the start of 2015. Although the number of events finally held is modest compared to the expectations, it more than doubles the number of EERA Bioenergy workshops organised in 2014. Moreover, all workshops have shown a good level of participation in general, and relevant conclusions and further work plans have been reported, which include the elaboration of two joint proposals to Horizon 2020 calls. Further information about next year's workshops will be available on the EERA Bioenergy website shortly

(www.eera-bioenergy.eu).

In October 2015, an expression of interest with three priority topics has been launched by the EERA Bioenergy JP Management Board to all EERA Bioenergy members for elaboration of proposals in response to the call LCE 33 (supporting the Strategic Energy Research Agenda, of the Secure, Clean and Efficient Energy Programme 2016-2017). The call has been attended by a total of 22 out of the 36 participants in the JP, which can be considered quite a satisfactory participation level.

EERA Bioenergy, as in previous years, was promoted at the European Biomass Conference and Exhibition. This year the event was held in Vienna in June, and as part of EERA

Bioenergy's strategy for raising awareness of the JP on an international basis, we jointly organized with the Conference organizer ETA, the second Europe-Asia Bioenergy Forum. This was attended by representatives from 37 universities and research organizations from ten European and seven Asian countries. The event was very well received and further activities are under study (including the elaboration of an ERA-Net proposal in the short term) with the purpose to create a stable collaborative framework between European and Asian R&D organizations in bioenergy matters.

During 2015, the EERA Bioenergy JP has participated in several meetings and working groups to assess the future governance of the new EERA AISBL. These meetings were mainly attended by the Joint Programme Coordinator and have counted with the support of the Joint Programme Management Board. Many of the decisions that are already being taken by the EERA AISBL

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See pages 17 and 18 for details about another European and Asian collaboration: ECOFUEL

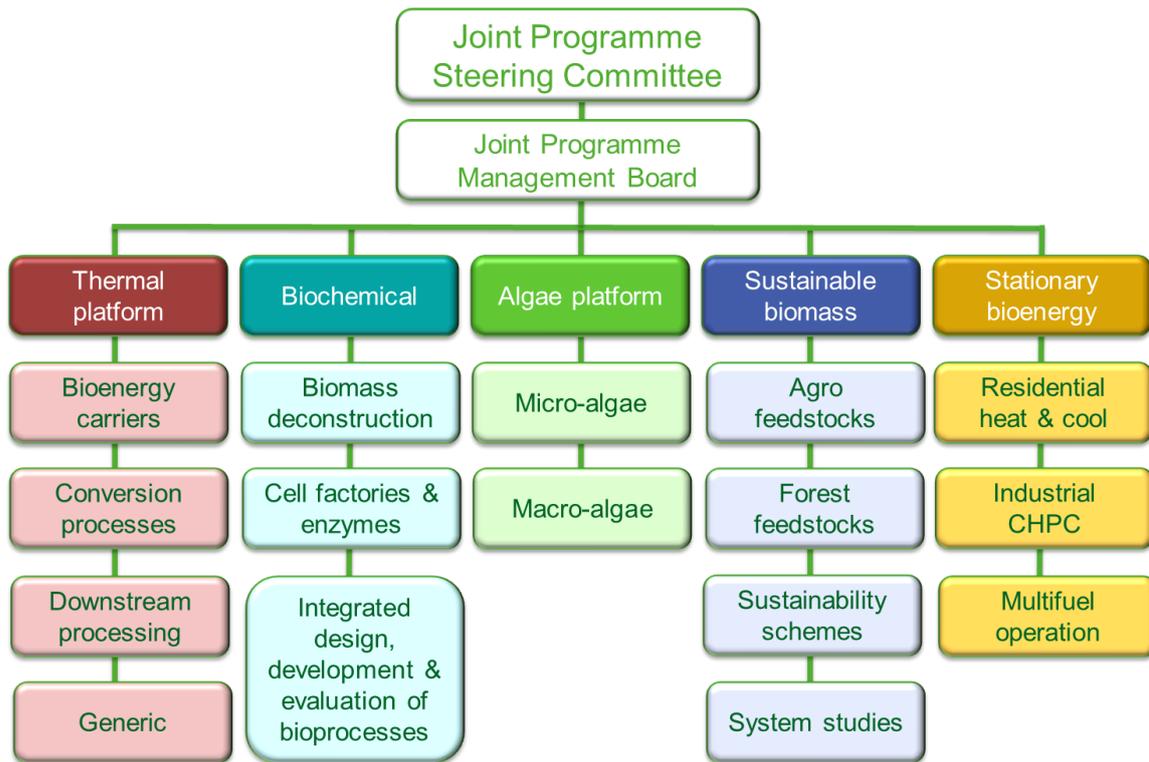


Figure 2: The structure of EERA Bioenergy.

ExCo will also affect the governance of our JP as well, in the future. Moreover, in the proposal of the new SET-Plan Agenda which is under discussion, EERA is clearly recognized as an implementing pillar of the SET-Plan for the development of both the

medium- and long-term agenda, and the Joint Programme Coordinators have been invited to provide their own inputs and issue papers to the SET-Plan Steering Committee, which will be an important assessment task to be envisaged for 2016.

In the context of global analysis, I think we can be moderately optimistic about the success of the strategy initiated in 2015 in order to promote the number of activities and to improve their level of integration in our JP. Further efforts, however are needed and to this purpose the JPMB has elaborated a new set of activities and different initiatives for 2016 that will be presented at the next JPSC meeting to be held on January 13, 2016. It is expected that the work to be carried out in 2016 will be a new step ahead for EERA Bioenergy, enabling it to

become a top actor for advanced bioenergy research, while obtaining significant support from the Horizon 2020 and other European Commission calls for the JP members. The JPMB and I hope we can continue working with all of you, members of EERA Bioenergy, in order to achieve these objectives.

Wishing you a merry Christmas and a very happy 2016.

Juan Carrasco
Programme Coordinator
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“It is expected that the work to be carried out in 2016 will be a new step ahead for EERA Bioenergy, enabling it to become a top actor for advanced bioenergy research.”





Karin Willquist
SP Technical Research
Institute of Sweden

EERA Bioenergy SP2 Workshop, 3 November, 2015 Lund, Sweden

A one-day workshop was organized by SP Technical Research institute of Sweden at the University building in Lund 2015. 30 participants were present from 20 pan-European institutions (5 industries and 15 research institutions). The workshop was followed by an open Symposium on 4th November organized by Lund University.

The goals of the workshop were:

- Networking;
- Identifying core research questions relevant for valorization of lignin and hemicellulose and commercialization of the products;
- Initiation of new ideas;
- Forming clusters for upcoming H2020 and similar calls.

The event was organized in three main parts:

The day started with a plenary session where an introduction to EERA Bioenergy and the biochemical Sub Programme (SP 2) was made. The researchers then gave a short description of themselves and their area of interest. Key challenges in the lignin and hemicellulose valorization value chain from an industrial perspective were then given by the keynote speakers:

- Fredrik Gellerstedt (representing SÖDRA a

- forest and pulp and paper industry in Sweden);
- Lisa Steudle (representing Technaro a lignin valorization SME in Germany);
- Hans Grundberg (representing Domsjö Fabriker a biorefinery industry in Sweden);
- Anne Stenbeak (representing Novozymes a large enzyme producing industry in Denmark).

Finally a presentation of upcoming calls was given to inspire the discussions in the afternoon.

The second part of the day was devoted to a ‘pressure cooker’ session, where the participants were divided into four groups; two focused on lignin valorization and two on hemicellulose valorization.

The group discussions were led by the moderators Richard Gosselink, Karin Willquist, Francisco Gírio and Michael O’Donohue. The discussions focused on previously defined challenges from the industrial key note presenters and the complementary research addressing those challenges from the researchers. In the second pressure cooker session, the four groups were merged to two and the discussions were guided using upcoming calls selected by the groups.

The day finished with a plenary session to sum up the discussions and develop an action plan for future activities. The future actions will be



Figure 1: The pressure cooker session where lignin and hemicellulose valorization challenges were discussed in four groups.

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Figure 2: The fruitful discussions continued during the coffee breaks in the University Building in Lund.

Biochemical Sub Programme 2

**Coordinator: Francisco Gírio
LNEG, Portugal**



There are three Work Packages (WP) covering pre-competitive R&D topics as follows:

- **WP1 - Biomass deconstruction** aims at further deployment of the sugar route by exploring the possibilities to adapt lignocellulosic biomass to the processes, by developing novel pre-treatment technologies and by integrating process steps.
- **WP2 - Cell factories and enzymes:** Major goals include the improvement of enzymatic hydrolysis, the efficient microbial conversion of sugars into biofuels or biofuel-precursors and integration of these two bioprocesses, preferentially in a consolidated bioprocessing system.
- **WP3 - Pilot scale and modelling** aims at identifying and defining joint research efforts to overcome current barriers at pilot and demonstration scale in ethanol and higher alcohols biological conversion paths, and on the deployment of biological and/or chemical processes to produce renewable hydrocarbons from carbohydrates containing biomass.



Figure 3: Lisa Steudle from Technaro GmbH was one of the key note presenters at the plenary session of the workshop highlighting the opportunities of lignin valorization and the challenges yet to be solved.

followed up via a members only LinkedIn group initiated by SP.

The organizing committee Karin Willquist (SP), Richard Gosselink (WUR), Michael O'Donohue (INRA), Francisco Gírio (LNEG) and Gunnar Lidén (LU), would like to thank all participants for a very interesting day with a lot of fruitful discussions and relevant challenges to further explore in the future.

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Stationary Bioenergy

Sub Programme 5—Review of Workshop



Sub Programme 5 Coordinator

Michael Becidan
(SINTEF, Norway)

EERA Bioenergy SP5 Workshop, 15-16 June, 2015 ECN, Petten

A two-day EERA Bioenergy SP5 Stationary Bioenergy workshop was organized by SINTEF (SP5 coordinator) and ECN at ECN's facilities in Petten, the Netherlands. 17 participants from 13 R&D institutions and 11 countries were present.

The goal of the workshop was four-fold:

- Networking - direct contact between researchers;
- Overview of partners' activities, competence and infrastructure;
- Initiation of ideas/proposals for Horizon 2020 (H2020) 2016 calls,
- Discuss possible follow-up activities.

The event was organized in three main parts.

Firstly, each participant had the opportunity to present its institution with focus on its SP5-relevant activities and infrastructure. This was done in a plenary session allowing

everybody to get a better insight into SP5 competence, equipment, facilities and project portfolio.

Secondly, ECN organized a site visit of its Petten facilities with a focus on thermal conversion reactors and associated analytical equipment. A special thanks go to Jaap Kiel and Mariusz Cieplik for this very impressive and instructive visit.

Thirdly, during the second day, parallel sessions were organized for the SP5 Work Packages detailed below:

- Domestic/residential heating and cooling (including micro CHP);
- Industrial and municipal combined, heat power and cooling (CHPC);
- Utility multifuel operation.

The parallel sessions were discussions around the current draft of the H2020 Energy Work Programme. The main goal of these sessions was to initiate, discuss and develop possible ideas or concepts for H2020 project proposals in 2016. Lively exchange of ideas and opinions took place and we hope that

they may ultimately lead to projects in the not-so-distant future.

Michael Becidan presented an update on the latest EERA developments and a short overview of funding opportunities beyond Horizon 2020.

We wish to thank all participants who actively took part in the workshop. All presentations (including short summaries of the parallel sessions) are available on the EERA Bioenergy SP5 eRoom (reserved to participants) and can be obtained from Michael Becidan, SP5 Coordinator.

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Figure 1: 17 participants from 13 R&D institutions and 11 countries were present at the EERA Bioenergy SP5 workshop held at ECN in the Netherlands.



Inés del Campo
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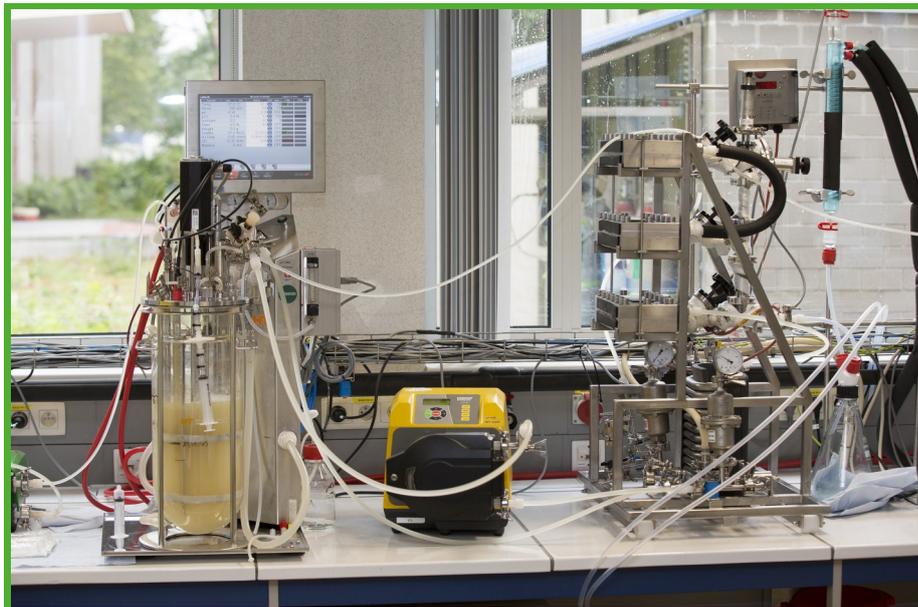


Figure 1: Fermentation and the in situ Product Recovery (ISPR) system at lab scale in VITO's laboratories (Belgium).

Biobutanol is an attractive advanced biofuel with superior fuel properties. It fits the existing fuel infrastructure; has a higher energy density (similar to petrol/gasoline) and has shown better performance properties than ethanol and biodiesel; however it has not yet been established in the market due to some technical and economic barriers.

The ButaNexT project aims to overcome some of those barriers by developing and demonstrating, at pilot scale, a novel integrated process for producing cost-competitive biobutanol from sustainable renewable feedstocks. The partnership includes a multidisciplinary team formed by several SMEs (Green Biologics Ltd. -coordinator, Dyadic Netherlands, E4TECH, CTECH, Zabala Innovation Consulting and Greenovate! Europe) one large enterprise (Técnicas Reunidas) and three research organisations (CENER, VITO and University of Castilla La Mancha), based in four European countries (United

Kingdom, Netherlands, Belgium and Spain). Together they will develop new technologies that will allow for the reduction of biobutanol production costs through the diversification of sustainable feedstocks, the improvement of conversion yields and efficiency, and a reduction of energy requirements and water usage.

More specifically the key project differentiators are:

- A focus on sustainable feedstocks (wheat straw, *Miscanthus* and organic fibre from municipal waste) that are not only low cost but also offer tremendous societal and environmental benefits relating to waste minimisation and GHG emissions reduction.
- The design and construction of a capital-efficient biomass milling process that significantly reduces

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Partners

Coordinator

- Green Biologics Ltd

SMEs

- Dyadic Netherlands
- E4TECH
- CTECH
- Zabala Innovation Consulting
- Greenovate! Europe

Large enterprise

- Técnicas Reunidas

Research organisations

- CENER
- VITO
- University of Castilla La Mancha



Figure 2: Vehicle testing facilities at University of Castilla la Mancha (Spain).

feedstock particle size. The net result is higher conversion yields in subsequent stages and a lower energy balance. The technology developed by Tecnicas Reunidas, is relatively simple, scalable and can be applied to difficult feedstocks as hard-wood biomass (willow, oak) and waste processing food (olive pits, apricot pit)

- The development of cellulase enzyme cocktails specifically for *Clostridium* taking

advantage of, *Clostridium*'s unique fermentation characteristics. Dyadic aims to reduce the number of enzymes required and the enzyme loading reducing hydrolysis time and more significantly enzyme cost.

- The redesign of the conventional solvent fermentation known as the ABE process named after the three products; acetone, butanol and ethanol. Greenbiologics' advanced microbes produce butanol

as the sole fermentation product in high yield. This significantly reduces the need and cost for distilling three separate products and lends itself to new energy efficient separation methods.

- The use and integration of a method for *in situ* butanol removal using pervaporation developed by VITO (Figure 1). This method reduces end product inhibition resulting in a step change in overall solvent titres and productivity. This novel approach also allows the use of more concentrated sugar streams reducing feedstock dilution and overall water balances. It results in lower energy costs in the downstream processing compared to the conventional distillation section for product purification.
- Demonstrate the efficacy of using biobutanol as both a fuel extender of conventional fuels (gasoline and diesel) but also as a superior fuel additive that improves the properties of existing biofuel blends based on either biodiesel or ethanol. This work will be developed by the University of Castilla La Mancha (Figure 2).

All process stages and technologies mentioned above will be integrated, optimized and demonstrated in a pilot facility owned by CENER and located in Aoiz-Navarra, Spain (Figure 3). In addition, E4TECH will demonstrate significant societal impacts relating to waste

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Figure 3: CENER's Second Generation Biofuels plant in Aoiz (Spain).

minimization, reduced air pollution, reduced GHG emissions and job and wealth creation within the EU. Finally, CTECH, Zabala and Greenovate will be in charge of the development of the exploitation plan, supporting coordination and management and dissemination activities, respectively.

ButaNexT is supported by the Horizon 2020 Programme of the European Commission and runs from May 2015 until April 2018.

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Jeremy Pruvost
University of Nantes, France

AlgoSolis is a new public facility from the University of Nantes and CNRS (France). It has been designed to address R&D issues related to the setting of a sustainable microalgae industry, by providing the scientific and technological environment for the development of mass-scale, controlled and efficient exploitation of microalgae. Its key features are as follows:



Figure 1: Microalgae research at AlgoSolis.

- 1500m² of biomass production area;
- 350m² thermoregulated greenhouse;
- 20 lines of biomass production;
- Possibility of microalgae culture on industrial emissions (flue gas, liquid waste);
- Fully equipped downstream processing R&D unit for production of raw and refined microalgae biomass.

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Downstream processing R&D unit

Biomass conditioning and storage area

Intensified photobioreactors area

Biofaçade for microalgae cultivation

Low-cost cultivation systems

Solar outdoor cultivation area

- Production area: 1500m² (350m² in thermoregulated greenhouse)
 - Downstream processing R&D unit: 240m²
- Total funding budget (infrast.+equip.): 3.8M€*

Figure 2: Schematic of the AlgoSolis facility.



Figure 3: Process optimization.

Applications

AlgoSolis services can address many fields of application including:

- **Food and feed** - proteins, lipids ω 3, carbohydrates;
- **Cosmetics and health ingredients** - pigments, texturing agents, nutrients;
- **Green chemistry** - plastics, bio-based bitumen, bio-based molecules;
- **Biofuels** - bio-diesel, bio-kerosene, methane, hydrogen;
- **Depollution** - CO₂ valorization, waste-to-value approaches for bio-

valorisation of phosphates, nitrates, sulfates, metals etc.

AlgoSolis services focus on the screening of algae strains and metabolic optimisation including:

- Industrial strains portfolio;
- Screening and characterisation of new strains;
- Metabolic engineering for strains optimisation.

Process Development and Optimization

- Cultivation, harvesting and biorefining: characterization of existing technologies and

development of innovative technologies, demonstration of industrial feasibility, process optimization, environmental impact and life cycle analysis;

- Characterization, optimisation and evaluation of processes for microalgal biomass dewatering, harvesting, and biorefining;
- Biorefining: development of harvesting and extraction methods of molecules of interest (i.e. biomass fractionation, metabolites

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Figure 4: Infrastructure.



Figure 5: Microalgae research.

- concentration and purification, lipids and pigments extraction...);
- Bioremediation of industrial waste (gas, liquid) / recycling of culture media.

Tailored Production of Microalgae Biomass and Bio-products

- Production and characterization of raw biomass (dry or wet);
- Refined biomass production (ingredients, active substances, lipids/sugars for food/feed and cosmetics, green chemistry, bio-jet fuel, biodiesel).

AlgoSolis offers a complete infrastructure including culture and analysis rooms, biomass production areas (thermo-regulated greenhouse, outdoor area), and downstream processing unit for algal biomass harvesting and biorefining).

Access

AlgoSolis services are accessible for industrial and academic projects, as follows:

- Scientific collaboration for projects using advanced technology;
- Self-service following training;
- Fee-for-service for activities such as biomass production.

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ALGOSOLIS
MICROALGAE R&D FACILITY

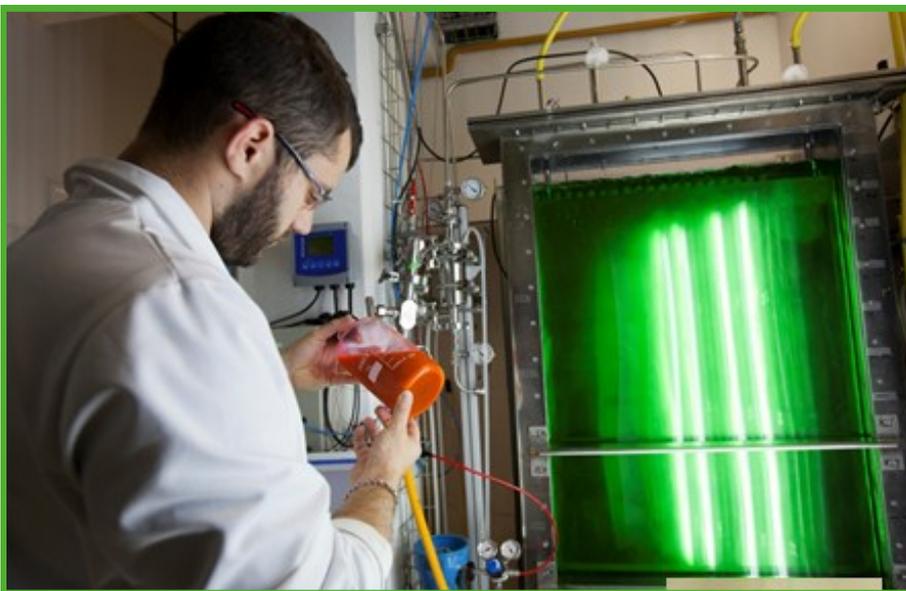


Figure 6: Refined biomass.



“AlgoSolis services are available for industrial and academic projects.”

Production of Renewable Fuels from Forest Residues

The most economically feasible solution under Finnish conditions



*Ilkka Hannula
VTT Technical Research
Centre of Finland*

In his doctoral dissertation, Ilkka Hannula, Senior Scientist at VTT, compared the economic feasibility of technologies suited for production of renewable transport fuels. Fuels produced from forest residues proved to be the most economically feasible solution under Finnish conditions.

The process based on the gasification of biomass was used as the starting point for the work and was compared with



“The amount of biofuel produced from the same amount of forest residues could be significantly increased if additional hydrogen was fed into the process from an external source.”



Figure 1: Forest residues.

the alternatives in which fuels are produced from carbon dioxide and water with the help of electricity. In addition, a hybrid process tailored to Finnish conditions that combines elements from the above-mentioned technologies was developed as part of the dissertation work.

The following gasoline equivalent (geq) production cost estimates were calculated for renewable transport fuels: 0.6–1.2 €/L_{geq} for methane, 0.7–1.3 €/L_{geq} for methanol and 0.7–1.5 €/L_{geq} for gasoline. The lowest costs within the range of variation were associated with the gasification-based process, the second lowest with the hybrid process and the highest

with the electrochemical process. The additional costs caused by distribution and final use were excluded from the prices of methane and methanol, whereas when using synthetic gasoline, the existing distribution network and equipment can be utilised.

The dissertation also showed that the amount of biofuel produced from the same amount of forest residues could be significantly increased if additional hydrogen was fed into the process from an external source. The additional hydrogen can be produced from renewable energy via water electrolysis, for example.

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Production of Renewable Fuels under Finnish Conditions

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To render this economically feasible, the renewable energy prices should be below 20 €/MWh, i.e. much lower than they are today.

The renewable fuels examined for the dissertation are more expensive than the refinery gate price for petroleum-derived gasoline (~0.5 €/l). However, the share of renewable energy in transportation must be increased to ensure that the target of 40% reduction in greenhouse gas emissions set by Europe for 2030 can be met.

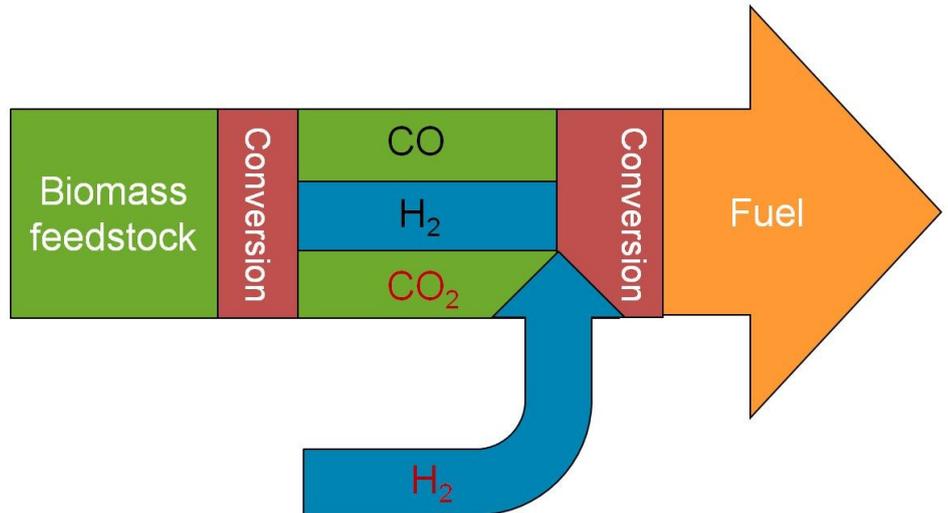


Figure 2: Schematic representation of a hydrogen enhanced gasification-based biorefinery process concept evaluated in the dissertation.

Synthetic fuels and light olefins from biomass residues, carbon dioxide and electricity

Performance and cost analysis

Ilkka Hannula

This requires long-term promotion measures, including significant investment in research, and specifically measures that expedite the construction of demonstration plants.

Ilkka Hannula defended his doctoral dissertation, “Synthetic fuels and light olefins from biomass residues, carbon dioxide and electricity: Performance and cost analysis”, on 16 October 2015 at the Department of Energy Technology of Aalto University (Hall 216, Otakaari 4, Espoo, Finland). The thesis is available online at <http://www.vtt.fi/inf/pdf/science/2015/S107.pdf>

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Figure 3: The thesis is available online at <http://www.vtt.fi/inf/pdf/science/2015/S107.pdf>



**Sub Programme 2
Coordinator**
*Francisco Gírio
(LNEG, Portugal)*

The PROETHANOL2G project focused on the effective integration and development of advanced technologies through the combined use of Biology and Engineering for the production of second generation bioethanol, from the majority of the representatives' European (wheat straw) and Brazilian (sugarcane bagasse and straw) feedstocks.

Europe is the world's third-largest producer of bioethanol – an important renewable fuel and energy source. Most stems from crops. Aiming to enlarge the feedstock basis for ethanol production, an EU-funded project has taken advanced bioethanol production from plant waste a large step closer to cost-efficient implementation.

By substituting fossil fuels in transport, power generation, the chemical industry and elsewhere, bioethanol could contribute substantially to the EU achieving its greenhouse gas emission (GHG) reduction goals. The sector has been growing continuously over recent years. Today, Europe boasts about 8.8 billion litres of installed production capacity with a market value of close to €8 billion, which only the US and Brazil exceed.

Most bioethanol production takes place in first-generation (1G) plants, which process crops such as wheat or maize, leading to possible competition

between food and energy needs. Advanced second-generation (2G) bioethanol production from lignocellulosic biomass, i.e. waste plant matter from forestry or agriculture such as wheat straw or sugarcane bagasse, could change that and substantially increase the GHG reduction potential at the same time.

“Our approach to bioethanol production can reduce GHG emissions by up to 90%, while the conventional crop-based technology achieves a reduction rate of 30 to 50%, depending on the efficiency of the plant,” says Francisco Gírio from the Portuguese National Laboratory for Energy and Geology (LNEG). He coordinated the PROETHANOL2G project, a collaborative effort between partners from Europe and Brazil.

From Waste to Fuel
When the PROETHANOL2G project started in 2010, no commercial advanced

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Figure 1: PROETHANOL2G focused on the production of second generation bioethanol from Brazilian feedstock - sugarcane (left), and European feedstock - wheat straw (right).



Partners

European

- LNEG (Portugal)
- DTU - Technical University of Denmark (Denmark)
- Lund University (Sweden)
- CIEMAT (Spain)
- INBICON (Denmark)
- FRAUNHOFER (Germany)
- Ghent University (Belgium)
- GreenValue (Switzerland)
- EPFL (École Polytechnique Fédérale de Lausanne) (Switzerland)
- HOLM (Denmark)

Brazilian

- UFRJ
- INT
- UFPE
- UFSC
- UFMG
- FURB

bioethanol plant existed in Europe. Today, Europe's first plant is up and running in Italy. Nonetheless, considerable R&D will still be needed to make 2G bioethanol a true alternative to its crop-based cousin.

"The main challenge is mostly due to the heterogeneity and complex chemical structure of lignocellulosic biomass," Francisco Gírio explains. "This means that you have different

molecules in the raw material compared to crop-based biomass. Therefore, it requires a very effective pre-treatment technology as well as a very good recombinant yeast strain for fast and easy conversion of all sugars after the biomass pre-treatment."

The production process involves several steps – from pre-treatment and enzymatic hydrolysis to break down the molecules into sugars, to fermentation of the sugar solution with the help of yeast and distillation.

Major Advances

The achievements of the PROETHANOL2G project included:

- Development of a novel recombinant yeast strain which enables efficient fermentation of different sugars, thus lowering the production costs of advanced biofuels from waste biomass.
- Vast improvement of the integration between biomass pre-treatment, enzymatic hydrolysis and fermentation, which is seen as a challenge to making this advanced biofuels technology competitive.
- Creation of a novel distillation system, which reduces energy consumption and enables the recovery of the largest part of the enzymes. Since one of the main costs of the 2G technology is the cost of the enzymes, being able to reuse them back in the hydrolysis represents major progress.

For the Brazilian market, the consortium altered the PROETHANOL2G process slightly, as a stand-alone 2G set-up might be less feasible in a country such as Brazil, with such large 1G usage.

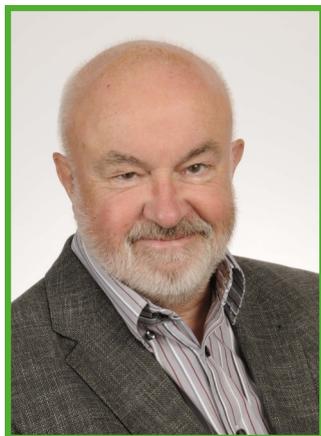
"Therefore, we integrated our European 2G technology in the 1G technology in Brazil," says Francisco Gírio. This combined 1G-2G system may be the secret to making the PROETHANOL2G technology a success in the South American country, where Inbicon A/S, an industrial project partner from Denmark, is in contact with a major industrial player, planning a joint venture to deploy a commercial 1G-2G plant.

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ECOFUEL, an EU-China cooperation for liquid fuels from biomass pyrolysis, is a five-year project funded by the European Commission. It focuses on the development of second generation biofuels from biomass by pyrolysis, biochemical conversion and oil extraction.

Fast pyrolysis is a relatively new biomass thermochemical conversion method in comparison to combustion and gasification. A wide range of routes are being explored for the use of bio-oils, upgrading and extraction of chemicals. International collaboration is an excellent solution to accelerate research and development in fast pyrolysis. Further

implementation of this technology will need a coherent approach involving academia, industry and policy makers. The composition of the project consortium has been optimised in view of these challenges.

The consortium partners bring a wealth of research experience and a range of advanced technologies from biomass characterisation, computational process modelling, reaction kinetics and catalytic processes across various disciplines including biology, chemistry, chemical engineering and mechanical engineering. Together, the partners form a unique team uniting innovative and traditional approaches in managing utilisation of virgin biomass and agricultural wastes.

ECOFUEL has built an international partnership for new second generation biofuel processes: the research will set the foundation stones for technologies being developed, that have the potential to be commercialised. The partnership will make further contributions to overcoming barriers to commercialisation.

For instance, costs of fast pyrolysis units can be reduced substantially through joint ventures between Chinese and European manufacturers. It is likely that large-scale implementation of this technology will initially take place in countries like China, while the EU will benefit as a key technology provider as the market grows. The knowledge

gained from Chinese and European experience on this biofuel technology will pave the way for commercial implementation in the future.

ECOFUEL will effectively integrate respective regional programmes for better allocation and utilisation of resources, in particular to achieve the critical mass required to move the second generation of biofuels forward.

The international partners included in this research consortium include Shanghai Jiao Tong University, China;

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Figure 1: Chinese 10000 t/y CFB fast pyrolysis demonstration plant in Shanxi.



Figure 2: Sources of biomass: fast growing wood and rice husk.

Objectives

ECOFUEL aims to:

- Draw together the very best academic research teams from the EU and China with diverse multi-disciplinary skills and expertise and with common interests in the field of bioenergy to confront the challenge of climate change and sustainable development in a global framework.
- Execute an innovative exchange and training programme that allows detailed comparison of different methodologies on their merits, encourages cross-fertilisation of the ideas behind the various approaches, and will stimulate the commercialisation of new biofuel technologies through close cooperation among international partners.
- Bring together the very best research groups in this field in order to remove fragmentation of the existing research activities at various universities and research institutes and to achieve a critical mass of research effort unparalleled anywhere in the world.
- Create a platform for research training and transfer of knowledge activities, both within the network domain and towards the public domain, crossing inter-sector boundaries; this is essential to promote new second generation biofuel technologies, train a sufficient number of people in this field to meet the challenges ahead, and ensure the competitiveness of EU industry.
- Disseminate knowledge to the larger international communities to maximise the impact of this network and ensure the academic and industrial relevance of its research activities.
- Provide researchers, young researchers in particular, with intensive training-through-research programmes as well as complementary skills training in order to become trainers of the future in a multi-disciplinary field of academic, industrial and societal importance; and as such improving the young researchers' career perspectives.
- Establish collaborative mechanisms for long-term partnerships between the EU and China researchers and institutes on important issues such as energy to combat the climate changes and other challenges for 21st century.



Guangzhou Institute of Energy Conversion, Chinese Academy of Sciences, China; Aalto University; Finland; University of Southampton, UK and Aston University, UK.

The project ran until the end of November 2015. It was funded by the European Commission under the FP7-PEOPLE-2009-IRSES programme, Grant Agreement 246772.

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Aston University

New Associate Participants



Welcome to the following four organisations who have joined the EERA Bioenergy programme:



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VSB - Technical University of Ostrava, Czech Republic
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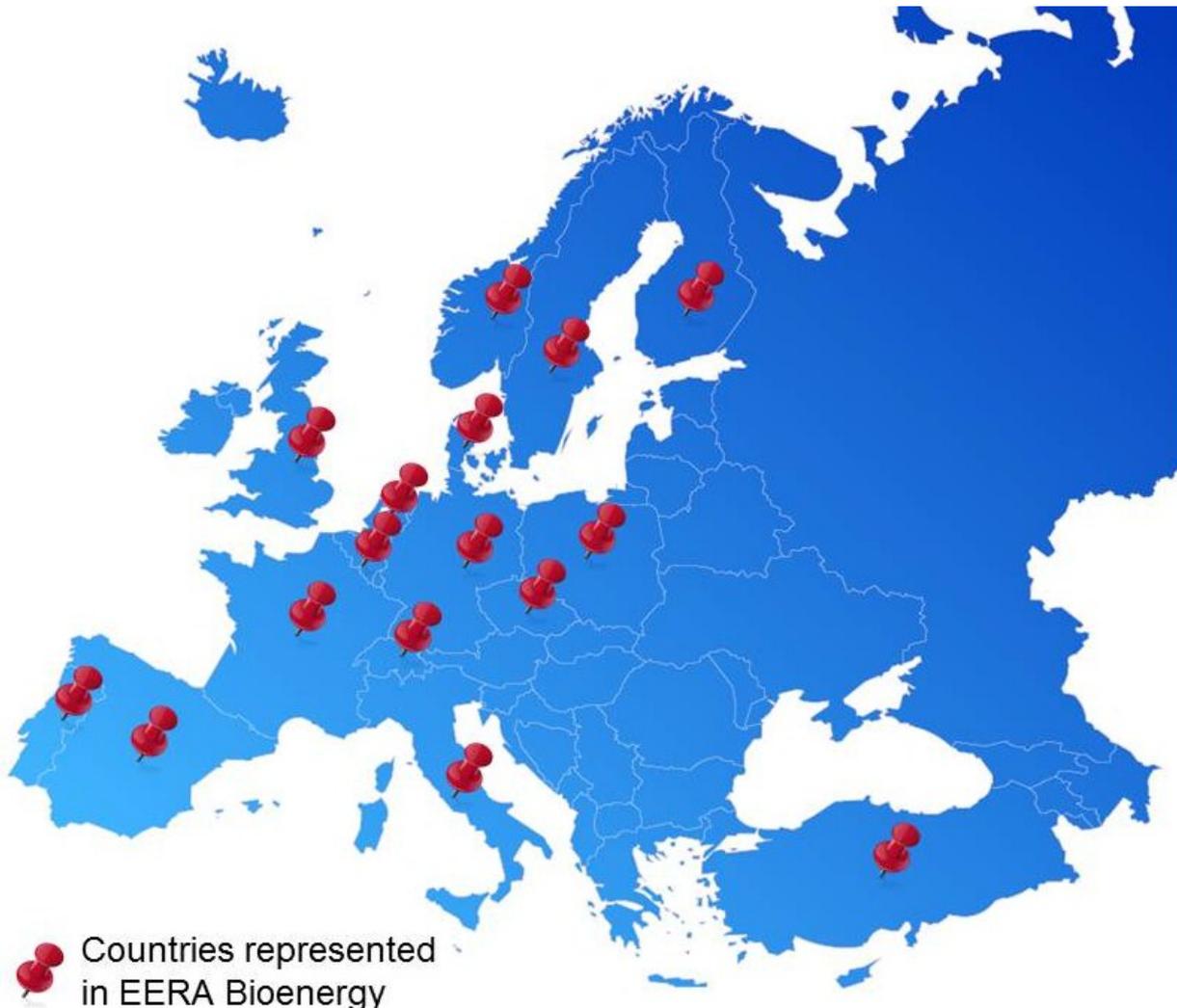


Figure 1: The EERA Bioenergy Joint Programme consists of 20 participants and 16 associate participants from a total of 16 countries. See the last page of this newsletter for a full list of organisations and their contact details, or alternatively visit www.eera-bioenergy.eu

Useful Information

Combustion, Gasification and Pyrolysis



Databases

IEA Bioenergy

Three of the tasks within the International Energy Agency (IEA) Bioenergy have produced databases on various bioenergy related areas. Below is a summary of those that are available on the worldwide web.

IEA Bioenergy Task	Task No.	Database description	URL Link
Biomass Combustion and Cofiring	32	Cofiring initiatives	www.ieabcc.nl/database/cofiring.php
Thermal Gasification of Biomass	33	Gasification plants around the world—operational, under construction, planned and non-operational	www.ieatask33.org/
Pyrolysis	34	Pyrolysis demoplants	www.pyne.co.uk/?_id=156



Videos

Interested in finding out more about the fast pyrolysis process and the production of bio-oil?

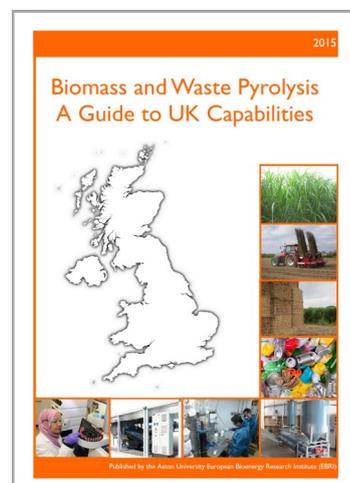
If so, have a look at the following two new videos:

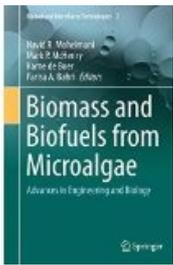
- [Bio-oil production at Fortum in Joensuu, Finland](#)
- [Fast pyrolysis process by VTT Technical Research Centre of Finland](#)



Guide

Aston University has published a new and updated edition of the guide to UK capabilities in biomass and waste pyrolysis which contains profiles of companies and universities who are involved in this area. To download a copy visit www.pyne.co.uk/?_id=120





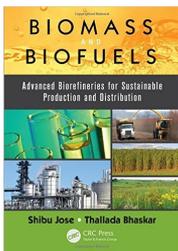
Biomass and Biofuels from Microalgae: Advances in Engineering and Biology (Biofuel and Biorefinery Technologies)

Editors: Navid Reza Moheimani, Mark P McHenry, Kame de Boer
 Publisher: Springer
 Published: 30 April 2015
 ISBN: 978-331916639



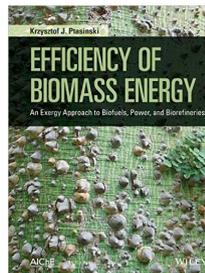
Biofuel Research Journal

Summer 2015
 Editor: Meisam Tabatabaei
 Open access online journal
 ISSN: 2292-8782



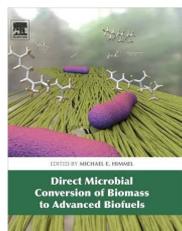
Biomass and Biofuels: Advanced Biorefineries for Sustainable Production and Distribution

Editors: Shibu Jose, Thallada Bhaskar
 Publisher: CRC Press
 Published: 15 May 2015
 ISBN: 978-1466595316



Efficiency of Biomass Energy: An Exergy Approach to Biofuels, Power and Biorefineries

Editor: Krzysztof J. Ptasinski
 Publisher: Wiley-Blackwell
 Published: 11 September 2015
 ISBN: 978-1118702107



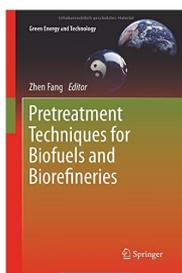
Direct Microbial Conversion of Biomass to Advanced Biofuels

Publisher: Elsevier
 Editor: Michael E Himmel
 Published: 1 June 2015
 ISBN: 978-0444595928



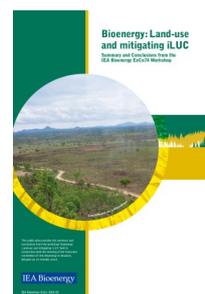
BRISK NEWS - Issue 8

October 2015
 Editor: Irene Watkinson, Aston University
 Published on behalf of the BRISK Consortium



Pretreatment Techniques for Biofuels and Biorefineries

Editor: Zhen Fang
 Publisher: Springer
 Published: 24 June 2015
 ISBN: 978-3642440509



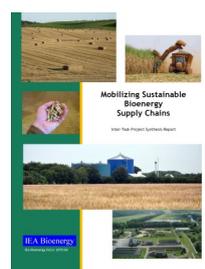
Bioenergy: Land-use and mitigating iLUC (indirect Land Use Change)

Publisher: International Energy Agency (IEA) Bioenergy
 Published: November 2015



Report: Advanced characterisation methods for solid biomass fuels

Published by IEA Bioenergy Task 32 project
 ISBN: 978-1910154144



Mobilizing Sustainable Bioenergy Supply Chains

Publisher: International Energy Agency (IEA) Bioenergy
 Published: November 2015

JANUARY 2016

18th-19th
[Fuels of the Future](#)
Berlin, Germany

20th-21st
[Lignofuels 2016](#)
Munich, Germany

FEBRUARY 2016

3rd-4th
[Energy Storage](#)
Paris, France

11th
[Cleantech Innovate](#)
London

25th-27th
[World Sustainable Energy Days](#)
Wels, Austria

MARCH 2016

6th-9th
[ECO-BIO 2016](#)
Rotterdam, Netherlands

14th-17th
[World Bio Markets](#)
Amsterdam, Netherlands

23rd-24th
[Gasification Summit](#)
Rotterdam, Netherlands

APRIL 2016

5th-7th
[Argus Biomass 2016](#)
London, UK

13th-14th
[Power & Electricity World Asia 2016](#)
Jakarta, Indonesia

20th-21st
[European Algae Biomass](#)
Berlin, Germany

MAY 2016

10th-11th
[2nd International Conference on Renewable Energy Gas Technology](#)
Malmö, Sweden

22nd-26th
[Fluidization XV](#)
Quebec, Canada

23rd-26th
[WasteEng 2016](#)
Albi, France

30th-31st May and 1 June
[RRB –12: 12th International Conference on Renewable Resources and Biorefineries](#)
Ghent, Belgium

JUNE 2016

6th-9th
[EUBCE 2016](#)
(24th European Biomass Conference and Exhibition)
Amsterdam, Netherlands

21st-22nd
[Oleofuels 2016](#)
Liverpool, UK

JULY 2016

28th-29th
[Industrial Biotechnology Congress](#)
Berlin, Germany

AUGUST 2016

25th-27th
[Biofuels & Bioenergy](#)
Sao Paulo, Brazil

SEPTEMBER 2016

6th-8th
[Energy Quest 2016](#)
Ancona, Italy

27th-29th
[European Biogas Association](#)
Ghent, Belgium





Conference of the European Biogas Association Ghent, Belgium 27-29 September 2016



The third Conference of the European Biogas Association will cover a broad range of topics related to biogas and biomethane from anaerobic digestion and gasification. Venue and programme details will be announced in the coming months. The 2016 edition is organized in close collaboration with Ghent University.

The biennial Conference of the European Biogas Association covers a broad range of topics related to biogas, biomethane and gasification, from production to utilisation. There is plenty of room for networking with 250+ representatives from research, industry, politics and production. A high quality poster session brings you up-to-date with the latest research and innovation topics. At the exhibition relevant company experts show you latest developments and product opportunities.

With this conference we strive to unite biogas experience and share the latest information on policies, industry developments, innovation and legislation. The programme consists of a day and a half of plenary and

parallel sessions plus one day of study tours to biogas facilities in the region.

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www.european-biogas.eu

Co-host



Following the success of the Lignofuels 2015 event in Madrid which included the Abengoa demonstration plant site visit, we are delighted to announce that our Lignofuels 2016 Summit will be taking place in Munich, Germany on the 20th and 21st of January 2016. This two day conference will bring together key lignofuels stakeholders to join our in-depth discussions and excellent networking, including leaders from advanced generation biofuels companies from across the globe.

Key Topics

- Lignofuel industry outlook & upcoming projects
- Technological challenges in lignofuels production
- Policies & regulatory framework
- Optimisation of existing pre-treatment processes
- Lignofuels R&D project
- Financing projects in the lignofuel sector
- Alternative business and diversification of products
- Case studies

Exclusive Clariant Site Visit – 19th January

In addition to the main two day event, during the afternoon of Tuesday 19th January 2016 a limited number of conference attendees will receive a unique opportunity to visit Clariant's pre-commercial scale Sunliquid Plant in Straubing, Germany. There is no extra charge to attend the site visit, but spaces are limited and allocated on a first come, first served basis.

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www.wplgroup.com/aci/event/lignocellulosic-fuel-conference-europe/



EUBCE 2016

AMSTERDAM - THE NETHERLANDS

6 - 9 JUNE 2016

24th European Biomass Conference & Exhibition



The EUBCE is the event in which members of the bioenergy community can get a broad picture of the situation and trends emerging in today's market. The Conference provides a high-level scientific programme and parallel events which attract participants from a wide-ranging background: researchers, engineers, technologists, standards organisations, financial institutions, policy makers and decision makers.

The EUBCE Parallel Events will offer a deep insight into specific topics along the most recent technology, market and business trends and will address global decision makers from industry, research, finance and politics. This event is supported by European and international organizations. The Technical Programme is coordinated by DG Joint Research Centre of the European Commission.

Conference Subjects

- Biomass Resources
- Biomass Conversion Technologies for Heating, Cooling and Electricity
- Biomass Conversion Technologies for Liquid and Gaseous Fuels, Chemicals and Materials
- Biomass Policies, Markets and Sustainability
- Bioenergy in Integrated Energy Systems

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Conference programme

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EUROPEAN ALGAE BIOMASS

20-21 APRIL 2016 / BERLIN, GERMANY

ACI's 6th annual European Algae Biomass Conference will take place on 20th and 21st April 2016 in Berlin, Germany. Once again it will bring together senior executives from industry and academia to discuss the latest commercial and technical developments, challenges and research breakthroughs throughout the entire algae value chain.

Topics

- Culture Management and Crop Protection
- Cultivation Systems: The Limits of Heterotrophy vs Autotrophy
- Optimisation of the Biomass Extraction – Harvesting Still a Big Issue
- Algae Research, Development, Demonstration and Deployment Projects
- European Regulation Regarding Microalgae Addressed to Feed, Food and Nutraceuticals

- Moving from R&D – How to Attract Investments Necessary to Upscale
- What Are the Most Successful Algae Products in Europe and Worldwide?
- Microalgae as a Sustainable Way to Treat Wastewater

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www.wplgroup.com/aci/event/european-algae-biomass-conference-europe/

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WUR	Netherlands	SP3 Coordinator	Maria Barbosa	maria.barbosa@wur.nl

EERA Bioenergy is open to new complementary RTD organisations. Please contact the Joint Programme Coordinator, Juan Carrasco for further details at juan.carrasco@ciemat.es

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Disclaimer - This newsletter was edited and produced by the European Bioenergy Research Institute (EBRI) Aston University, UK on behalf of the European Energy Research Alliance (EERA) Bioenergy. Any opinions or material contained within are those of the contributors and do not necessarily reflect any views of the European Energy Research Alliance, Aston University or any other organisation.