Book of **Abstracts**

SUMMARIES

EUBCE

29th European Biomass Conference & Exhibition

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Improving Vegetation Demographic Modeling to Estimate Future Biomass Sink Potential of Tropical Forests

Short introductive summary:

The effects of rising atmospheric CO2 concentrations on tropical forest biomass have been the focus of a large body of research, and the question of whether intact tropical forests will act as a large biomass sink remains contested. In addition, the inclusion of dynamic vegetation and demography in Earth System Models (ESMs) has been identified as a critical step in moving ESMs towards more realistic representations of plant ecology and the processes that govern carbon-climate feedbacks. ESMs currently predict a wide range of net land carbon fluxes over the next century, including differences in ability of ecosystems to be strong biomass sinks. Therefore, we compared ELM-FATES against other models to investigate how to improve predictions of long-term biomass accumulation. All models predicted positive vegetation growth that outpaced mortality, leading to continual increases in present-day biomass accumulation. Modeling updates via ELM-FATES, improved simulated gradients in total biomass, biomass sink in large vs. small trees, and density-dependent interactions. Inclusion of these processes allowed for a lower, more realistic biomass sink with a doubling of CO2.

Presenter: **Jennifer HOLM, Lawrence Berkeley National Laboratory, Climate and Ecosystems Science Division, Berkeley, USA**

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Session reference: AP.1.1
Subtopic: 4.3 Climate Impacts and GHG Performance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Competitiveness of Syngas Biomethanation within The BECCS and Power-To-Gas Concepts: Techno-Economic Modeling and Evaluation of the Level of Incentives Required at Different Scales

Short introductive summary:

Biomethanation of biomass-derived syngas is a promising renewable methane production technology with high carbon efficiency, but there is lack of evidence on how process scale-up and biomass cost impact the profitability of full-scale processes. In this study, we developed a set of techno-economic models for the assessment of process competitiveness under several scales and configurations, integrating syngas biomethanation with Power-to-Gas (PtG) services, carbon capture and storage (CCS) and biomethane liquefaction. The results indicate that the incentive mechanism currently supporting biomethane production from anaerobic digestion in Italy would grant profitability for small-scale (6 MWth input) syngas biomethanation plants at biomass costs equal to or below 80 €/t. Under the Danish mechanism, such biomass cost corresponds to 60 €/t. At the currently valid biomass cost of 150 €/t, an 8-MW system delivers a minimum selling price (MSP) of 1.07 €/Nm3 biomethane, but such MSP increases substantially when PtG and CCS are included.

Presenter: **Lorenzo MENIN, Free University of Bozen-Bolzano, Bioenergy & Biofuels Lab, Bolzano, ITALY**

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Session reference: AP.1.3
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Defining and Measuring Circular Use of Biomass in Bioeconomy

Short introductive summary:

There is an urgent need to take measures to decouple economic growth from resource use, increase resource efficiency and stimulate a more sustainable production and consumption system. The increase in use of biomass as a renewable resource for bioeconomy should also go together with a more circular use of biomass. To be able to monitor this transition we need circularity indicators for biobased products. Therefore, the aim of this study is to propose a list of indicators for biobased products covering different aspects of circular economy principles. For this, we first define what circularity specifically implies for biobased products and, according to these principles, we identify the requirement that indicators need to fulfill. We then carry out a critical assessment of existing circularity indicators to evaluate their suitability for application to biobased products and identify which aspects of circular economy principles they relate to. A circularity assessment framework is then developed with a set of existing and proposed indicators covering the defined principles.

Presenter: **Iris VURAL GURSEL, Wageningen Food & Biobased Research, Wageningen, THE NETHERLANDS**

Presenter's biography:

Dr. Iris Vural Gursel, is a scientist at Wageningen Food & Biobased Research working in the group of Chain design and Systems analysis. She has expertise in sustainability assessment of bio-based products.

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Session reference:	AP.2.1
Subtopic:	4.5 Resource Efficient Bioeconomy
Topic:	4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Integrating Biochar into Value Chains for Sugar-Cane Based Biorefineries: Fuels, Products, Energy for Sustainable Agriculture

Short introductive summary:

The present work defines and investigates possibilities along the sugarcane value chain, mainly integrating a biochemical pathway (1G bioethanol production) with a thermochemical rout (slow pyrolysis) to diversify the product portfolio of sugarcane mills and enhance technical indices while also improving economic and environmental impacts.
Three main scenarios will be assessed.
Through an integrated framework of assessment (the Virtual Sugarcane Biorefinery, or VSB, developed by the Brazilian Biorenewables National Laboratory) mainly technical, economic and environmental impacts of each scenario will be determined.

Presenter: **David CHIARAMONTI, Polytechnic of Turin, Energy Department, Industrial Engineering Dpt., Florence, ITALY**

Presenter's biography:

David Chiaramonti teaches Bioenergy Conversion Technologies at the University of Florence, where he carries out research on thermochemical biomass conversion at CREAR. He chairs the Renewable Energy COnsortium for R&D of the University of Florence (RE-CORD)

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Session reference: AP.2.2

Subtopic: 3.5 Bio-Alcohols from Sugars, Starch and Lignocellulosic Biomass

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Sustainable Bio-feedstock Availability in the EU Concept: A Look into Different Scenarios towards 2050

Short introductive summary:

In the context of the EU strategy of achieving net-zero emissions by 2050, one of the key questions regarding the role of bio-feedstocks is the potential sustainable availability in EU and which conditions, including technical/economic ones, are required to maximize this availability by 2050 without causing any other negative impacts, such as preserving biodiversity.
To answer this question, Concawe developed a project with Imperial College London via Imperial Consultants, aiming to provide technical clarity and methodological recommendations for biomass assessment.
Imperial Consultants developed different bio-feedstock availability scenarios and sensitivity cases on the key parameters, including assessments on costs, agricultural inputs requirements, implications in terms of land requirement, land use change potentially associated, potential impacts on biodiversity and sensitivities on trading/imports. Furthermore, the bio-feedstock availability was matched with the relevant conversion pathways allocating for each of the decided scenarios, the bio-resources to transport sector (biofuel) and providing an overview of potential demand (competition)from other sectors.

Presenter: **Calliope PANOUTSOU, Imperial College London, Centre for Energy Policy and Technology, London, UNITED KINGDOM**

Presenter's biography:

Dr Calliope Panoutsou is a Senior Research Fellow at Imperial College London and the Vice Chair of the Scientific Board, for BBI. Recent work IS related to integrated policy for biomass value chains.

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Session reference: 1AO.1.1

Subtopic: 1.1 Biomass Potentials and Biomass Production Models

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Bioenergy Crops and Options for Increased Soil Carbon Storage and Water Holding Capacity through Sustainable Agriculture and Forestry: Modelling Results from Showcase Regions in Austria and Beyond

Short introductive summary:

Sustainable agriculture and forestry are important topics under climate change and the related adaptation needs. This is also true for climate change mitigation, for the reduction of fossil fuels and increased use of bioenergy crops and forest biomass. This is a potential route for fostering long-term soil and biomass carbon storage, soil water retention capacity and for reducing water and wind erosion risks. This study uses agricultural and forest regions in Southeastern Austria as showcase regions for exploring sustainable whole-system options for climate change adaptation and mitigation under increased hot-dry conditions in agriculture and forestry. Model results will show the yield potential and adress the questions around synergetic effects of bioenergy crop production in Austria and Europe. Such sustainable whole-system options for farmers are a major overall study aim and will supply valuable local data and results in the representative areas as well as for upscaling to country and EU level.

Presenter: **Dagmar HENNER, Wegener Center for Climate and Global Change, University of Graz, Vienna, AUSTRIA**

Presenter's biography:

I am employed at the Wegener Center for Climate and Global Change at the University of Graz in Austria. I am working on second-generation bioenergy crops to determine their climate change mitigation potential and the impact of their increased use on ecosystems, specifically soil carbon and erosion.

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Session reference: 1AO.1.2
Subtopic: 1.1 Biomass Potentials and Biomass Production Models
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

An Online Tool for Visualising EU Biomass Flows

Short introductive summary:

This study aims to present an updated overview of the biomass flows in the EU. The EU Biomass Flows tool offers a representation of harmonised data from the dataset created by the various JRC units contributing to the BIOMASS Assessment study . It represents the flows of biomass for each sector of the bioeconomy, from supply to uses including trade. The diagram enables deeper analysis and comparison of the different countries and sectors across a defined time series.

Presenter: **Patricia GURRIA ALBUSAC, European Commission, JRC, Seville, SPAIN**

Presenter's biography:

Researcher at the Sustainable Resources Directorate of the Joint Research Centre in Seville, Spain

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Session reference: 1AO.1.3

Subtopic: 1.1 Biomass Potentials and Biomass Production Models

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Food, Feed, Fuels, and the Environment: Delimit the Feasible Production Set of the European Agricultural System.

Short introductive summary:

Using an agricultural supply model, we assess the production potential of the European Union to satisfy two objectives, one related to food calories, the other to biofuels. We focus on advanced lignocellulosic biofuels, and we rely on recent yields assessment studies to derive agent-specific yields for bioenergy crops and conventional crops residues. We determine the feasible production set by varying the thresholds for food calories and bioenergy simultaneously. We contrast the set of jointly reachable targets in terms of economic and environmental outcomes, highlighting changes in land uses and in the composition of food production in Europe. We find that the EU shows a large potential of biomass resources that allows a great margin for action where food and energy security could be compatible. However, the implicit high prices associated with the two constraints show that this potential could only be achieved at the cost of substantial structural and spatial changes of the agricultural production system. We show in particular the emerging tension on animal production, and we find that food and bioenergy production targets jointly induce significant emissions reductions.

Presenter: **Eva GOSSIAUX, Paris School of Economicsaris School of Economics, Université Paris 1 Panthéon-Sorbonne, Paris, FRANCE**

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Session reference: 1AO.1.4

Subtopic: 1.1 Biomass Potentials and Biomass Production Models

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Reduction of Dry Matter Losses during Wood Chips Storage by Using of Calcium Hydroxide as Additive - Results from Storage Trials with Spruce at Industrial Scale

Short introductive summary:

To compensate differences in provision and consumption of wood chips used for heat production and industrial applications, storage of wood chips is an important yet problematic step in the supply chain when considerable dry matter losses respectively losses of the energetic value may occur. This study aimed at determining the effect of storing spruce forest residues with varying amounts of an alkaline additive (Ca(OH)2) to reduce dry matter losses and contamination with mould. The intermixture of 3% Ca(OH)2 reduced the dry matter loss for moist wood chips from spruce from 15% to 9%. Furthermore, the additive intermixture led to up to 5 °C higher maximum pile temperatures, relevant also in terms of microbial sanitization, and a constant as well as faster drying process occurred. The proposed alkaline intermixture proved to be a low-cost and efficient alternative storage strategy, as shown by the significant reduction of dry matter losses, and thus of financial benefit. However, further studies are necessary to understand underlying processes in stored wood biomass caused by the addition of Ca(OH)2.

Presenter: **Ralf PECENKA, Leibniz Institute for Agricultural Engineering and Bioeconomy, Post Harvest Dpt., Potsdam, GERMANY**

Presenter's biography:

Dr. Ralf Pecenka works as a researcher at the Leibniz Institute for Agricultural Engineering and Bioeconomy(ATB), Germany. His main research subjects are harvest, storage and processing of short-rotation woody crops. Further information: www.atb-potsdam.de

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Session reference: 2AO.2.2
Subtopic: 2.1 Production and Supply of Solid Fuels and Intermediates
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Development of Techno-economic Model for Assessment of Bio-Hubs

Short introductive summary:

Forest resources including main products, residues and by-products can supply long-term sustainable renewable energy as well as non-energy needs. In order to reposition the forest industry and develop the bioeconomy, new practices should be applied to make forest main products, by-products and residues available at a lower cost and in accessible locations called biohubs. In this study, funded by the International Energy Agency (IEA) and Government of Canada, bio-hub model is assessed to establish a value-added supply chain for increasing the accessibility and value of forest biomass, and meet the needs of emerging biorefinery and other bio-based industries. These terminals or bio-hubs serve as storage, loading and processing centres, from where the biomass may be reloaded and transported to end users such as industries through different transportation means. The bio-hubs have different configurations and can include any of the following operations of storage, sorting, processing, conversion to intermediates and reloading. A techno-economic assessment of various biohub configuration will be presented.

Presenter: **Maryam AKBARI, University of Alberta, Mechanical Engineering Dpt., Edmonton, CANADA**

Presenter's biography:

Maryam Akbari is a PDF at the University of Alberta in the Department of Mechanical Engineering with Engineering Management specialization. Her research is focused on techno-economic analysis of conversion pathways of biomass residues/wastes to value-added products (fuels and chemicals).

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Session reference: 2AO.2.3
Subtopic: 2.1 Production and Supply of Solid Fuels and Intermediates
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Investigation into Wood Pellet Breakage under Impact Loads

Short introductive summary:

The knowledge of size reduction of wood pellets during pneumatic conveying is important to achieve failure-free system operation and to set-up adequate quality assurance processes. In the present study, experiments are performed with a single particle impact test facility. A stereoscopic high-speed camera set allows 3D-particle tracking and visual analysis of the particles' degradation properties. Based on the data obtained, empirical correlations for the statistical description of the pellets' breakage behaviour are presented depending on particle length, impact velocity and colli-sion angle. These relationships are expressed mathematically by two key functions: the so-called selection function (breakage probability) and the breakage function (fragment size distribution). As expected, higher impact velocities lead to more damage, especially at normal collisions (90°) due to the maximum change of momentum and smaller particles tend to be more breakage resistant. Finally, an outlook on the influence of pellet quality and target material on the particles' degradation behaviour is given.

Presenter: **Julian JAEGERS, Ruhr-University Bochum, Energy Plant Technology, Bochum, GERMANY**

Presenter's biography:

M.Sc. Julian Jaegers, studied mechanical Engineering at Ruhr-University Bochum and University of Sheffield. Worked as a student assistant and student worker before starting to work as a research assistant since June 2016. Topics of research: Pneumatic transport of wood pellets, DEM-CFD simulations.

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Session reference: 2AO.2.4

Subtopic: 2.1 Production and Supply of Solid Fuels and Intermediates

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Enzymatic Conversion for Natural Vanillin Production

Short introductive summary:

The trend in many research areas is changing towards a more natural approach. Also the flavor and fragrance industrie is effected by this. One important product is vanillin. The more natural it is produced, the more expensive it is, therefore it is of interest to many companies. Enzymatic conversion of lignin is one possiblity for the production of natural vanillin due to the basic aromatic structure of lignin. However, the enzymatic production of aromatics from lignin raises a number of challenges related to the heterogeneity of the structure and the repolymerization reactions occurring during enzymatic processing.Based on the above-mentioned reasons, research is being conducted into the possibilities of targeted vanillin extraction using lignin.

Presenter: **Annika JAHN, Freiberg University of Mining and Technology, Institute of Chemical Technology, Freiberg, GERMANY**

Presenter's biography:

- studied applied Science from 2009-2014

- since May 2015 research assistant at the Institute of Chemical Technology in the biotechnology area

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Session reference: 3AO.3.1

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Eco-efficient Bioprocess for the Production of PHA Biopolymers Using Industrial Saline Wastewater Streams.

Short introductive summary:

Cost-effective strategies for PHA (Polyhydroxyalkanoates) biopolymers production such as the use of agro-industrial waste streams as feedstock using mixed microbial cultures (MMC) are required. In this work, a full PHA producing bioprocess using saline wastewaters as feedstock is analysed. It consists on a common 3-stage MMC PHA production process: acidogenic fermentation step, followed by PHA-producing MMC acclimatization and PHA accumulation. An artificially salted cheese whey stream was used to assess the best strategies for acidogenic fermentation in an Upflow Anaerobic Sludge Blanket reactor, revealing insights on the degree of acidification and product composition. A halotolerant PHA-producing MMC was successfully obtained, using a feast and famine regime in a sequence-batch reactor in a saline environment (30g NaCl.L-1), allowing PHA accumulation assays.

Presenter: **Joao CARVALHO, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, Chemistry Dpt., Lisboa, PORTUGAL**

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Session reference: 3AO.3.2

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Pre-Treatment Coupling Bioconversion of Corn Cob to Succinic Acid Using Clostridia Thermosuccinogenes in "one- Pot" Bioconversion System

Short introductive summary:

This study investigated the production of succinic acid from corn cob by a single succinic acid producing organism, Clostridia thermosuccinogenes (C. succinogenes) in a fermenter unit where pre-treatment, hydrolysis and fermentation were combined. The unit consisted of ZnCl2.4H2O as the pre-treatment system and Clostridium thermosuccinogenes DSM 5807 as the organism. An inoculum of Clostridium thermosuccinogenes DSM 5807 was prepared and added to the unit consisting of 5 g of sterilized corn cob and ZnCl2.4H2O MHS at a ratio of 1:12. Other nutrients such as Citrate buffer, Yeast extract, Peptone, MgCO3 were added to the fermenter at a volume of 50 mL and pH of 7.2. Fermentation was performed in small anaerobic bioreactors (SABs) for 96 h at 37oCand the samples were withdrawn at 6 h intervals and stored for analysis. The withdrawn samples were analysed with High Performance Liquid Chromatography (HPLC) to determine the quantity of glucose, xylose, succinic acid and by-products (e.g. acetic acid, formic acid, citric acid).

Presenter: **Olayile EJEKWU, University of Pretoria, School of Engineering, Pretoria, SOUTH AFRICA**

Presenter's biography:

Olayile is a PhD student in the School of Engineering in the department of Chemical Engineering at University of Pretoria.

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Session reference: 3AO.3.3

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Improving Thermoplastic Starch - Natural Plant Fibers Green Composites Using Meta-Analysis

Short introductive summary:

Our work focused on the use of published scientific data to predict mechanical properties of well-known biodegradable starch-based and natural fibers-based biocomposites.
This helped to determine the lacks in this field and the path to take for further research in this area.

Presenter: **Lionel DUMOULIN, Gembloux Agro Bio-tech - ULiège, SMARTECH Dpt., Gembloux, BELGIUM**

Presenter's biography:

After a Bachelor in Bioengineering, Lionel followed a Master on Chemistry and bio-industries.
Now, Lionel is a PhD candidates in the "Biomass and Green Technologies Laboratory"

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Session reference: 3AO.3.4

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Looking Back at Ten Years Micro-Scale Biogas Implementation in Indonesia: Evaluation on Sustainability and Public Acceptance

Short introductive summary:

Indonesian biogas market is still in the nascent state. Compare to China and India, who have millions of biogas unit, the number of biogas unit in Indonesia is still within ten of thousand unit. Although the Government of Indonesia (GoI) has set ambitious target for biogas implementation, the realization of biogas production is still low. This paper gives comprehensive overview of biogas development in Indonesia: from the policy perspective (which includes current development) as well the social acceptance and the sustainability of biogas usage. In the end, the paper provides several recommendation of moving toward wider biogas implementation.

Presenter: **Elisabeth RIANAWATI, Resilience Development Initiative, Resilience Development Initiative, Bandung, INDONESIA**

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Session reference: 4AV.1.1
Subtopic: 4.1 Sustainability, Socio-Economic Impacts and Public Acceptance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Sustainable Assessment of Bioethanol Production from Multiple Agro-Industrial Biomass Residues Using Process Simulation

Short introductive summary:

In this work, a robust sensitivity analysis is carried out for the biorefinery case using different 2G biomass from the agro-industry in Colombia.

Presenter: **Daniel BERNIER-OVIEDO, Universidad de Caldas, Engineering Dpt., Manizales, COLOMBIA**

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Session reference: 4AV.1.2
Subtopic: 4.1 Sustainability, Socio-Economic Impacts and Public Acceptance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Developing Biofuel Industry in an Oil Dependent Economy: Design of a Model to Optimice Gdp and Land Use Ensuring Food Sovereignity

Short introductive summary:

A linear programming model has been developed with the objective of determining the optimal distribution of land uses in a context where the use of biofuels is globalized, and food crops and energy crops destined for food and energy market compete for the soil area. The available agricultural area and guarantee a predefined national consumption of both biofuels and food are taken as restrictions. Different scenarios are evaluated by varying the international market price of the products and moving the subsidies that actually hold cheap the internal prices of naphtha and diesel to the biofuels industry and crops in a country like Ecuador, which is an oil dependent economy with high levels of subsidies for its internal oil derivate prices. The optimal crop distribution is obtained from the study of each competing crops in each homogeneous area, their yields, the costs of production and transformation of raw materials, and the trend in market prices, and food and fuel needs. The import and export for each produced crop are also forecast for this country.

Presenter: **Carola MENA CAMPOVERDE, Facultad de Economía, Universidad Católica de Santiago de Guayaquil, Economía Dpt., Guayaquil, ECUADOR**

Presenter's biography:

I am finance teacher at Universidad Católica de Guayaquil, I work for Veolia Ecuador, I am financial manager. Actually doing a PhD in Economics at Argentina. My line of research is bioeconomy .
Kind regards.
Carola

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Session reference: 4AV.1.3
Subtopic: 4.1 Sustainability, Socio-Economic Impacts and Public Acceptance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Sustainability Assessment of the Production of Microbial Bio-Based Surfactants

Short introductive summary:

Related to the development of production processes for microbial bio-based surfactants like rhamnolipids and mannosylerythritol lipids a sustainability assessment from different points of view is carried out within the project Bio². Environmental impacts, economic issues and social risks of defined process chains allow a classification of different processing options. By the identification of hotspots and result comparisons the generated results are able to work as an indicator for the further development.

Presenter: **Andreas SCHONHOFF, Forschungszentrum Jülich, Institute of Energy and Climate Research - Systems Analysis and Technology Evaluation, Jülich, GERMANY**

Presenter's biography:

- environmental (process) engineer
- practical experience: research and development (5 y), recycling/disposal (3 y)
- Life Cycle Assessment, Biomass conversion and use, recycling of minerals, plastics etc., waste (water) treatment, biogas, project development/management, network coordination

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Session reference: 4AV.1.5

Subtopic: 4.1 Sustainability, Socio-Economic Impacts and Public Acceptance

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Analysis of Residual Biomass Energy Use in Low Human Development Index (HDI) Municipalities: Case Study Bahia and Sao Paulo.

Short introductive summary:

Access to electrical energy is fundamental factor in raising the standard of living of society but only electricity access for basic needs is not enough for poverty alleviation and economic development. In least developed municipalities in Brazil, there is still a lack of energy access and a significant lack of basic sanitation. This paper that is a conclusion of a PhD thesis will discuss how the use of residual biomass as a renewable energy source can impact the HDI of municipalities with low HDI.

Presenter: **Suani COELHO, University of São Paulo, São Paulo, BRAZIL**

Presenter's biography:

Short bio.
Suani Teixeira Coelho is a Chemical Engineer, Master and PhD in Energy in the Graduate Program in Energy from the University of São Paulo, where she is currently lecturer, thesis advisor, PD supervisor and coordinator of the Research Group on Bioenergy (GBIO - former CENBIO).

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Session reference: 4AV.1.7
Subtopic: 4.1 Sustainability, Socio-Economic Impacts and Public Acceptance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Social Representation of Biogas in Brazil: a Media Analysis of Folha de São Paulo Newspaper between 2000 and 2020

Short introductive summary:

The present study aims to analyze the social representation of biogas in the Brazilian media according to the Folha de São Paulo newspaper between the years 2000 and 2020, recognizing the newspaper as a way to serve the public interest, in which events and debates within these mediatized spheres are capable of impacting and mobilizing society and its institutions to develop biogas and also different sources of energy, with a background of the reality of biogas in Brazil.

Presenter: **Fernando DAMASCENO ZAMBRONA, UNICAMP, Campinas, BRAZIL**

Presenter's biography:

Fernando D. Zambrona is a master's student in Energy Systems Planning at Unicamp, a top university in Latin America. Being graduated in Public Policies and Business Administration, his studies include the production and uses of biogas and biomethane in different branches of society.

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Session reference: 4AV.1.8
Subtopic: 4.1 Sustainability, Socio-Economic Impacts and Public Acceptance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Sustainable Transition from Fossil-Based to Renewable Energy-Based Heating Systems in South-Savo Region of Finland

Short introductive summary:

The Finnish government aims to go carbon neutral by 2035 but there are many obstacles to achieve such ambitious target such as, sparingly distributed houses and their fossil-oil based heating systems. There are about 9,000 oil-fired heating systems in South-Savo region of Finland consuming about 620 GWh of oil per year and replacing them with cleaner technology in a sustainable manner is itself a challenge.

In this research, the aim is to conduct a survey among the oil heaters and ask them their knowledge about environmental aspects of fossil fuel consumption, their willingness to new investment on heating system, their wish for support if they would like to renovate the heating system, their heating system of choice and other relevant questions. In addition to the survey, aim is to calculate the environmental impact (greenhouse gas emissions) of heating system alternatives using life cycle assessment (LCA). The heating alternatives include, geothermal, bioenergy, electricity, heat pump and others (if available). Based on the survey and LCA results, aims is to rank the heating system of choice using multi-criteria decision analysis (MCDA) and analytic hierarchy process (AHP).

Presenter: **Raghu KC, Lappeenranta-Lahti University of Technology, Laboratory of Bioenergy, Mikkeli, FINLAND**

Presenter's biography:

Raghu KC is a post-doctoral researcher at the LUT University, Bioenergy laboratory unit located in Mikkeli, Finland. The theme of his research is mainly focused on sustainability study of biomass based energy.

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Session reference:	4AV.1.9
Subtopic:	4.1 Sustainability, Socio-Economic Impacts and Public Acceptance
Topic:	4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Do "Publics" Support Bioenergy In Brasil?

Short introductive summary:

Bioenergy, in its various formats, is one of the possible solutions for greening the energy grid in countries as Brazil. The understanding of the perception of diverse publics in USA and EU have been accessed and described in many papers and are summarized on, e.g. Radics, et al., 2015. This paper aims to analyse the views and the perception of agents as government, academia, industry, media and society in Brazil, comparing them to other countries of EU and states in the USA. A historical perspective will be explored to identify the key factors that have impacted the adoption of bioenergy in the country. It will also ponder the challenges involved in moving into Bioenergy and Carbon Capture and Storage (BECCS) considering the perception of the diverse publics. As a result, will discuss probable scenarios for the development of such technologies, under a social perspective and approach.

Presenter: **Karen MASCARENHAS, RCGI - Research Centre for Gas Innovation, Human Resources & Leadership, São Paulo, BRAZIL**

Presenter's biography:

Director Human Resources at Research Centre for Gas Innovation, researcher in Public Perception, Leadership,Social Licence to Operate energy transition with emerging technologies as BECCS, Prof Adm Post-graduation at FGV, MSc Social Psychology and PhD candidate USP,research period Imperial College.

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Session reference: 4AV.1.11
Subtopic: 4.1 Sustainability, Socio-Economic Impacts and Public Acceptance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Exploitability of Woody Forest Residues for Energy Purposes Through Small Scale Gasification

Short introductive summary:

Forestry residues are typically treated as waste biomass, unlike virgin wood which finds applications in timber and other industries. This work aims to investigate the possibility of using forestry residues as low-cost feedstock for the gasification process. Results obtained from and gasification experiments on forest residues collected from the province of Bolzano in South Tyrol are presented, and comparisons are made with previous data of wood chips and pellets. Several different types of residues were analyzed and it was encouraging results were obtained. However certain drawbacks need to be addressed.

Presenter: **Rohit BOROOAH, Free University of Bozen-Bolzano, Bolzano, ITALY**

Presenter's biography:

Rohit Borooah is currently a PhD student at the Free University of Bozen-Bolzano, Italy. His main research interests include biomass gaisifcation, combustion and waste-to energy. He is currently working on varolization of biomass forest residues for production of heat and power.

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Session reference: 2AV.2.2
Subtopic: 2.4 Gasification for Power, CHP and Polygeneration
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Influence of Different Devolatilization Models on CFD Modeling of Entrained Flow Gasification

Short introductive summary:

This work aims to quantify the influence of different devolatization models on the overall gasification process. Simulations are conducted with an existing entrained flow gasification model CFD model in ANSYS Fluent. The devolatilization model complexity ranges from a constant rate approach to mechanistic models (e.g. CPD model).

Presenter: **Sebastian WILHELM, Technical University of Munich, Chair of Energy Systems, Garching, GERMANY**

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Session reference: 2AV.2.4

Subtopic: 2.4 Gasification for Power, CHP and Polygeneration

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Gasification Adiabatic Temperature Concept for Modelling a Fixed Bed Biomass Gasifier

Short introductive summary:

A thermodynamic equilibrium model was developed and applied to assess the gasification system behavior of an open top pilot-scale gasifier placed at the Bioenergy and Biofuel Lab of the Free University of Bolzano.
Unlike the classical equilibrium strategy that calculates the gasification products using the Gibbs energy minimization method at fixed temperature and pressure, the developed approach is based on the enthalpy balance between reactants and products using the concept of adiabatic gasification temperature.
The data used for the tune up of the model have been collected over a period of three years of gasification experiments using several biomasses at different gasification conditions. A correction factor has been calibrated versus the entire set of experimental data in order to account for the differences between the theoretical hypothesis implemented in the model and the real system.

Presenter: **Francesco PATUZZI, Free University of Bolzano, Faculty of Science and Technology, Bolzano, ITALY**

Presenter's biography:

Francesco Patuzzi received his PhD in 2014 and is presently assistant professor at the Faculty of Science and Technology at the Free University of Bozen-Bolzano (Italy). His research activities are mainly related to the study of thermochemical conversion of ligno-cellulosic biomasses.

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Session reference: 2AV.2.5
Subtopic: 2.4 Gasification for Power, CHP and Polygeneration
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Emission Analysis of Syngas Combustion and Flammability Limit Assessment

Short introductive summary:

Gasification of biomass can be a very effective technology to fight climate change due to the carbon negativity of the process. However, syngas combustion could release a variety of pollutant compounds such as carbon monoxide and nitrogen dioxide. Improving the emissions of syngas combustion is very important in order to promote the diffusion of small scale gasifiers that often have no complex flue gas treatment systems. In this work a study on syngas combustion from a small scale gasification system is presented. A combustion chamber designed after a preliminary numerical evaluation was built to test different geometrical configurations. An experimental campaign with an emission analyzer was carried out to identify the best combustion chamber shape and to evaluate the pollutant released by syngas combustion. To further explore syngas combustion, the flammability limits were evaluated through the “Le Chatelier” equation and considering the presence of various inert gases.

Presenter: **Marco PUGLIA, University of Modena and Reggio Emilia, DIEF Dpt., Modena, ITALY**

Presenter's biography:

I am a mechanical engineer. During my thesis I started to study biomass gasification. After my master degree I spent a year as a research assistant studying the utilization of vine prunings as fuel for small scale gasifiers. Now I am a PhD student in the field of thermodinamics and gasification.

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Session reference: 2AV.2.9

Subtopic: 2.4 Gasification for Power, CHP and Polygeneration

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Increased Chestnuts Processing Sustainability Using Byproducts Gasification as Energy Aid

Short introductive summary:

This study presents the production process of Monsurgel Lda, a portugal company which deals with the production of semi-finished chestnuts for food industries. The company disposes about 660 tons per year of dry chestnut skins. This work presents two ways to transform chestnut skins into energy in order to increase the economical and environmental sustainability of the process. Two scenarios are simulated using gasification as the key technology of the byproduct energy conversion.

Presenter: **Simone PEDRAZZI, University of Modena and Reggio Emilia, of Engineering "Enzo Ferrari" - Bio Energy Efficiency Laboratory, Modena, ITALY**

Presenter's biography:

Simone holds M.Sc. and Ph.D. degrees in Mechanical Engineer at the University of Modena and Reggio Emilia. He works as assistant professor of Thermodynamics and Heat Transfer at the University of Modena and Reggio Emilia and he is a co-founder of the Bio Energy Efficiency Lab (BEELab).

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Session reference: 2AV.2.10
Subtopic: 2.4 Gasification for Power, CHP and Polygeneration
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Coupling a Fixed Bed Gasifier with a Char Bed Reactor to Improve Syngas Quality

Short introductive summary:

Gasification produces a syngas with high CO and H2 contents, which can be injected into an internal combustion engine to produce electricity. As tar content must be lower than 100 mg/Nm3, gas cleaning is a major bottleneck for this technology development. In this work, we investigated the tar cracking of a syngas from a commercial gasifier along a fixed bed of char.

Presenter: **Valentin HUCHON, NAODEN / CIRAD, Montpellier, FRANCE**

Presenter's biography:

No biography

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Session reference: 2AV.2.11

Subtopic: 2.4 Gasification for Power, CHP and Polygeneration

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Precision Forest Harvesting: Wood Extraction Planning and Validation of Gis Models

Short introductive summary:

The present study was set up in Abruzzo Region in Italy, and it had a double aim. The first one was the validation of the reliability of three different Digital Terrain Models (DTM) for forest operations planning. The first DTM is a 10 m resolution one available at national scale, the second one is a 10 m resolution DTM developed by Abruzzo Region and the last one is a 1 m resolution DTM derived from LiDAR data. The RDBM model for calculation of topographic distance from existing forest road network was applied using the three different DTMs as an input. Subsequently a GNSS field survey allowed for checking the reliability of the predictions of the RDBM model, for what concerning the estimation of topographic distance from road network. After identifying the most reliable DTM, a forest utilization planning was developed considering cable skidder and cable yarder as extraction systems.

Presenter: **Francesco LATTERINI, CREA-IT, Monterotondo, ITALY**

Presenter's biography:

Researcher in Agricultural Mechanization.

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Session reference: 1AO.4.1

Subtopic: 1.1 Biomass Potentials and Biomass Production Models

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

A Framework for Addressing Global Biophysical Potential of Land-Based Negative Emissions through Soil Organic Carbon Sequestration Through Biopumps

Short introductive summary:

The world's depleted soil organic carbon stocks (e.g. due to intensive agricultural practices) have been recognised as carbon sinks with large mitigation and adaptation potentials. The questions arise on whether higher SOC stock levels can be achieved and preserved, and to which extent they contribute to climate neutrality as a negative emission element compared against a baseline. The main objective of this study is thus to assess global soil carbon sequestration potentials of specific crops (here referred as biopumps) on target areas worldwide under biophysical constraints. We propose a step-wise framework to identify the sequestration potentials on so-called "marginal land" (including abandonment) featuring low soil organic carbon stocks =30 t/ha and match them with the most suitable biopumps for each given target area. The approach builds on a typology and geospatial data to cluster resulting target areas and define archetypes with unique characteristics (e.g. land cover and SOC stock class, climate and soil type, etc.). Subsequently, soil organic carbon simulations compare both the baseline with long-term future scenarios (i.e. implementation of biopumps as negative.

Presenter: **Ariane ALBERS, INSA-Toulouse, Toulouse Biotechnology Institute, Bio & Chemical Engineering Dpt., Toulouse, FRANCE**

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Session reference: 1AO.4.3

Subtopic: 1.1 Biomass Potentials and Biomass Production Models

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Can Long-Term Soil Organic Carbon Stocks Be Maintained When Considering the Recalcitrant Returns from Bioeconomy Processes? a National Case Study for France.

Short introductive summary:

This work studies the interaction between the maintenance of long-term (100 years) soil organic carbon (SOC) stocks, and the use of crop residues for the bioeconomy in France. More specifically, it focusses on conversion pathways involving a partial carbon return to soils, often in a more recalcitrant form. The hypothesis is that the consideration of this interaction may allow to harvest a higher amount of crop residues, without changing the SOC that would have otherwise been observed without harvest. Five bioeconomy scenarios are thus compared to a no-harvest scenario, for the period 2020-2120. These include the use of crop residues for pyrolysis (biochar return), anaerobic digestion (digestate return), hydrothermal liquefaction (hydrochar return), bioethanol (molasses and fibers), and gasification (tar and char return). The aim of this work is to determine the maximal amount of crop residues that can be removed from arable lands for each conversion pathway and optimize the distribution of the carbon returns of bioeconomy products at the national level, in order to maximize the amount of crop residues that can be used for bioeconomy while maintaining current SOC stocks.

Presenter: **Christhel ANDRADE, INSA Toulouse, Toulouse, FRANCE**

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Session reference: 1AO.4.4
Subtopic: 1.1 Biomass Potentials and Biomass Production Models
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Assessment of Agrobiomass Combustion in State-of-The-Art Residential Boilers

Short introductive summary:

Substitution of fossil fuels with agrobiomass can be a very promising option for the decarbonisation of the heating sector, especially in rural areas. AgroBioHeat is an on-going EU Horizon 2020 project that aims to provide a comprehensive platform for overcoming barriers and support the market uptake of agrobiomass heating. In the context of the project agrobiomass involves straw, prunings, agro-industrial residues (e.g. olive stones, nut shells) and energy crops.
One specific aspect tackled by AgroBioHeat is the investigation of the performance of market available residential heating boilers during operation with agrobiomass (evaluation of emissions and efficiencies as well as of the operational performance). Therefore, comprehensive test runs with in total seven different boilers and 15 agrobiomass assortments are presently performed at three different project partners. The test runs at BIOS BIOENERGIESYSTEME GmbH (AT)are already in their final phase and their results shall therefore be presented in this paper.

Presenter: **Thomas BRUNNER, BIOS Bioenergiesysteme, Graz, AUSTRIA**

Presenter's biography:

Studied Chemical Engineering at Graz University of Technology
PhD thesis "Aerosols and coarse fly ashes in fixed-bed biomass combustion–formation, characterisation and emissions" at Eindhoven University of Technology.
Since 1995 project manager at BIOS BIOENERGIESYSTEME GmbH, Graz(AT).

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Session reference: 2AO.5.1
Subtopic: 2.2 Biomass and Bioliquids Combustion for Small and Medium Scale Applications
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Influence of Wood Species and Additives on the Combustion Behavior of Wood Pellets in Stoves and Boilers

Short introductive summary:

A high proportion of the pellets sold on the market are already labelled with ENplus but a former pellet screening (42 samples from certified wood pellets) had shown a high variability in some physical (i. e. pellet length, bulk density, particle density) and chemical parameters. Moreover; common sources of raw material for pellet production like spruce and pine residues from sawmills will become less important since these wood species are sensitive to climate changes and bark beetles. Other wood species such as douglas fir, larch, beech and oak may become more important for wood pellet production. This study aims at a systematic assessment of pellet properties and their impact on combustion and pollutant emissions in stoves and boilers. Particular focus is set on wood species, binders and additives.

Therfore in total 31 pellet assortments were produced from different wood species and spruce wood with various binders, additives and a variation in length, share of fines and water content. These pellets were combusted in a pellet stove an a pellet boiler to investigate differences in emissions caused by these fuel parameters.

Presenter: **Robert MACK, Technology and Support Centre of Renewable Raw Materials, Solid Biofuels Dpt., Straubing, GERMANY**

Presenter's biography:

Robert Mack completed his Master degree in Environmental Engineer-ing at the University of applied sciences Amberg-Weiden in 2014. He now works as a researcher in the department of Solid Biofuels at the Technology and Support Centre.

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Session reference:	2AO.5.2
Subtopic:	2.2 Biomass and Bioliquids Combustion for Small and Medium Scale Applications
Topic:	2. BIOMASS CONVERSION FOR BIOENERGY

Inverted Flame Multi-Stage Combustion: Modelling of A Newly Developed Pellet-Stove Prototype with Flue Gas Recirculation

Short introductive summary:

Pellet stoves for space heating have become more and more popular throughout Europe in the last years, but there is the need to achieve always higher conversion efficiencies and to further lower pollutant emissions. A new prototype of pellet stove is here proposed. The basic system is an inverted flame stove in which part of the flue gases produced during the combustion process is recirculated back into the feeding and used for gasifying the input biomass. A thermodynamic model was developed and integrated with a kinetic model to estimate the temperature profiles and the evolution of the gaseous phase and of the combustion flame inside the stove. The model is able to describe the activation and development of the flame both in the gasification and in the combustion sections, and thus it allowed to identify the conditions under which the stove could work satisfactorily keeping the emissions level under control. Validation of the model was done on a purpose-built prototype, specifically arranged for the measurement of temperature levels inside the stove, flows, gas composition and pollutants concentrations.

Presenter: **Eleonora CORDIOLI, Free University of Bolzano, Faculty of Science and Technology, Bolzano, ITALY**

Presenter's biography:

Eleonora Cordioli recently got her PhD in Sustainable Energy and Technologies from the Free University of Bolzano (Italy). She is dedicated to the study of biomass gasification processes, and, in particular, to the valorization of char through use in adsorption and catalytic applications.

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Session reference: 2AO.5.3
Subtopic: 2.2 Biomass and Bioliquids Combustion for Small and Medium Scale Applications
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Reduction of NOx Emissions from Biomass Boilers by an Integrated Three-Way Catalyst

Short introductive summary:

Within recent years the limitation of NOx emissions for biomass combustion systems gets stricter and stricter. On the other hand the NO content of biomass fuels which is mainly responsible for NOx emissions often varies and increases from pellets over wood chips, bark, SRC to agricultural residues. Do to the strict emissions limits primary measures for NOx reduction are often not efficient enough. Conventional secondary measures (SNCR or SCR) show considerably higher conversion efficiencies but are cost expensive and also induce additional operation costs due to the reducing agents (e.g. urea) needed. Thus, innovative and economically attractive novel measures for NOx emission reduction in biomass combustion systems are of relevance.

Presenter: **Christoph MANDL, BIOS Bioenergiesysteme, Graz, AUSTRIA**

Presenter's biography:

Christoph Mandl studied Process Engineering at the Graz University of Technology in Graz, did his PhD at the Graz University of Technology and since January 2010 works as a senior project engineer at BIOS BIOENERGIESYSTEME GmbH in the research department.

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Session reference: 2AO.5.4

Subtopic: 2.2 Biomass and Bioliquids Combustion for Small and Medium Scale Applications

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Quantitative NMR Analysis of the Aqueous Product Streams from Large Pilot-Scale Steam Explosion Revealing High Value-Added Platform Chemicals

Short introductive summary:
This study demonstrates the identification and quantification of valuable bio-based chemicals in the aqueous phase product streams from large pilot-scale steam explosion using a quantitative analytical NMR-method.

Presenter: **Solmaz GHOREISHI, University of Bergen, Chemistry Dpt., Bergen, NORWAY**

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Session reference: 3AO.6.1
Subtopic: 3.7 Bio-Based Chemicals and Materials
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Optimization Study for Extraction of the Value-Added Compounds Polyphenols from the Waste Biomass Coffee Silverskin in the Perspective of Circular Economy

Short introductive summary:

Coffee is one of the largest consumed drinks all over the world, generating a very significant amount of wastes during the beans processing. Among these by-products, coffee silverskin is a very interesting waste product deriving from the roasting process. Up to now, these waste residues have no specific use, being mostly discharged in landfill or burned. On the other hand, in recent years, coffee silverskin has attracted great attention as promising source of bioactive compounds, including valuable polyphenols as chlorogenic acids and caffeine. The aim of the present research is the investigation and the optimization of a sustainable solid-liquid extraction of valuable antioxidant polyphenols from coffee silverskin under microwave irradiation. The influence of the main reaction parameters, such as temperature, extraction time and composition of the solvent, consisting of a green binary mixture of water/ethanol, has been assessed, also employing statistical modeling. Maximum yield in total polyphenols of about 45 mgGAE/g, expressed as mg of gallic acid for g of starting biomass, was experimentally achieved, a value higher than the majority reported, up to now, in the literature.

Presenter: **Claudia ANTONETTI, University of Pisa, Chemistry and Industrial Chemistry Dpt., Pisa, ITALY**

Presenter's biography:

C. Antonetti is Associate Professor of Industrial Chemistry. She took her Master degree cum laude at University of Pisa in 2006, her PhD cum laude at Scuola Normale Superiore in 2010 and her Master’s degree in Bioenergy and Environment in 2015. Co-author of 50 scientific international publications.

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Session reference:	3AO.6.2
Subtopic:	3.7 Bio-Based Chemicals and Materials
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Assessment of Wood Ashes from Decentralized Heating Plants as Raw Material for Fertilizer Production

Short introductive summary:

Ashes from biomass heating (and power) plants that apply natural fuels may be suitable for the use as fertilisers if certain requirements regarding pollutants and nutrient contents are met. The range and average values of relevant nutrients and pollutants in wood ashes from Bavarian biomass heating and power plants were determined by on-site sampling. For this purpose, different ash fractions from 18 Bavarian heating and power plants were investigated (n=50, bottom and cyclone ashes). In 30% of all cases, the heavy metal limits of the German Fertiliser Ordinance were met in the sampled bottom ashes directly. The limit values were exceeded in some cases for chromium(VI), cadmium and lead. Cyclone ashes were high in cadmium, lead and zinc. If chromium(VI) could be reduced by suitable treatment, 85% of the bottom ashes would comply with the required limit values. Therefore, quality assurance systems should be applied at biomass heating plants if wood ashes should be used as fertilisers in agriculture. The analysis of the main nutrients showed high values for potassium and calcium, but also relevant amounts of phosphorus in wood ashes, making them suitable as fertilisers.

Presenter: **Hans BACHMAIER, Technology & Support Centre in the Centre of Excellence for Renewable Resources, Solid Biofuels Dpt., Straubing, GERMANY**

Presenter's biography:

University of Applied Sciences Weihenstephan and University of Natural Resources and Life Sciences Vienna
2003-2011: Bavarian State Research Center for Agriculture in Freising / Germany (energy generation from biogas)
Since 2012: TFZ in Straubing / Germany (solid biofuels)

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Session reference: 3AO.6.3

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Conversion of Pine Sawdust into Ductile Bioplastic and Hydrochar

Short introductive summary:

Pine sawdust was converted into a novel ductile bioplastic and hydrochar through chemical and biological processing.

Presenter: **Jian YU, University of Hawaii at Manoa, Hawaii Natural Energy Institute, Honolulu, USA**

Presenter's biography:

Dr. Jian Yu graduated from University of British Columbia (PhD, 1991), Zhejiang University (MSc, 1985) and Zhejiang Institute of Technology (BEng, 1982). Dr. Yu is now a research professor at University of Hawaii at Manoa (2001-present).

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Session reference:	3AO.6.4
Subtopic:	3.7 Bio-Based Chemicals and Materials
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Consequential LCA of Advanced Biofuels Based on Biomass Residues - Case Studies for Flanders

Short introductive summary:

The presentation will show results of a study that developed an assessment framework to evaluate the environmental and societal relevance of the use of biomass residues for biofuel production through consequential LCA (CLCA). This was applied to the following case studies for Flanders (Belgium): (1) lignocellulose fermentation to ethanol (corn stover), (2) liquefaction and further processing to fuel quality and (3) gasification and methane synthesis (options 2 and 3 for the woody fractions).

Presenter: **Luc PELKMANS, CAPREA Sustainable Solutions, Mol, BELGIUM**

Presenter's biography:

Luc Pelkmans (°1971)worked as project manager biobased economy for VITO in Belgium from 1996 to 2017. Currently he is Technical Coordinator of the IEA Bioenergy Technology Collaboration Programme. He is also manager of the consultancy firm CAPREA Sustainable Solutions.

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Session reference: 4AV.3.2

Subtopic: 4.2 Environmental Impacts

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Spatial Life Cycle Assessment of Rapeseed Based Biodiesel Production in Central Germany

Short introductive summary:

This study integrated a regional life cycle assessment approach with GIS to evaluate the environmental impacts of rapeseed-based biodiesel system. The inclusion of spatial heterogeneity could enhance generic LCA for environmental impact assessment.

Presenter: **Xueqing YANG, Helmholtz Center for Environmental Research - UFZ, Bioenergy Dpt., Leipzig, GERMANY**

Presenter's biography:

My primary research interest is conducting landscape ecosystem service evaluation, land-use change monitoring, and modelling carbon dynamics by using ecological modelling tools and GIS techniques. I am also passionate about spatially explicit environmental life cycle assessment on bioenergy system.

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Session reference:	4AV.3.3
Subtopic:	4.2 Environmental Impacts
Topic:	4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Life Cycle Assessment of Ethanol and Calcium Tartrate Production from Wine Industry Residual Biomass: the Case Study of Caviro Extra Srl

Short introductive summary:

This work aims to perform a Life Cycle Assessment (LCA) according with ISO 14040-44 of the ethanol and TCa production process of Caviro Extra, a company which is an example of a real biorefinery and of industrial symbiosis, and which is adopting a cascade approach in the valorisation of winery by-products, achieving also self-sufficiency in energy consumption. Also, a comparison to case studies found in literature and secondary data (in particular ecoinvent datasets) is applied. LCA is conducted using GaBi software with Gabi Professional Database and ecoinvent version 3.6 database.

Presenter: **Serena RIGHI, University of Bologna, Centro Interdipartimentale di Ricerca per le Scienze Ambientali and CIRI Energia e Ambiente, Bologna, ITALY**

Presenter's biography:

Assistant professor at the of Bologna University since 2002, she carries out her research activities in the field of environmental impact assessment. Particular attention is paid to the study and application of the concept of Life Cycle Thinking and to the evaluation methods connected to it.

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Session reference: 4AV.3.4

Subtopic: 4.2 Environmental Impacts

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Impact of Riparian Plants Biomass Assessed by UAV-Acquired Multispectral Images on the Hydrodynamics of Vegetated Streams

Short introductive summary:

Please note: the author Lama is participating to EUBCE Student award

UAVs indexes and hydraulics measurements are useful to predict how biomass change can affect the behavior of vegetated water bodies. Riparian vegetation has a paramount impact on both flow resistance and water quality in vegetated open channels. Defining the most appropriate management practice of riparian vegetation inside both natural and manmade water bodies is crucial for assuring a balance between a satisfactory level of hydraulic conveyance and a high environmental value of water. The presence of riparian vegetation significantly affects both mean and turbulent flow fields, with important implications on oxygen production and transport of nutrients within vegetated open channels. The processing of UAVs acquisitions is a fast way to assess riparian vegetation biomass, synthetically expressible by means of Leaf Area Index (LAI). LAI maps can be easily related to NDVI maps by processing UAV-acquired multispectral images. Comparing LAI derived from UAV and ground-based LAI measurements based on optical devices, it was possible evaluating the impact of the accuracy of UAV techniques on channels behavior.

Presenter: **Giuseppe Francesco Cesare LAMA, University of Napoli Federico II, Agricultural Sciences Dpt., Portici, ITALY**

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Session reference: 4AV.3.6

Subtopic: 4.2 Environmental Impacts

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Air Pollutant Emissions from Biomass-Fired Boiler in a Modeled Hydrocarbon-Fuel Biorefinery

Short introductive summary:

Production of biofuels can reduce our dependency on fossil sources and help achieve energy independence. However, the process of converting biomass to biofuels is expected to emit air pollutants including greenhouse gas (GHG) emissions, hazardous ai pollutants (HAP), ammonia, and other criteria pollutants. While prior research has evaluated the technical feasibility of biofuel production technologies,1–5 there are still gaps in understanding the emissions from novel biofuel production facilities, especially from unit operations burning unconventional fuel such as boiler which could be the largest contributor of air pollutant emissions, depending on the size and operation. The aim of the research is to refine the emission estimates for a biomass boiler in a design biorefinery burning unconventional fuel (lignin, unconverted cellulose and hemicelllulose, biogas, wastewater, and off gases) to produce steam and electricity. Results from this analysis could be helpful to the biorefinery developers for deployment of novel technologies and assist with issues related to emission estimation which is a pre-requisite for permit application.

Presenter: **Arpit BHATT, National Renewable Energy Laboratory, Strategic Energy Analysis Center, Golden, USA**

Presenter's biography:

Arpit Bhatt is a Bioenergy Process Analysis Engineer at the National Renewable Energy Laboratory. His research interests include techno-economic analysis for advanced biofuel production, and air quality analysis for evaluating the sustainability of biofuel conversion technologies.

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Session reference: 4AV.3.7
Subtopic: 4.2 Environmental Impacts
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Consequential Life Cycle Assessment Framework for Thermochemical Biomass Conversion Processes

Short introductive summary:

The main objective of this study was to provide a generic and consistent LCA framework to quantify the environmental performance of thermochemical processes (pyrolysis, gasification and hydrothermal liquefaction (HTL)) for the transition from fossil-based carbon in France. The LCA framework is herein presented and exemplified with three case studies for the valorisation of three biomasses (forestry residues (PFR), wheat straw and Miscanthus). Detailed LCA results about the pyrolysis process in the first case study (PFR) were obtained; the other results for the three thermochemical processes in the three case studies are under elaboration. Overall, the pyrolysis scenario showed a better environmental performance than the reference scenario in which PFR are left on soil to decompose. For example, in the climate change impact category, the pyrolysis scenario shows a reduction of 906 kg CO2e as compared to the reference scenario. The framework built in this study provides a guide for LCA practitioners with the key considerations to be addressed when setting the system boundary for such systems.

Presenter: **Lorie HAMELIN, University of Toulouse, Toulouse Biotechnology Institute, Toulouse, FRANCE**

Presenter's biography:

Lorie Hamelin have received funding from the French presidential climate plan “Make our planet great again”. In this framework, she is, since August 2018, establishing a carbon management research line within the facilities of Toulouse University.

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Session reference: 4AV.3.8

Subtopic: 4.2 Environmental Impacts

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Evaluation of Leachate from Wood Chip Piles Regarding Water Protection

Short introductive summary:

There are ongoing controversies between forestry and environmental administrations regarding the environmental impacts of leachate-ingredients from open-stored wood chip piles. Wood chips from forest residues (FRC) and energy roundwood (ERC) were stored uncovered in two outdoor piles (120 m³, each) for six months. Wood chips samples of each pile were irrigated following two common precipitation scenarios (2.5 and 10 mm/h). In total, 120 irrigation trials were performed at the field laboratory using a custom built irrigation set-up. Chemical analysis of leachate included important organic ingredients, such as COD, BOD and DOC, element contents and measurements of pH-value, electrical conductivity and dry matter. The highest concentrations of most ingredients occurred after chipping, but decreased rapidly. Concentrations of heavy metals and trace elements complied with thresholds of German waste water laws. The results suggest that assessing the environmental impact of leachate from wood chips has to include chemical load, soil-filter effects and alternative use of the storage site. Simple guidelines of caution, e.g. a 5 m distance-rule to surface waters, should be followed.

Presenter: **Markus RIEBLER, Bavarian State Institute of Forestry, Forest Technology, Business Management and Timber Dpt., Freising, GERMANY**

Presenter's biography:

Markus Riebler studied Forest Engineering (B.Eng.) at the University of Applied Sciences Weihenstephan-Triesdorf (2008 – 2012). He achieved his master degree (M.Sc.) from the Technical University of Munich in Forest and Wood Sciences in 2014. After, he successfully completed the Forest Preparatory S

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Session reference: 4AV.3.9
Subtopic: 4.2 Environmental Impacts
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Emission Factors from Wood Briquette Combustion: Comparative Study of the French Market

Short introductive summary:

Nowadays, climatic changes become a major issue mainly because of the energy fuel consumption of human activities. This is why European directives encourage the use of renewables energies. Currently, the most used renewable energy in France for the heat production is wood-energy mainly under log form.Densified fuels (log or pellet) have the additional advantage of upcycling by-products of the wood industry like sawdust and chips. In France, by comparison with the wood pellets industry, the wood briquette industry suffers from a lack of structuration.This work aims to make a state of the characteristics (ash content, water content, PCI, elemental content, pollutants emission factors) of 20 commercial briquettes representative of the actual French market. This sample group was set up with the different actors of the French wood briquette industry (producers and/or distributors). Combustion tests were performed in real conditions in a domestic stove with emissions tracking of gaseous emissions (O2, CO2, CO, SO2, NO2, NO, THC and NMHC) and particulate emissions (ELPI and TSP).

Presenter: **Gontrand LEYSSENS, Université de Haute Alsace, Mulhouse, FRANCE**

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Session reference: 4AV.3.10
Subtopic: 4.2 Environmental Impacts
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Biomass Combustion: Comparison between "Open Burning" and Boiler Combustion, and Characterization of the Metals Present on the PM10, 2.5 and iltermediate Fractions

Short introductive summary:

The uncontrolled combustion of agricultural waste (open burning) represents an important source of atmospheric pollution. PM is certainly one of the main harmful compounds generated by the biomass combustion process. It has a negative effect both on the environment and on the respiratory system of living beings and when is generate in combustion phase is often rich in terms of metals.The proposed work characterizes, in terms of metals emitted, PM10, PM2.5 and the fraction between 10 and 2.5 generated by a biomass combustion plant with and without multi-cyclonic filter.The aim of the work is to use a biomass (citrus pruning) to compare the open burning (simulating it through a boiler without abatement systems, 80 KWth) with the controlled combustion in a 35 KWth boiler with a PM abatement system (Multicyclone Filter). Chimney sampling with an impactor designed by DADOlab srl for PM 10, 2.5 PM 10 and PM2.5 and the subsequent analysis of the filters in ICP-MS allows to observe the distribution of metals.

Presenter: **Francesco GALLUCCI, CREA-IT, Monterotondo, ITALY**

Presenter's biography:

Researcher at the Council for agricultural research and economics - Research Centre for Engineering and Agro-Food Processing (CREA-IT). He works on the energy conversion of biomass (combustion, gasification and anaerobic digestion). Authors of more than 40 scientific publications.

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Session reference: 4AV.3.11
Subtopic: 4.2 Environmental Impacts
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Evaluation of the Impacts of Anaerobic Digestion on C and N Cycles Using an Anaerobic Digestion Model Coupled to a Crop Model at the Scale of a French Crop-Livestock Farming System.

Short introductive summary:

Anaerobic digestion (AD) is a way to treat organic wastes and produce biogas, a renewable energy. The digested organic matter, called digestate, can be returned to agricultural soils as an organic fertilizer. The use of digestate in agriculture increases, with several advantages (nutrient recycling, decrease of chemical fertilizers usage, soil organic matter increase) and risks (NH3 volatilization, soil compactions, N2O emissions). There is still a need to characterize those impacts altogether, at the farming system scale. Long-term effect of digestate application on soil organic matter also needs further investigation. In this study, the introduction of an anaerobic digester in an integrated crop-livestock farming system was investigated. The implementation of AD in a such farm induces the substitution of raw animal manures by digestates with different characteristics, and in different quantities. Thus, it induces changes in Carbon (C) and Nitrogen (N) cycles, both in the field and during treatment step (storage, digestion process).
The objectives of this study were to investigate the impacts on C/N cycle of the introduction of AD in livestock farming system.

Presenter: **Victor MOINARD, INRAE, Thiverval-Grignon, FRANCE**

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Session reference: 4AV.3.12
Subtopic: 4.2 Environmental Impacts
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Characterization of Biomass Burning Tracers in PM2.5 Aerosols

Short introductive summary:

Biomass combustion processes release considerable amounts of pollutants into the atmosphere on a global scale. Molecular tracer techniques have been applied in several investigations to assess the contributions of biomass burning smoke to the ambient aerosol burden. Particularly, potassium is a well-known tracer of biomass burning deriving from the extensive use of fertilizers that aim to increase the biomass production. More recently, the anhydrosugars levoglucosan, mannosan, and galactosan have been recognized as suitable markers due to their source-specific generation and stability. Determining and quantifying the contribution of biomass burning to atmospheric particulate matter through the use of these markers could be a useful tool for managing and evaluating the different sources of atmospheric pollution.

Presenter: **Beatrice VINCENTI, CREA, CREA-IT, Monterotondo, ITALY**

Presenter's biography:

Graduated in Analytical chemistry, I am a research fellow at CREA (Council for Research in Agriculture and Economic Agraries - Monterotondo, Italy) and I deal with the characterization and analysis of biomass of agroforestry origin to be used as new green fuels.

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Session reference: 4AV.3.13

Subtopic: 4.2 Environmental Impacts

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Environmental Impact Analysis of Brazil's Southern Region Canola Oil Production

Short introductive summary:

The present work's objective is elaborating a life cycle inventory (LCI) of canola production in the South of Brazil, considering its two main products, oil and bran. This study applies this tool to evaluate the hotspots (critical points) that most contribute to the oil production chain's environmental impacts.

Presenter: **Edgar A. SILVEIRA, University of Brasilia, Mechanical Engineering Dpt., Brasília, BRAZIL**

Presenter's biography:

Professor at the Department of Mechanical Engineering, University of Brasilia. PhD in Mechanical Sciences from the University of Brasilia (Brazil) and in Fiber and Wood Sciences from the University of Lorraine (France)

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Session reference: 4AV.3.14
Subtopic: 4.2 Environmental Impacts
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Assessing the Role of Gap Fraction on the Leaf Area Index (LAI) Estimations of Riparian Vegetation Based on Fisheye Lenses

Short introductive summary:

Leaf Area Index (LAI) is one of the most used parameters to characterize the phenological stage of riparian vegetation biomass. A smart method to assess LAI is embodied by the imagery of images acquired by means of Fisheye lenses, based on binarization methods capable to return the value of gap fraction referring to each image. The statistical analysis of the gap fraction on LAI of riparian vegetation can furnish useful insights to hydraulic and environmental engineers when dealing with riparian vegetation management and design.

Presenter: **Giuseppe Francesco Cesare LAMA, University of Napoli Federico II, Agricultural Sciences Dpt., Portici, ITALY**

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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Session reference: 4AV.3.16

Subtopic: 4.2 Environmental Impacts

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Environmental Assessment of Biofuel Production Using Waste Wood Integrated in a Large-Scale Steel Mill

Short introductive summary:

The methodological approach of the environmental assessment of waste wood used for biofuel production integrated in a large-scale steel mill is described. Therefore, the approach, the system and the environmental impacts of the use of waste wood in a steel mill are presented. This work is part of the H2020 project TORERO (TORefying wood with Ethanol as a Renewable Output: large-scale demonstration). This project demonstrates a cost-, resource-, and energy-efficient technology concept for producing bioethanol from waste wood, integrated in a large-scale steel mill. Wood waste is converted to biocoal by torrefaction, biocoal replaces fossil powdered coal in a steel mill blast furnace. Carbon monoxide and hydrogen in blast furnace exhaust fumes is microbially fermented to bioethanol, while material and energy loops of the process are closed to a very large degree. The results of the environmental assessment using the methodology Life Cycle Assessment (LCA) show, the importance of including the whole value chain and comparing the results to the actual situation to evaluate the environmental impacts of waste wood use.

Presenter: **Maria HINGSAMER, Joanneum Research Forschungsgesellschaft, Graz, AUSTRIA**

Presenter's biography:

Maria Hingsamer holds a diploma in Environmental System Sciences and is a scientist at JOANNEUM RESEARCH. She is working in the field of Life Cycle Sustainability Assessment (technological and environmental) with a focus on biofuels, biorefineries and integration in existing industries.

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Session reference: 4AV.3.17
Subtopic: 4.2 Environmental Impacts
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Application of Techno-Ecological Synergies in Life Cycle Assessment (TES-LCA) to Microalgal Biofuel

Short introductive summary:

TES framework is illustrated by the application of Life Cycle Assessment(LCA) to a microalgal biofuel production system. The techno-ecological synergy in life cycle assessment (TES-LCA) of microalgae-based biofuel availed in this study has enabled the assessment of complete environmental sustainability integrating demands and supplies of ecosystem services that are overlooked in a conventional LCA. TES involves ecosystem modules in addition to process modules in LCA. TES-LCA defines a “techno-ecological” matrix equivalent to the technological matrix in traditional LCA. The production of microalgal biofuel in this study is carried out by cultivation of algae in photobioreactors(PBRs) utilizing the biofuel process pathway: hydrothermal liquefaction(HTL) followed by hydro-treating of bio-crude. TES-LCA is applied to this biofuel production system by employing demands for and supply by the ecosystems. The demand for ecosystem services comprises the natural resources utilized by the biofuel production system and further their discharge of emissions into the environment, whereas supply by relevant ecosystems (e.g., a grove of trees of a particular type) accounts for ecosystems

Presenter: **Neelima KUMARI, Indian Institute of Technology Roorkee, Hydro and Renewable Energy Dpt., Jamshedpur, INDIA**

Presenter's biography:

I am currently pursuing MTech from Indian Institute of Technology Roorkee, India. My research area includes Techno-Ecological Synergy Assessment and Life Cycle Assessment of Microalgae based Biofuels.

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Session reference: 4AV.3.18

Subtopic: 4.2 Environmental Impacts

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Simulation of Supercritical Water Gasification of Black Liquour - the Fate of CO2 and H2S

Short introductive summary:

In this presentation we will show how the supercritical water gasifcation of black liquor can be simulated taking into account both the high temperature, super critical part, and the acid-base reactions after condensation of the products. The result show that carbon dioxide show a determining role in the distribution of the final products. The system was simulated and optimised in Python using Cantera and Chempy. The model integrates the supercritical water conversion of the organic matter as well as the acid base reactions after condensation.

Presenter: **Geert HAARLEMMER, CEA-LITEN, DTBH, Grenoble, FRANCE**

Presenter's biography:

Chemical engineering degree from Eindhoven University of Technology and a PhD degree from the University of Manchester (UMIST). Professional experience includes 13 years in the petroleum industry and 12 years in biomass conversion projects and CEA.

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Session reference: 2AV.4.1
Subtopic: 2.5 Gasification for Synthesis Gas Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Pyrolysis and Steam Gasification of Biomass and Waste in a Bubbling Fluidized Bed: Effect of Operating Conditions and Fuel Nature

Short introductive summary:

Thermochemical conversion of waste appears as a promising alternative to biomass du to lower competition in its uses and thus lower prices. Among these, Refuse-Derived Fuels are of particular interest due to their important calorific value and a rather high amount of plastics but variations in composition and thepresence of Chlorine, Nitrogen and Sulfur in these fuels remain an issue for their use in industrial gasification plants.

This work aims provides a parametric study of the pyrolysis and steam-gasification behavior of Refuse-Derived Fuels and Pine Wood in a pilot scale Bubbling Fluidized Bed reactor between 700 and 850°C.

The experimental results presented in this work show that syngas produced through RDF pyrolysis and steam-gasification contains a high amount of H2 and light hydrocarbons in comparison with pine wood making RDF an excellent candidate for use in steam-gasification plants.

Presenter: **Thomas ESTEVES PEREIRA, INP Toulouse, LGC Dpt., Toulouse, FRANCE**

Presenter's biography:

PhD student at the Laboratoire de Génie Chimique in Toulouse, France under the supervision of Pr. Mehrdji HEMATI.
PhD subject : Steam-gasification of biomass/RDF mixtures in a Fast Internally Circulationg Fluidized Bed for the production of a hydrogen-rich syngas.
PhD funded by ENGIE Lab CRIGEN.

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Session reference: 2AV.4.2
Subtopic: 2.5 Gasification for Synthesis Gas Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Steam Reforming of Hydrocarbons from Sorption Enhanced Gasification of Biomass: Influence of Tar Model Compounds on Methane Conversion and Catalyst Behavior

Short introductive summary:

To enhance the overall gas quality for further synthesis applications, methane and other light hydrocarbons as well as tar in the synthesis gas from sorption enhanced gasification (SEG) of biomass are desirable to be converted into H2 and CO. This work focuses on steam reforming of methane and tar model compounds over a nickel-based catalyst in the simulated SEG derived condition. Since tar in synthesis gas can easily deactivate nickel-based catalysts, the influence of tar on methane conversion and catalyst behavior in the long-term reforming were discussed. Various parameters were studied such as reaction temperatures, amount and different fractions (toluene to naphthalene) of tar model compounds.

Presenter: **Thiansiri KERTTHONG, University of Stuttgart, Institute of Combustion and Power Plant Technology, Stuttgart, GERMANY**

Presenter's biography:

Thiansiri Kertthong is a PhD candidate at the Institute of Combustion and Power Plant Technology (IFK), University of Stuttgart, Germany. Her research is in the field of fluidized bed gasification of biomass and focuses specifically on the reduction/conversion of methane.

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Session reference: 2AV.4.3
Subtopic: 2.5 Gasification for Synthesis Gas Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Gasification Campaigns at a Bench Scale Bubbling Fluidized Bed Plant for Syngas Production: Evaluation of Primary Methods for Gas Cleaning and Conditioning

Short introductive summary:

The present contribution concerns the results collected in an experimental gasification campaign carried out at a bench scale facility, based on a bubbling fluidized bed reactor. By using Olive pomace and RDF as feedstocks, process characterization data were collected when carried out in the presence of olivine alone and when mixed with dolomite and with the addition of alkali sorbents as primary methods for the reduction of tar and inorganic contaminants (e.g. HCl and H2S). The work is part of a wider activity aimed at evaluating the potential exploitation of residual feedstocks in an advanced gasification plant for high efficient CHP application, in which both primary and secondary methods are considered to achieve the high demanding technical specifications required by commercial SOFCs.

Presenter: **Donatella BARISANO, ENEA Research Centre, Energy Technologies Dpt., Rotondella, ITALY**

Presenter's biography:

Donatella Barisano is senior researcher at Enea Trisaia Research Center. She works in the field of biomass valorization for bioenergy and biofuels production. Her present activity is focused on biomass gasification and use of catalysts and sorbents for gas upgrading and conversion.

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Session reference: 2AV.4.5
Subtopic: 2.5 Gasification for Synthesis Gas Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Influence of Pre-Treatment of Herbaceous Biomass Feedstocks on Ash-Related Issues in Chemical Looping Gasification

Short introductive summary:

The paper deals with investigations, experimental as well as modelling, on the influence of pre-treatment (e.g., additivation, leaching and/or torrefaction) of herbaceous biomass feedstocks on ash-related issues in gasification.

Presenter: **Florian LEBENDIG, Forschungszentrum Jülich, Microstructure and Properties of Materials (IEK-2), Jülich, GERMANY**

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Session reference: 2AV.4.6
Subtopic: 2.5 Gasification for Synthesis Gas Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Dry Reforming of Methane over Ni-Based Coconut Char Catalysts for Syngas Production

Short introductive summary:

In this study, Ni-based coconut activated char (Ni-CAC) has shown good catalytic ability in dry reforming of methane. Since exceeding loading of Ni amount over 10% has no promising enhancement of methane conversion, 10%Ni on CAC is regarded as the properest fraction for dry reforming. The catalytic performance and reforming path over 10%Ni-CAC and Ni-CC are highly affected by temperature. Increasing temperature from 600 to 800 °C results in the rise of CH4 conversion and H2/CO selectivities. Although Ni-CC exhibits a better performance on dry reforming compared to 10%Ni-CAC, 10%Ni-CAC can better prevent coke formation, which is beneficial for long-term operation. In addition, when the volumetric ratio of CH4 to CO2 rises from 0.5 to 2, CH4 conversion over 10%Ni-CAC remains similar performance without intense coke formation, suggesting a possible utilization of this char catalyst in practical biogas with a typical VCH4/VCO2 of 2. In the future, a kinetic model of methane reforming with CO2 over 10%Ni-CAC has to be developed. The theoretical residence time for complete methane conversion can be thus found out.

Presenter: **Zongpei YE, IFK, Stuttgart, GERMANY**

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Session reference: 2AV.4.7
Subtopic: 2.5 Gasification for Synthesis Gas Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Air Gasification of Low Grade Biomass in a Pilot-Scale Gasifier with a Bubbling Fluidized Bed Reactor: Effect of Activated Carbon Tower on Tar Removal

Short introductive summary:

Low grade biomass, which is known as third grade wood pellet in South Korea, was gasified in a pilot-scale (1 ton /day) fluidized bed reactor equipped with char separation system and activated carbon tower. In gasification experiment, the tar generated is crucial problem due to the blocking of pipe lines and equipment. In this study, the gasification of low grade biomass was carried out under the various equivalence ratios (ERs). In addition, the effect of activated carbon tower was investigated to reduce the tar content in producer gases. The compositions of producer gases generated were analyzed using NDIR (Non-dispersive infrared absorption) and GCs (FID and TCD). As the ER increased, the amounts of combustible gases (H2, CO and CH4) were decreased. At an ER of 0.26, the contents of H2, CO and CH4 in producer gas were 6.2, 13.4 and 4.5 vol.%, respectively. The tar content was 971 mg/Nm3. When the activated carbon tower was applied, the H2 content was clearly increased, reaching a 11.3 vol.%. In addition, the tar content was reduced to 462 mg/Nm3 due to the activated carbon tower.

Presenter: **Hyun Seung RHEE, Korea Institute of Industrial Technology, Clean Energy R&D Group, Cheonan-si, Chungcheongnam-do, REPUBLIC OF KOREA**

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Session reference: 2AV.4.8
Subtopic: 2.5 Gasification for Synthesis Gas Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Experimental Study on the Performance of Gasification of Eucalyptus in Downdraft Fixed Bed Gasifier at Various Conditions

Short introductive summary:

I am research scholar.My work area is biomass gasification.

Presenter: **Praveen KUMAR, IIT Dellhi, CRDT Dpt., South Delhi, INDIA**

Presenter's biography:

I am a Ph.D. scholar at the Indian Institute of Technology Delhi. my working area is gasification.

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P. Kumar, IIT Delhi, INDIA

Session reference: 2AV.4.9

Subtopic: 2.5 Gasification for Synthesis Gas Production

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Pruning of Biomass from Plant-Assisted BioRemediation (PABR): Use in a Gasification Plant and Monitoring of Syngas Quality

Short introductive summary:

Plant-assisted bioremediation (PABR) technology is a green strategy to recovery contaminated areas. Plant species and soil microorganism act synergistically to promote the transformation of contaminants in less toxic compounds.
In this work, a gasification plant produced by RESET srl and located at CISA spa (Massafra, TA, Italy) was used to gasify two different types of poplar pruning: uncontaminated and coming from PABR soil. Preliminarily the biomasses were chemically-physically characterized, subsequently the syngas generated by the plant was monitored to quantify the TAR and the metals present. One of the aims of this work is to analyse the emission released from the gasification process of biomass produced from pruning from PABR compared to an uncontaminated biomass. Demonstrating that the pruning of contaminated biomass is fully compatible with gasification plants would make it possible to transform what is currently recognized as a toxic waste product into a precious energy resource.

Presenter: **Enrico PARIS, CREA-IT, Monterotondo, ITALY**

Presenter's biography:

Analytical chemists specialized in GC/MS system. Technical collaborator at the LASER-B laboratory (Laboratory of experimental activities for renewable energy and biomass) of CREA-IT. In 2019 he began the PhD in "Energy and Environmental Engineering" at the Sapienza University of Rome.

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Session reference: 2AV.4.11
Subtopic: 2.5 Gasification for Synthesis Gas Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

A First and Second Law Thermodynamic Analysis of Different Biomass Gasification Coupled to Fischer-Tropsch Synthesis Configurations

Short introductive summary:

In this work, four Aspen Plus models of different configurations of an Integrated biomass Gasification Fischer-Tropsch system (IGFT) have been developed and compared, using the streams data to calculate the energy and exergy efficiencies of each piece of equipment.

Presenter: **Marco BARATIERI, Free University of Bolzano, Faculty of Science and Technology, Bolzano, ITALY**

Presenter's biography:

Professor in Thermal Engineering and Industrial Energy Systems at the Free University of Bolzano (Italy). M.Sc. and Ph.D. in Environmental Engineering, Director of the Energy Engineering Master and Head of the Bioenergy&Biofuel Lab. His main research field is thermochemical conversion of biomass.

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Session reference: 2AV.4.12
Subtopic: 2.5 Gasification for Synthesis Gas Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Permeate Composition Dependency on Feed Composition During Syngas Improving Utilizing Membrane Operations

Short introductive summary:

The study focuses on membrane operation utilization for syngas improving. The study however is being performed and thus results are not included. The expected time of finishing is Dec 2020.

Presenter: **Petr SEGHMAN, Czech Technical University in Prague, Process Engineering Dpt., Prague, CZECH REPUBLIC**

Presenter's biography:

- born 9th July 1993 in Slaný
- in september 2017 finished Ing. studies in Proces Engineering
- since then studying PhD in Process Engineering

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Session reference:	2AV.4.15
Subtopic:	2.5 Gasification for Synthesis Gas Production
Topic:	2. BIOMASS CONVERSION FOR BIOENERGY

Avoidance of the Operational Problem of Bed Agglomeration during Gasification of Barley Straw in Fluidized Bed Energy Generation Technologies

Short introductive summary:

In this work untreated barley straw, rich in ash and of low bulk density, was fed into the fluidised bed reactor at temperatures ranging between 750-920oC under gasification conditions, each resulting in bed agglomeration. The de-fluidisation operational problem became more prominent as the bed temperature increased. On the other hand, pre-treated barley straw didn't lead to any bed agglomeration during continuous operation of the FBG and was found to produce a greater concentration of producer gas. Also, leaching was found to reduce K, Cl, Na, P, Ca, S and Mg collectively resulting in an ash decrease of 82%.

Presenter: **Hassan ALABDRABALAMEER, University of Hull, Chemical Engineering Dpt., Hull, UNITED KINGDOM**

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Session reference: 2AV.4.19
Subtopic: 2.5 Gasification for Synthesis Gas Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Estimating the Thinning Removal of Boom-Corridor Harvesting with Agent-Based Simulation Model

Short introductive summary:

A developed agent-based model is used to estimate thinning removal for different boom-corridor thinning patterns. Results are compared to analytically calculated values. Mode future development and how it can be implemented in the future was discussed.

Presenter: **Mika AALTO, Lappeenranta University of Technology, Laboratory of Bioenergy, Mikkeli, FINLAND**

Presenter's biography:

Postdoctoral researcher from Lappeenranta University of Technology, Finland. Specialised in agent-based modelling and numerical methods in biofuel quality modelling. Recently have been working on agent-based simulation models of biomass logistic systems.

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Session reference: 1AO.7.1

Subtopic: 1.1 Biomass Potentials and Biomass Production Models

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Utilizing Biomass Waste as a Fuel for Diesel Generators in Africa.

Short introductive summary:
This research is most suited to sub topic 1.1 because of its focus on the assessment of the waste biomass residues arising from four waste streams in the three African countries of interest. The waste streams of interest are from the following sectors: agriculture, forestry, animal and urban human waste. This research looks at the energy generation potential of these waste streams when utilised as a gaseous fuel in an internal combustion engine after conversion using anaerobic digestion and gasification techniques.

Presenter: **Zahida ASLAM, University of Leeds, SCAPE Dpt., Huddersfield, UNITED KINGDOM**

Presenter's biography:
I am a PhD researcher based at the University of Leeds, I am working within our EPSRC Centre for Doctoral Training in Bioenergy. I come from a background of Chemistry and education.

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Session reference: 1AO.7.2
Subtopic: 1.1 Biomass Potentials and Biomass Production Models
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Biomass of Bark- the Unknown Factor of Nutrient Sustainability

Short introductive summary:

Several studies on nutrient sustainability were conducted in Germany during the past decade. Therein, the factor bark was often neglected. Bark hast an important role on nutrient exports caused by logging and supplying wood chips especially from forest residues. Existing biomass equations for bark can yield deviations of 50 – 150 % for bark dry mass, volume and density, even when fed with the exact same initial values. The research goal was to verify existing biomass equations using bark biomass on-site data, including thickness, density and volume for spruce bark of selected trial stands, in order to choose the appropriate statistical model for Bavarian conditions or to develop a new one based on on-site date of this project. In total, more than 2.700 samples were taken from three forest stands and measured in the laboratory to determine bark density volume and thickness for both moist (fresh) and dry (105°C) conditions. The evaluation of the database also considers all values along each stem, for each stand and cross complied between all three stands in order to develop a new bark biomass equation or model for Bavarian spruce stands, if necessary.

Presenter: **Markus RIEBLER, Bavarian State Institute of Forestry, Forest Technology, Business Management and Timber Dpt., Freising, GERMANY**

Presenter's biography:

Markus Riebler studied Forest Engineering (B.Eng.) at the University of Applied Sciences Weihenstephan-Triesdorf (2008 – 2012). He achieved his master degree (M.Sc.) from the Technical University of Munich in Forest and Wood Sciences in 2014. After, he successfully completed the Forest Preparatory S

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Session reference: 1AO.7.3
Subtopic: 1.2 Agroforestry Residues and By-Products
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Online Fuel Characterization - a Prerequisite for Fuel Flexibility in Biomass Fired Boilers

Short introductive summary:

How can we increase fuel flexibility? How can we optimize process stability in biomass combustion when facing solid biomass with inhomogeneous characteristics and qualities? One decisive step is to know more about the fuel and its characteristics, right before it is transported into the furnace. Online fuel characterization is needed to give the process control of any biomass-fired plant the chance to act in time to changing fuels and fuel qualities. In the ongoing project DigitalFire (funded by the German Federal Ministry of food and agriculture) an innovative approach for online fuel characterization is being developed. The concept is based on the idea, that different fuels behave differently when exposed to hot air convective drying. Simple measurement equipment is used to measure temperature, water content and pressure drop. Subsequently profiles and key parameters from their functions over time are created. With a sufficient large database, it will be possible not only to distinguish between different fuels, but also to calculate water content and estimate Lower Heating Value (LHV) and ash content.

Presenter: **Martin MEILLER, Fraunhofer-Institut UMSICHT, Renewable Energies Dpt., Sulzbach-Rosenberg, GERMANY**

Presenter's biography:

Martin Meiller studied industrial engineering at HAW Amberg-Weiden, where he also graduated fromthe Master’s Program"Environmental Engineering". Since July 2011he is scientific assistant at the Fraunhofer Institute UMSICHT.

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Session reference: 2AO.8.1
Subtopic: 2.3 Biomass Combustion in Large Utilities
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Experimental and Numerical Investigation of Pulverized Biomass Flames in a Pilot-scale Reactor Using OH* Chemiluminescence Imaging and In-flame Probing Techniques

Short introductive summary:

An experimental study is performed on a down-fired pilot-scale combustion facility to evaluate the structure and characteristics of pulverized biomass flames. The combustion chamber is made in a way to allow analyzing the different involved phenomena using OH* chemiluminescence imaging and in-flame probe measurements of gas concentrations (O2, CO, CO2, NO). The characterization of the flames was completed by a CFD simulation including specific combustion model developed from experimental characterization of the combustion of single particles of the tested fuels. CFD simulation was validated against experimental data, and then used to predict the aerodynamics and the trajectory of the particles, as well as their degradation process and thermal history. Three types of biomass were tested: maritime pine, moderately torrefied pine and pyrolyzed pine.

Presenter: **Hassan MOHANNA, Veolia, Limay, FRANCE**

Presenter's biography:

Thermal process engineer at Veolia Enviroment with a Ph.D. focused on experimental and numerical investigation of pulverized biomass flames from Institut national des Sciences appliquées de Rouen, CORIA laboratory, CIRAD BioWooEB and Veolia Research and Innovation.

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Session reference:	2AO.8.2
Subtopic:	2.3 Biomass Combustion in Large Utilities
Topic:	2. BIOMASS CONVERSION FOR BIOENERGY

Temperature-Resolved Experimental Investigation of the Alkali Release during the Combustion of Solid Biomasses

Short introductive summary:

In this work, a temperature-resolved potassium release pattern of different biomasses, like beech wood and wood pellets, is presented. These data not only enable a qualitative analysis of the temperature at which the potassium release occurs, but also a quantitative understanding of the potassium release rates at a given temperature.

Presenter: **Hendrik MÖRTENKÖTTER, Technische Universität München, Chair of Energy Systems, Garching b. München, GERMANY**

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Session reference: 2AO.8.3
Subtopic: 2.3 Biomass Combustion in Large Utilities
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

The Behaviour of Ash Forming Elements in Waste Wood Operated Large-Scale Updraft Gasifiers with Subsequent Gas Combustion

Short introductive summary:

Waste wood is a rather cheap and CO2 neutral energy source but features a higher ash content and higher contents of Na, Cl, S and heavy metals (especially Zn and Pb) compared to virgin wood. Increased ash contents lead to higher coarse fly ash emissions from the fuel bed. Elevated contents of Na, K, Pb and Zn in the feedstock lead to higher fine particulate (aerosols) emissions. Moreover, increased Cl contents in the fuel can enhance the Na and K release from the fuel bed. Increased coarse fly ash and aerosol emissions cause increased deposit formation in the boiler that decreases the boiler efficiency and shortens the time span between maintenance shutdowns. Grate combustion systems feature a comparatively high amount of fly ash particles entrained from the fuel bed and high release rates for Na, K, Zn and Pb. Fixed bed updraft gasifiers show for virgin wood close to zero coarse fly ash emissions and lower release rates for K and Na and are therefore an interesting option to minimise the adverse effects of waste wood on deposit formation and corrosion in waste wood to energy plants. However, a detailed investigation of the release behaviour of aerosol forming elements is needed.

Presenter: **Klaus SUPANCIC, BIOS Bioenergiesysteme, Graz, AUSTRIA**

Presenter's biography:

I joined BIOS in 2001 and participated in many R&D and engineering projects as an project engineer and since 2005 also as an project manager. In recent years, my focus was on the investigation and evaluation of ash related problems in biomass-fired combustion and gasification plants.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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Session reference: 2AO.8.4
Subtopic: 2.3 Biomass Combustion in Large Utilities
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Production of Ethylene Glycol from Lignocellulosic Biomass: the Role of Lignin

Short introductive summary:

Saccharides such as cellulose are well suited for the production of short polyols due to their excellent match in atomic composition. However, cellulose in nature is present in a matrix of lignin and hemicellulose. In this work we investigate the role of lignin on the catalytic hydrogenolysis targeting the production of ethylene-glycol.

Presenter: **Thimo TE MOLDER, University of Twente, Sustainable Process Technology Dpt., Enschede, THE NETHERLANDS**

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Session reference:	3AO.9.1
Subtopic:	3.7 Bio-Based Chemicals and Materials
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Lignin-Based Functional Fillers - Environmental Effects of the Substitution of The Conventional Finite-Resource-Based Fillers Silica and Black Carbon

Short introductive summary:

So far, lignin produced in pulp and paper industry or in biorefineries has mainly been used internally in order to produce thermal process energy. Due to its carbon and aromatic basic components, lignin has great potential for material valorisation. Since at most pulp mill and biorefinery sites, excess energy is produced by burning the lignin, a partial flow of lignin can also be upgraded to bio-based fillers via hydrothermal carbonisation (HTC) and thus be used for material purposes. In this study, we have analysed the potential environmental benefits of substituting the conventional finite-resource-based fillers silica and carbon black with the bio-based filler by means of life cycle assessments (LCA). The LCA shows that this potential substitution would result in very high savings in GHG-emissions (72-94 %), SO2-emissions(80-93 %) and PAH-emissions (88-98%). The substitution of conventional fillers black carbon and silica with the lignin-based one is of high relevance regarding climate protection measures and reducing other air emissions in the industry sector.

Presenter: **Kathleen MEISEL, DBFZ-Deutsches Biomasseforschungszentrum gemeinnützige, Bioenergy Systems Dpt., Leipzig, GERMANY**

Presenter's biography:

Kathleen Meisel holds a Diploma in Geography and obtained a doctorate in the field of environmental assessments. As a research scientist at DBFZ she primarily conducts life cycle assessments of biofuel-, bioenergy- and biomaterial production systems.

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Session reference: 3AO.9.2

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Nanocellulose Extracted from Energy Crops Residues as Reinforcement for Chitosan Bionanocomposites

Short introductive summary:

Extended years of massive industrialization have been the genesis of uninterrupted exhaustion of nonrenewable resources, being achieved high pollution levels. The overuse of nonrenewable resources has helped as an incentive for intensive research and development of new kinds of green bio-based and degradable feedstocks obtained from renewable sources. Lignocellulosic biomass is one of the least used bioresources in the world, basically composed of lignin, cellulose, and hemicellulose. This type of biomass could be acquired from multiple sources, among which are wastes from agricultural and industrial lignocellulosic crops. It is feasible to isolate cellulose from the lignocellulosic fibers and then depolymerize them giving rise to an extraordinary nanometer-scale bio-based material, called nanocellulose (NC). Recently, the methodologies progression, as well as the profound study of nanocellulose characteristics, enhanced the range of applicability in diverse technological areas. Abundance, biodegradability, renewability, and low-cost, together with excellent mechanical properties nominate NC as one of the most promising nanometric biomaterials.

Presenter: **João PIRES, Universidade Nova de Lisboa / Faculdade de Ciências e Tecnologia, Ciências e Tecnologia da Biomassa Dpt., Caparica, PORTUGAL**

Presenter's biography:

I´ m a Bioenergy Ph.D. student, with a specialization in bioplastics and bionanocomposites. Actually working in the valorization of agro-industrial lignocellulosic biomass for Cellulose Nanocrystals production. Researcher in MEtRICs Group involved in several projects.

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Session reference: 3AO.9.3

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Mitigation of the Ash-Melting Behavior During Combustion of Silica-Rich Biomass AssortmentstTo Enhance Porosity of Biogenic Silica

Short introductive summary:

The aim of the present investigation is to conduct comprehensive systematical research based on dedicated experiments besides theoretical calculations and statistical analysis in order to assess the impact of fuel pretreatment of rice husk and rice straw (i.e. washing and leaching) on ash-melting behavior on microscopic and macroscopic level of silica-rich biomass assortments during combustion with respect to the porosity of the biogenic silica.

Presenter: **Hossein BEIDAGHY DIZAJI, DBFZ Deutsches Biomasseforschungszentrum gemeinnützige, Thermochemical Conversion Dpt., Leipzig, GERMANY**

Presenter's biography:

Hossein Beidaghy Dizaji is a PhD student at Leipzig University and a researcher at German Biomass Research Centre (DBFZ). His research focus is ash related aspects during thermochemical conversion of silica-rich biomass assortments.

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Session reference: 3AO.9.4

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

The Economic and Environmental Assessment of Castor Oil Supply Chain

Short introductive summary:

The adoption of energy crops could generate benefits from the reduction of fossil energy dependence, improvement of rural economies, and the achievement of environmental goals that will be indicated by the new RED II Directive. Among the species currently cultivated for industrial vegetable oil production, Ricinus communis, L. (castor) could be a good candidate for future investments due to the good resistance to pests, tolerance to drought, and suitability for marginal lands cultivation. Limited studies have been dedicated to the environmental and economic sustainability of castor oil production and in particular, a comparison the of the environmental sustainability between different castor hybrids, harvesting methods, and by-products management have not been investigated yet. Using a case study approach, the work compared the environmental impacts and economic assessment results of two different castor hybrids harvested both manually and mechanically (manual vs. mechanical harvestings) considering different by-products managements scenarios, in order to identify the most feasible.

Presenter: **Alessandro SUARDI, CREA- Council for Agricultural Research and Economics, Centro di ricerca Ingegneria e Trasformazioni Agroalimentari, Monterotondo RM, ITALY**

Presenter's biography:

Temporary Research Associate at CREA-ING
Field of research:
- Agricultural mechanization
- Energy crops
- Life Cycle Assessment

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Session reference:	4AV.5.1
Subtopic:	4.3 Climate Impacts and GHG Performance
Topic:	4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Environmental Sustainability of Poplar Short Rotation Coppice Harvesting Systems

Short introductive summary:

One of the possible sources of wood biomass production is represented by the SRC of poplar. In the present work, the carbon footprint of four harvesting systems and different cutting shifts (2-, 3-, 4-, 5-years) of poplar rotation coppice plantations were assessed. The environmental impact relating to the production of 1 Mg of dry woodchips was calculated considering the entire life cycle, from the field phase to the woodchip storage. The result of each rotation cycle and level of mechanization adopted were compared to evaluate the different environmental impacts attributable to the different combinations of the options examined.

Presenter: **Alessandro SUARDI, CREA- Council for Agricultural Research and Economics, Centro di ricerca Ingegneria e Trasformazioni Agroalimentari, Monterotondo RM, ITALY**

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Session reference: 4AV.5.2
Subtopic: 4.3 Climate Impacts and GHG Performance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

The Impacts of Three Vehicle Stock and Motive Power Scenarios on the Distribution of Petrol, Diesel, Gas and Electricity In 2040 - a Case Study from Eastern Finland

Short introductive summary:

This paper presents a simulation model and a case study focusing on the performance of a regional road traffic system. The model includes spatial high-resolution data about the long-term development of population movement (principally urbanization), changes in transit preferences, and three different forecasts of vehicle fleet development in 2020-2040. The forecasts are 1) a "business-as-usual" scenario and trajectories representing the region achieving 2) carbon neutrality and 3) total freedom from fossil transportation fuels.

The preliminary results of the case study indicate that more distribution capacity of transportation gas, i.e. new stations and more fueling systems, are required to meet the ambitious targets of carbon-neutral or fossil-free system. More public charging points for EVs are also required, but the extent of the needed capacity depends greatly on the development in EV batteries and home-charging units.

Presenter: **Olli-Jussi KORPINEN, Lappeenranta-Lahti University of Technology, Laboratory of Bioenergy, Mikkeli, FINLAND**

Presenter's biography:

Olli-Jussi Korpinen, M. Sc. (For.), is as a project researcher from the Laboratory of Bioenergy at LUT University. He is experienced in finding and deploying suitable GIS data for operations research in transportation and logistics.

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Session reference: 4AV.5.4
Subtopic: 4.3 Climate Impacts and GHG Performance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Greenhouse Gas Emissions Calculations of Biofuel from Municipal Sewage Sludge: a Comparison of Assessment Tools

Short introductive summary:

This work aims to compare two calculation tools for lifecycle greenhouse gas (GHG) assessment of biofuels produced from municipal sewage sludge by an innovative integrative system plant (TCR®-PSA-HDO integrated system) as required by the Renewable Energy Directive. The compared tools are “BioGrace GHG calculation tool” recognised as a voluntary scheme by the European Commission and a conventional LCA tool such as “GaBi Software”.
The greenhouse gas emission savings of biofuel produced by the TCR®-PSA-HDO integrated system is evaluated and compared with conventional fuel (diesel and gasoline). The preliminary results are in line with the sustainability criteria defined by the Renewable Energy Directive. However, the results might depend on the method of calculation.

Presenter: **Serena RIGHI, University of Bologna, Centro Interdipartimentale di Ricerca per le Scienze Ambientali and CIRI Energia e Ambiente, Bologna, ITALY**

Presenter's biography:

Assistant professor at the of Bologna University since 2002, she carries out her research activities in the field of environmental impact assessment. Particular attention is paid to the study and application of the concept of Life Cycle Thinking and to the evaluation methods connected to it.

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Session reference: 4AV.5.5
Subtopic: 4.3 Climate Impacts and GHG Performance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Drop-in the Tank or a New tank? - a Comparison of Costs and GHG Performance for Forest-based Biofuels

Short introductive summary:

The overall aim of the project is a comparison of key aspects of selected single molecule biomass-based transport fuels (biofuels) and "drop-in" biofuels primarily produced from forest biomass and by considering the entire biofuel pathway from biomass to use and that includes (i) total cost (that is fuel production cost, and cost for distribution infrastructure and vehicles), GHG performance and resource efficiency.

Presenter: **Patrik KLINTBOM, RISE, Göteborg, SWEDEN**

Presenter's biography:

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Session reference: 4AV.5.6

Subtopic: 4.3 Climate Impacts and GHG Performance

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Climate Change Hotspots and Consequences from Kraft Lignin Valorization: a Matter of Methodological Choices

Short introductive summary:

Lignin has recently received attention as a renewable precursor of value-added products such as bio-based chemicals, materials, or fuels. At present, the valorization of lignin into bio-based products is still in the developing stage and most of the lignin is either burned for the internal energy needs of pulp mills and biorefineries, or sold as a low-grade fuel for electricity production.

The environmental impact of lignin-based products is often calculated using life cycle assessment (LCA). Our consequential LCA showed that using lignin for high-value-added products instead of low-value fuel for bioenergy leads to higher impacts in climate change. This is caused by the higher impacts of producing electricity from marginal technologies instead of from lignin pellets. Future research should assess other impact categories and possible changes in the technologies for electricity generation (i.e. with a higher share of renewable sources).

Presenter: **Christian MORETTI, Utrecht University, Utrecht, THE NETHERLANDS**

Presenter's biography:

Moretti Christian is a Ph.D. candidate at Utrecht University. His research focuses on LCA of bioeconomy systems for the production of energy, fuels and chemicals. Previously, he was employed in the industry and at the Commission Joint Research Centre.

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Session reference:	4AV.5.8
Subtopic:	4.3 Climate Impacts and GHG Performance
Topic:	4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Determination of Carbon Footprint for Thermal Use of Corn Waste

Short introductive summary:

This work therefore develops a specific methodology for the calculation of CFP associated with production and use of biomass waste from corn cultivation, taking into account the aforementioned concept of Circular Economy in all aspects associated with the use of biomass (environmental, technical, economic, etc.). For this, the Greenhouse Gas Protocool method included in the Simapro software (v 9.11) is used, dividing the energy system into 3 subsystems: Corn production (S1), Pre-treatment and densification (S2) and Domestic consumption (S3).

Presenter: **Pilar ROMERO MUÑOZ, University of Extremadura, BADAJOZ, SPAIN**

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Session reference: 4AV.5.9

Subtopic: 4.3 Climate Impacts and GHG Performance

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Assessment and Valorisation of Ecosystem Services in Biomass Cropping Systems: the Case of Miscanthus Cultivation for Isobutanol Production

Short introductive summary:

Conceptual case study about ecosystem service exploration and assessment in miscanthus cultivation for biofuel production

Presenter: **Bastian WINKLER, University of Hohenheim, Biobased Resources in the Bioeconomy, Stuttgart, GERMANY**

Presenter's biography:

Researcher on integrated food and energy production systems including planning and various assessment approaches.

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Session reference:	4AV.5.10
Subtopic:	4.3 Climate Impacts and GHG Performance
Topic:	4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Life Cycle Assessment and Life Cycle Costing of Bioenergy from Crop Residues in Turkey

Short introductive summary:

This study focuses on a cradle-to-grave life cycle assessment and life cycle costing of bioenergy from direct combustion of two agricultural residues - wheat straw and corn stover - using four different technologies and the aims are to quantify the environmental and economic impacts related to generation of heat and electricity from bio-residues and to identify the most sustainable energy technologies and feedstocks.

Presenter: **Gulizar BALCIOGLU, The University of Manchester, Chemical Engineering Dpt., Manchester, UNITED KINGDOM**

Presenter's biography:

Gulizar received her BSc (2012) and MSc (2015) degrees in Chemical Engineering from Istanbul Technical University (ITU), Turkey, and doing her PhD on the identification of most sustainable bio-energy technologies at the University of Manchester.

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Session reference: 4AV.5.11

Subtopic: 4.3 Climate Impacts and GHG Performance

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Study of the Production of Lignocellulolytic Enzymes by the Fungus Pleurotus Ostreatus in a Bioreactor Using Fruit Residues as a Substrate

Short introductive summary:

In the present study, the quantification of reducing sugars and the evaluation of the enzymatic activities of laccase, exopolygalacturonase, and exoglucanase, in submerged culture of fungus Pleurotus ostreatus as a biological treatment for cellulose hydrolysis and delignification of mango and pineapple peel. The cultures were incubated in glass flasks at shaking speeds of 75 and 150 rpm with different proportions of fruit and the results were subjected to a full factorial design to subsequently scale to a Batch bioreactor. According to the results, the stirring speed has a significant effect on the concentration of reducing sugars and the activity of the enzymes studied, while the respective analysis of variance showed that the Mango / Pineapple fruit ratio does not have a significant effect. Culture of P. ostreatus in the best conditions at bioreactor scale results in an increment on the enzymatic activiy and as a consequence high amounts of reducing sugars are produce which could be used for bioethanol production.

Presenter: **Valeria MASTRODOMENICO PULIDO, Universidad de los Andes, Bogotá, COLOMBIA**

Presenter's biography:

Current student of chemical engineering at the University of the Andes, Colombia. She carried out research related to the evaluation of the influence of biological pretreatment with Pleurotus Ostreatus.

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Session reference:	3AV.6.3
Subtopic:	3.5 Bio-Alcohols from Sugars, Starch and Lignocellulosic Biomass
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Evaluation of the Influence of Biological Pretreatment with Fungi (Pleurotus Ostreatus) in the Improvement of Alcoholic Fermentation of Mango Residues

Short introductive summary:

The main objective of this study is to determine the influence of biological pretreatment with Pleurotus ostreatus in the alcoholic fermentation of mango residues. In order to achieve that, the production of reducing sugars and the enzymatic activity of laccase, exopolygalacturonase, and Exoglucanase was evaluated. Pleurotus ostreatus was inoculated in a 5L bioreactor at 150 rpm at 25°C for 10 days, in which two levels were evaluated: 10 g and 20 g of dried mango per liter; then, solid and liquid fractions were separated, the liquid was fermented in 1L amber bottles for 10 days with Saccharomyces bayanus yeast, and the solid was treated in order to measure the biomass degradability. It was found that reactor scale influences enzymatic activity of exopoligalacturonase and glucanases. Also, at the established conditions no laccase activity was detected. Biomass degradation was observed in both levels, but no significant effect was detected in any of the response variables of interest.

Presenter: **Manuela OSORIO ZULUAGA, Universidad de los Andes, Bogotá, COLOMBIA**

Presenter's biography:

Chemical Engineer and Environmental Engineer from Universidad de Los Andes. Chemical engineering degree project on the evaluation of the influence of the Pleurotus Ostreatus fungus on the alcoholic fermentation of mango residues.

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Session reference:	3AV.6.7
Subtopic:	3.5 Bio-Alcohols from Sugars, Starch and Lignocellulosic Biomass
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Sequential Acid and Steam Explosion Pretreatment for Ethanol Production from Olive Stone Biomass

Short introductive summary:

Olive stone (OS) is a lignocellulosic by-product of the olive oil production process that can be considered of interest as alternative feedstock for cellulosic ethanol production,based on its availability and composition of up to 50% of carbohydrates in dry weight basis (dwb).
In this work, OS biomass was sequentially pretreated first with sulphuric acid in an autoclave and the resulting solid fraction by steam explosion in a 2L pilot unit. Next, the sequientially-pretreated solid was submitted to a liquefaction plus saccharification and fermentation process (LSSF), using CellicCtec2 cellulolytic cocktail (kindly provided by Novozymes, A/S, Denmark) and Saccharomyces cerevisiae yeast (Ethanol Red, Fermentis, France) in order to estimate the ethanol production potential. Results show ethanol concentration up to 30 g/l after 76 h process, which corresponds to a LSSF yield around 60% of the theoretical yield. The use of the liquid fraction generated in the SE step as sugar-containing media in LSSF allows increasing the final ethanol concentration achieved up to 36 g/l.

Presenter: **Paloma MANZANARES, CIEMAT, Biofuels Unit, Renewable Energy Division, Madrid, SPAIN**

Presenter's biography:

Paloma Manzanares is PhD in Biology and Senior Scientist at Biofuels Unit of CIEMAT, Spain. She has large expertise in biomass production and utilization and in the last years has specialized in advanced technologies for 2nd generation bioethanol and bioproducts within the biorefinery concept.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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Session reference: 3AV.6.9

Subtopic: 3.5 Bio-Alcohols from Sugars, Starch and Lignocellulosic Biomass

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Enzymatic Pretreatment of Rice Husks Lignocellulosic Biomass with Pleurotus Ostreatus in Submerged Fermentation

Short introductive summary:

Although white-rot fungi naturally have an enzymatic arsenal for the complete mineralization of lignocellulose, usually this type of biomass is known as recalcitrant material to enzymatic hydrolysis.This recalcitrance is due in large part to the characteristics of the polymers that compose it, but these are variable factors in each type of lignocellulosic biomass since it depends on the quantity, composition, and structure of the constituent polymers. Therefore, fungal secretomes research to find different ligninolytic enzymes could be a strategy for the design of lignocellulose enzymatic pretreatments. In this type of strategy, all biomass is exposed not only to one type of enzyme but also to secret enzyme cocktails by the fungus that can increase the degradation. Natural enzyme cocktails strategy would facilitate the use of pretreated biomass as a carbon feedstock for biofuel production and other biorefinery processes. In this study, rice husks (RH) were used to induce natural enzyme secretion in cultures of P. ostreatus in SmF. RH changes from systems in which the laccase activity was different were compared. The changes observed suggest different enzymatic actions.

Presenter: **Dinary Eloisa DURáN-SEQUEDA, Universidad de los Andes, Bogotá D.C, Bogotá, COLOMBIA**

Presenter's biography:

I am a microbiologist, I have a master's degree in microbiology. Currently, I am doing my Ph.D. in chemical engineering at the Universidad de Los Andes, Colombia. My research interests focus on bioprocesses and the biological pretreatment of lignocellulosic biomass using fungal enzymes.

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Session reference: 3AV.6.11

Subtopic: 3.5 Bio-Alcohols from Sugars, Starch and Lignocellulosic Biomass

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Bacillus Velezensis, Bacillus Toyonensis, and Bacillus Safensis Are Able to Produce 2,3-Butanediol from Lignocellulosic Sugars

Short introductive summary:

2,3-Butanediol is chiral, bivalent alcohol, widely used by the chemical and pharmaceutical industries. It is employed as a fuel additive, in industrial production of butadiene or methyl ethyl ketone, in the manufacturing of printing inks, perfumes, fumigants, insecticides, explosives, plasticizers, and as a constituent of foods and pharmaceuticals. Industrial production of 2,3-BD via microbial fermentation is preferable over chemical synthesis due to the ecological concerns and fossil feedstocks exhaustion. In this study, among 62 isolated and identified Bacillus strains (risk group 1) producing 2,3-BD, 17 strains displayed cellulolytic activity, degrading CMC, HE-cellulose, and ß-glucan and 5 were able to hydrolyse also arabinoxylan, arabinan, galactomannan, xyloglucan, xylan, galactan (included in hemicellulose), as well as starch and fructans. Three strains, B. velezensis 5RB, B. toyonensis 11RA, and B. safensis 14A were found to belong to species not reported as 2,3-BD producers before.

Presenter: **Penka PETROVA, Bulgarian Academy of Sciences, Institute of Microbiology, Sofia, BULGARIA**

Presenter's biography:

My main activities are in the area of microbiology and molecular biology. My best expertise is connected with the search for novel enzymatic activities and strains improvement for new properties acquiring. I have publications in microbiology, molecular biology or biochemistry.

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Session reference: 3AV.6.14
Subtopic: 3.5 Bio-Alcohols from Sugars, Starch and Lignocellulosic Biomass
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Comparison of Barothermal and Microwave-Assisted Pretreatment Efficiency in Degradation of Distillery Stillages

Short introductive summary:

The use of a new source of lignocellulosic biomass requires the selection of parameters of different pretreatment methods. Aim of the study was to evaluate the effectiveness of barothermal dilute sulfuric acid pretreatment and microwave-assisted pretreatment in degradation of distillery stillages. In dilute sulfuric acid pretreatment, the highest glucose concentration exceeding 85 mg/g of DW was obtained by pretreatment of maize stillage with 0.2M H2SO4, at 131°C, for 60 minutes. Glucose concentrations above 55 mg/g of DW had rye stillage, processed with 0.2 M H2SO4, for 60 minutes, at 121 and 131°C. The highest observed glucose concentration in wheat stillage exceeded 47 mg/g of DW for the following processing parameters: 0.2 M H2SO4, 121 and 131°C, 30 and 60 minutes. This pretreatment conditions also gave the best results in the preparation of stillage for enzymatic hydrolysis, which was reflected in the amount of glucose released. Using microwave-assisted pretreatment, glucose concentration after pretreatment was obtain

Presenter: **Dawid MIKULSKI, Kazimierz Wielki University, Biotechnology Dpt, Bydgoszcz, POLAND**

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Session reference:	3AV.6.15
Subtopic:	3.5 Bio-Alcohols from Sugars, Starch and Lignocellulosic Biomass
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Renewable Natural Gas Resource Assessment and Co-Produced Carbon Capture and Storage: a Pennsylvania Case Study

Short introductive summary:

The renewable natural gas (RNG) and co-produced carbon capture and storage potential from energy crops and organic waste streams in Pennsylvania were assessed. Total RNG potential was nearly 10% of the state's current natural gas consumption. Co-produced carbon dioxide was equivalent to over 800 years of the state's geologic storage capacity.

Presenter: **Matthew ARENAS, The Pennsylvania State University, Agricultural and Biological Engineering Dpt., State College, USA**

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Session reference:	IAV.7.1
Subtopic:	6.1 Advances in Large Scale Gasification
Topic:	6. INDUSTRY TRACK

Mapping of Marginal, Underutilised and Contaminated Lands in Europe and Ukraine and Sustainability Assessment of Bioenergy Value Chains through the BIOPLAT-EU webGIS Tool

Short introductive summary:

In the framework of the BIOPLAT-EU project, the marginal, underutilised and contaminated (MUC) lands in Europe and Ukraine were mapped and a tool (BIOPLAT-EU webGIS Tool) was developed. This tool will allow any stakeholder to search for MUC lands in Europe. It will give the user some specifications about these lands such as agronomic and climatic ones, and consequently what type of biomass would be suitable to be planted on these lands. The tool will then allow assessing the environmental, social and techno-economic sustainability aspects of the defined value chain when the user choose or enter the required data.

Presenter: **Cosette KHAWAJA, WIP Renewable Energies, Munich, GERMANY**

Presenter's biography:

Cosette Khawaja is a project manager at WIP Renewable Energies in the Unit Bioenergy and Bioeconomy since 2012. She completed studies in agricultural engineering (Univ. Dipl.) and acquired an International Master’s degree in Sustainable Resource Management.

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Session reference: IAV.7.3
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Potential of a New Seed Propagated Elephant Grass Cultivar for Bioenergy Purposes

Short introductive summary:

This work is a puzzle piece that intends to engage more cooperation between academic institutions and industry in Brazil in the field of biomass. The breeding for better cultivars, as well as characterization of new feedstocks, are key for defining the righteous approach regarding energy conversion and use of new biomasses. The new elephant grass PCEA (P. purpureum x P. purpureum) was specifically developed to meet Brazilian tropical conditions and is the first seed propagated genotype worldwide to be launched by Embrapa Dairy Cattle and evaluated regarding field yield under sustainable cultivation practices at Embrapa Agrobiology (https://link.springer.com/article/10.1007/s13199-020-00730-8). After observing field adaptation and great yield, the present work was developed at the Institute for Technological Research of São Paulo State (IPT-SP) under the New Talents Program (NT) and accessed the full composition characteristics and properties of PCEA, where contents of cellulose and hemicellulose outstand guiding more investigation for employment of the grass as raw material for lignocellulosic bioethanol. In addition, there are interesting possibilities regarding thermochemical routes for PCEA. With the results, this work will certainly contribute to the energy sector in Brazil by broadening biomass alternatives for diverse use, as well as offering other resources besides sugarcane to supply the bioethanol sector in Brazil.

Presenter: **Alessandra CAMELO, Institute of Energy and Environment (IEE-USP), Institute for Technological Research (IPT-SP), Sao Paulo, BRAZIL**

Presenter's biography:

Agricultural & Environmental Engineer (UFRRJ, Brazil), awarded with 1-year fellowship in Environmental Engineering (UIC Chicago, US) and M.Sc in Energy Planning & Analysis (USP, Brazil) with short stay at the DBFZ GmbH (Leipzig, DE). Young researcher and engaged professional in the energy industry.

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Session reference: IAV.7.6
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

The Macro Algae Biorefinery - Prefeasibility Study

Short introductive summary:

In the project Macro Algae Biorefinery a step-wise biorefinery concept was developed in order to extract high value compounds from macro algae. As a part of the project, a business case analysis of a full scale biorefinery facility was conducted with promising results.

Presenter: **Kurt HJORT-GREGERSEN, Danish Technological Institute, Environment Technology Dpt., Aarhus, DENMARK**

Presenter's biography:

Agricultural Economist, biogas technology

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Session reference: IAV.7.8

Subtopic: 6.1 Advances in Large Scale Gasification

Topic: 6. INDUSTRY TRACK

Drying Kinetics of Microalgae for Selection of Drying Method

Short introductive summary:

Drying technology is critical for algae from consideration of long term storage, reduction of transportation cost, compensation of seasonal productivity variation etc. Drying poses a major economic constraint in processing cost of microalgae. Drying is very energy intensive unit operation & most challenging aspect in algae drying is selection of right drying process technology. Algal system is observed to be temperature sensitive and hence appropriate drying condition, like drying temperature, time cycle are critical from drying process point of view. This work aims to develop multi-stage algae drying process, keeping in mind the heat sensitivity & drying kinetics aspect of algal slurry.

Presenter: **Deepthi MENON, Reliance Industries Limited, A2O Dpt., Mumbai, INDIA**

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Session reference: IAV.7.9
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Increasing Economic Efficiency of Cultivating Microalgae by Recycling Process Water

Short introductive summary:

This abstract gives a glimpse of the output revealed in a project focusing on recycling used medium from algae cultivation. In close cooperation with the University of Natural Resources and Life Sciences Vienna, the Institute of Microbiology - The Czech Academy of Sciences as well as the algae biomass production company Ecoduna GmbH, it was possible to target industrial needs with scientific research approaches.

Presenter: **Matthias NEUBAUER, BEST - Bioenergy and Sustainable Technologies, Bioconversion and Biogas Dpt., Wien, AUSTRIA**

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Session reference: IAV.7.10
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Alleviating Pollution to Create New Biomass for Animal Feed

Short introductive summary:

The ALG-AD INTERREG North-West Europe project is developing algal technology to convert excess nitrogen produced from the anaerobic digestion of food and farm waste to produce protein for animal feed. In this presentation, I will give background to the ALG-AD project (2018-2021) and cover progress to date regarding the successes and challenges on the project and our plans moving forward. Within this circular economy ALG-AD project, three 5 tonne photobioreactors (UK, France and Belgium) incorporating up and downstream membrane processing were constructed and operated by the cultivation of microalgae on a semi-continuous feed of concentrated digestate. Produced biomass had the processing of hydrolyzation prior the animal feed development. The animal feed trials (pigs and fish) will confirm the circular economy concept, combining waste management and new product services creation.

Presenter: **Alla SILKINA, Swansea University, Biosciences Dpt., Swansea, UNITED KINGDOM**

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Session reference: IAV.7.11

Subtopic: 6.1 Advances in Large Scale Gasification

Topic: 6. INDUSTRY TRACK

Goat and Sheep Cheese Whey by Products Can Be Used for the Production of Recombinant Proteins from Escherichia Coli

Short introductive summary:

Cheese Whey (CW) is one of the major dairy by products. The global production of cheese whey was 180 million in 2011 with an annual growth of 2 % approximately and 70 % of CW production US and Europe (Baldasso et al., 2011; ADPI 2009; Kaminarides et al, .2013). Nowadays, CW is a major environmental problem because of its high COD/BOD ratio. Its disposal to the environment can lead to excessive oxygen consumption and eutrophication. Furthermore approximately 47 % of the 120 million tons of whey produced world-wide every year it is untreated prior to disposal in the environment (Ryan and Walsh., 2016). CW consists mainly by water and nutrients such as soluble proteins, lactose, lipids, mineral salts, and vitamins that could turn to valuable resources instead of environmental pollutants. In the last two decades there is much effort to develop different products from CW. We determined nutritional values from goat and cheese CW and developed a protocol for clearing the turbidity of CW. The resulting medium was used successfully to overexpress recombinant proteins in Escherichia coli.

Presenter: **Alexios VLAMIS, University of Patras, Chemistry Dpt., avlamis@upatras.gr, GREECE**

Presenter's biography:

Biology (1987, University of Athens, Greece), MSc in Clinical Biochemistry (1988, U. of Newcastle-upon-Tyne, UK), PhD Biochemistry (U. of Sussex, UK). Post Doc Karolinska Institutet, Sweden (Assoc. Prof, in 2003). 2011 Assistant Professor at U. of Patras, Greece.

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Session reference: IAV.7.14
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Comparison of Different Storage Systems of Softwood Biomass and Urban Pruning Residues

Short introductive summary:

The work studied the influence of storage in the quality of different biomass for energy generation. Softwood biomass and urban pruning residues were used.

Presenter: **Paola CETERA, National Research Council, Institute of BioEconomy, San Michele all'Adige (TN), ITALY**

Presenter's biography:

Currently works as a researcher at the CNR-IBE, San Michele all'Adige (TN). Main research interests are: valorization of biomass; characterization and application of by-products obtained from different wood species and wood characterization by using different parameters of TH process.

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Session reference: IAV.7.16
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Value Chain Analysis of Co-Firing Steam Explosion Pellets in Large-Scale Pulverized-Coal Power Plant

Short introductive summary:

This work addresses the economic and environmental impact of co-firing black pellets produced by steam explosion of woody biomass in large-scale pulverized coal power plants. The analysis is based mathematical modelling of the value chain model including: 1) the properties and availability of the raw feedstock, 2) the logistics of feedstock pretreatment, supply and storage and 3) the process, cost and environmental performance of the technologies for pretreatment of the feedstock and co-firing. A preliminary evaluation of the overall energy efficiency, greenhouse gas (GHG) emissions and the economics along the complete value chain is performed and benchmarked with other relevant technological routes enabling the co-firing of woody biomass into pulverized-coal power plants.

Presenter: **Gonzalo DEL ALAMO, SINTEF Energy Research, Trondheim, NORWAY**

Presenter's biography:

I hold a PhD in Combustion Modelling from the University of California San Diego in USA and have over seven-year experience as engineer in industry. I have work as Research Scientist at SINTEF ER mainly focused on techno-economics and value-chain analysis.

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Session reference: IAV.7.17
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Harvest of Cereal Straw and Catch Crops in Mixture for Biogas Production: Effect of Ensiling on Methane Yield

Short introductive summary:

This study explores the concept of harvesting and ensiling the two residual biomasses straw and catch crops together for subsequent use in biogas production. Results are presented on biomass yield, specific methane potential and methane yield per hectare. Besides, the study demonstrates a pretreatment effect of ensiling in terms of increased specific methane potential.

Presenter: **Søren Ugilt LARSEN, Danish Technological Institute, AgroTech Division, Aarhus N, DENMARK**

Presenter's biography:

Søren Ugilt Larsen has worked with research and development within plant science and agronomy for 20 years. For the last 10 years, the main focus has been on biomass production and biomass handling, including field trials and experimental work with ensiling of wet biomass.

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Session reference: 1BO.1.1
Subtopic: 1.2 Agroforestry Residues and By-Products
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Cereal Chaff Collection: Project AGROinLOG Results and Field Experience

Short introductive summary:

Chaff is the fine fraction of the threshing residues. Despite it represent a great amount of biomass it is usually not collected. This material is normally either left to fall on the ground below the straw swath or is spread.
The chaff harvesting technologies are not so common and very often unknown to the farmers. The spread of these technologies could therefore favour the development of new markets. In addition to the limited knowledge and dissemination of these technologies, there is a lack of information about their functioning, the amount of biomass that can be collected, the quality of the work done (losses and consumption).
For this reason, a series of large field tests were carried out using an independent scientific approach, in order to create a dataset to make up the lack of information about the residue harvesting, critical for subsequent assessment of their economic and environmental feasibility.
With the aim to assess the amount of chaff retrievable during cereal threshing, during the AGROinLOG H2020 project, CREA, in collaboration with local partners performed several harvesting tests with different systems in France, Sweden and Italy from 2017 to 2019.

Presenter: **Vincenzo ALFANO, CREA - Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Monterotondo (Rome), ITALY**

Presenter's biography:

Dr. Vincenzo Alfano has got more than 10 years of research experience in the field of bioenergy. Currently he works at Council for agricultural research and economics (CREA), Research Centre for Engineering and Agro-Food Processing. He is board member of the Italian Biomass Association - ITABIA.

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Session reference: 1BO.1.2
Subtopic: 1.2 Agroforestry Residues and By-Products
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Integrated Harvesting and Biomass Haulage of Olive Tree Prunings. Evaluation of a Two Year Harvesting Campaign in Central Greece

Short introductive summary:

Olive tree groves are a typical crop of the Mediterranean landscape that generate substantial amounts of residual biomass (prunings). Until now, prunings are mostly piled and burned in open-fires. However, olive tree prunings represent an abundant source of energy biomass, or raw material for added value products, still largely unexploited due to the lack of cost-effective harvesting technology. The aim of the present paper is to evaluate the most intensive demonstration of harvesting of olive tree prunings ever occurred in Greece. For two years (2018 and 2019), an integrated mulcher was used to harvest the local olive groves of Agios Konstantinos, Central Greece. The purpose of the paper is to compare and evaluate the two year harvesting campaign in terms of biomass productivity, harvester performance, biomass haulage to storage, working times, fuel consumptions, salaries, costs of whole chain etc. Furthermore, the fuel characterization of the harvested biofuels is performed and analyzed. Thus, the outcome of the present paper is to evaluate a real olive pruning harvesting value chain and export main results on the feasibility and performance of such configuration.

Presenter: **Michael-Alexandros KOUGIOUMTZIS, Centre for Research and Technology Hellas, Chemical Process and Energy Resources Institute, Athens, GREECE**

Presenter's biography:

Michael- Alexandros Kougioumtzis is a Research Associate at Centre for Research and Technology Hellas/CPERI. His main research interests include agro-biomass value chains, biomass derived chemicals and biofuels, process modeling of advanced biorefineries, biomass logistics and technoeconomics.

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Session reference: 1BO.1.4

Subtopic: 1.2 Agroforestry Residues and By-Products

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

The Effects of Process Design and Operation Conditions on the Performance of Syngas Production by Dual Fluidised-Bed Gasification

Short introductive summary:

The main findings of the PDU gasification tests carried out with bark, forest residues and clean wood using the two different oxidiser designs and simulating both steam-alone gasification and oxygen-assisted steam gasification. The gasifier was operated at a temperature range of 710-840 °C and the oxidiser temperature was 30-150 °C higher depending on the mode of operation and the feedstock. The produced gas was filtered with novel sintered metal filters and reformed in a two-stage reformer that was operated with nickel catalysts. A total of seven DFB gasification test weeks were performed during which the plant was operated under gasification conditions for about 500 hours. The experimental results of selected set points representing different oxidiser designs and operating conditions of the gasifier are presented. The results were utilised as input in a process model, which was applied for evaluating the material and energy balances and also for estimating the reactor dimensions of industrial scale units.

Presenter: **Esa KURKELA, VTT Technical Research Centre of Finland, Thermochemical Conversions Dpt., Espoo, FINLAND**

Presenter's biography:

I joined VTT in 1981 and have since then been working with different types of biomass, coal and waste gasification technologies. At present I am working as a senior principal scientist in VTT's Thermochemical Conversions team. Present activities are mainly focused on the synthesis gas applications.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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Session reference: 2BO.2.1
Subtopic: 2.5 Gasification for Synthesis Gas Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

EFR Gasification of Hardwood Bark: Experimental Characterization of Inorganics Matter Versus Equilibrium and Viscosity Predictions

Short introductive summary:

The objective of this work is to present the behavior of the slag of a hardwood bark biomass containing a high ash content (6.5% at 815°C) gasified in the CEA Girofle pilot scale pressurized EFR slagging reactor (250KW th). Allothermal condition - where external energy was supplied to the reactor by a natural gas/O2 burner – were used which has never been studied on a pilot scale to our knowledge nor to a working pressure of 5 bar. Furthermore a global and elemental mass balance of the inorganic matter could be achieved which is rarely done in the literature for ash. This study showed that the inorganic matter collected after the EFR gasification could be well characterized and predicted with the Factsage 7.3 software tools.

Presenter: **Françoise DEFOORT, CEA Grenoble, CEA Tech/LITEN/DTBH/LTCB Dpt., Grenoble, FRANCE**

Presenter's biography:

Research engineer at the CEA (Commissariat à l'Energie Atomique et aux Energies Alternatives) in Grenoble (France). Phd in metallurgy and is specialized in material science and thermodynamic calculations. Since 10 years work in the biomass field

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Session reference: 2BO.2.2

Subtopic: 2.5 Gasification for Synthesis Gas Production

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

CO2 Gasification of Olive Kernel Fuel: Effect of Fuel Thermal Treatment and Carbonates Addition on Syngas Production

Short introductive summary:

Today, significant efforts are devoted to decarbonize the energy mix and combat climate change. Thus, conventional technologies to generate power from fossil fuels are gradually abandoned and alternative energy conversion methods and fuels are proposed. The gasification of biomass by captured CO2 emissions is an interesting approach, since the derived syngas can be directly used as fuel or as raw material to produce chemicals and liquid fuels. The present study aims to explore the effect of olive kernel thermal treatment and carbonates addition on fuel on the CO2 gasification performance and syngas production of pristine olive kernel, pyrolyzed char at 500 oC and olive kernel-carbonates feedstock mixtures. The gasification performance was examined under isothermal (700, 800 oC) conditions and batch mode of operation using pure CO2 as gasification agent. The produced syngas consisted mainly of CO followed by minor quantities of H2 and CH4. The superior performance of char is attributed to its improved textural properties, less ordered structure, higher fixed carbon content and lower volatile matter content compared to pristine sample. The carbonates-olive kernel admixture

Presenter: **Athanasios LAMPROPOULOS, University of Western Macedonia, Mechanical Engineering Dpt., Kozani, GREECE**

Presenter's biography:

Mr. Lampropoulos (mechanical engineer, MSc) is currently a Ph.D. student at the UWOM. His ongoing thesis focuses on the effect of various operational parameters on the gasification performance of fossil and biomass solid fuels. Part of his work has been already published in scientific journals.

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Session reference:	2BO.2.3
Subtopic:	2.5 Gasification for Synthesis Gas Production
Topic:	2. BIOMASS CONVERSION FOR BIOENERGY

Black Liquor Supercritical Water Gasification in Batch Reactor for Biofuel Production

Short introductive summary:

The H2020 Pulp&Fuel project intends to make a significant contribution to biofuel development by taking advantage of the synergy between dry gasification and supercritical water gasification. The project has chosen to demonstrate its applicability to pulp industry that have both dry and wet wastes available. These wastes are today either recycled in low value fuel for combustion or are disposed at great cost. The mechanical and chemical processes provides large amounts of bark and wood co-products as dry waste. It also produces sludge as wet waste and an excess of black liquor in chemical pulp mills.
Supercritical water gasification (SCWG) is considered the most suitable route as no drying step is required to transform wet waste as black liquor in syngas (mainly composed of H2, CH4 and CO2).
Black liquor gasification is studied in two kinds of reactors in the CEA platform: batch and continuous reactor.
This abstract focuses on batch experiments.

Presenter: **Marine PEYROT, CEA Grenoble, LITEN/DTBH/TLB Dpt., Grenoble, FRANCE**

Presenter's biography:

Marine Peyrot works in the L2CH laboratory for 10 years in the LITEN CEA in Grenoble; she has her expertise in biomass and waste pyrolysis and gasification and more particularly in reactor modeling, and also hydrothermal processes (liquefaction, and supercritical water gasification).

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Session reference:	3BO.3.1
Subtopic:	3.6 Biorefineries
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Current State of Chemical and Material Driven Biorefineries Implementation in the EU

Short introductive summary:

In this study we analyse biorefineries in the EU with a focus on chemical and material driven biorefineries that produce mainly innovative high-value biobased products.
An online-tool - a dashboard - was created which shows details of the feedstock, conversion processes, platforms, and products, which allows all stakeholders to obtain an overview of the current state of chemical and material biorefineries in the EU.
By collecting information on multiple characteristics, such as feedstock types, processes, product types and linking it with geographical information, analysis of the territorial dimension of biorefineries in the EU is possible.
Currently, the database underpinning the dashboard contains details of around 350 biorefineries. It points towards an interwoven landscape of installations that produce both fossil and bio-based products and/or production of traditional biomass products in combination with innovative/advanced bio-based products.

Presenter: **Robert M'BAREK, European Commission, JRC, Seville, SPAIN**

Presenter's biography:

Robert M'barek is an Agricultural Economist at the European Commission's Joint Research Centre, Directorate for Sustainable Resources (Seville). He received his PhD on EU trade relations from the University of Hohenheim, Germany. Since many years he is coordinating and involved in economic modelling

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Session reference: 3BO.3.2
Subtopic: 3.6 Biorefineries
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Energy-Driven Biorefinery Approach for Double Biofuel Recovery from Microalgae

Short introductive summary:

Microalgal biofuels have been subject of discussion concerning energy efficiency. Sustainability objectives request an overall positive energy balance of the biofuel process which is dependent of the efficiency of each process unit and also on the amount of biofuel produced. Strain selection and the development of dedicated, efficient and low-energy production process (culture systems and wet-biomass treatment) are here of primary relevance. Relevant approaches in the BioDiesel production (N. gaditana) are simulated and discussed in terms of their impact on the Net Energy Ratio. Next, as a further attempt of optimization, it is also included the co-production of BioEthanol, as allowed by a microalgae strain exhibiting simultaneous lipids and carbohydrates accumulation (P. kessleri). Solar light co-valorization by using a photovoltaic panel is also discussed.

Presenter: **Vladimir HEREDIA, GEPEA-CNRS, Saint nazaire, FRANCE**

Presenter's biography:

Vladimir has been working in bioprocess engineering for around 7 years. Their main research activities are related to biofuels and microalgal cultures. The main fields of expertise are the biomass production, bioseparations and biomolecules recovery. He has also been project leader for students and

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Session reference:	3BO.3.3
Subtopic:	3.6 Biorefineries
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Syngas and Greenhouse Gas (CO2) Bioconversion to Biofuels and Bioproducts: the Potential of Acetogenic Bacteria

Short introductive summary:

The Abstract focusses on the innovative bioconversion of syngas (e.g., from biomass, waste) and CO2 through a range of biofuels and bioproducts in bioreactors with acetogenic bacteria as primary biocatalysts as well as bacteria or yeasts as second stage whenever required.

Presenter: **Christian KENNES, University of La Coruna, Chemical Engineering Dpt., La Coruña, SPAIN**

Presenter's biography:

Professor of Chemical Engineering - Group leader - BIOENGIN group - University of La Coruña - Spain.
Scientific expertise in the valorization of biomass, waste, wastewater, and industrial gas emissions, including greenhouse gas (CO2, CH4) valorization and bioconversion, syngas and biogas upgrading.

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Session reference:	3BO.3.4
Subtopic:	3.6 Biorefineries
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Evaluation of Operational Conditions on the Performance of Microalgae-Based Wastewater Treatment. Variation in the Bioremediation Capacity of Primary Urban Wastewater and Microalgae-Bacteria Consortia

Short introductive summary:

One of the key strategies of the advanced treatment and nutrient recovery of wastewater is the microalgae-based wastewater treatment processes. This increased interest is due that the use of microalgae has a dual benefit: economically wastewater treatment and microalgae biomass production, which can be converted into added-value product such as biofertilizers and animal feed. Production of microalgae in wastewater involves the interactions between microalgae and bacteria in the phycosphere, the microscale surrounding microalgae cells.

Presenter: **Ainoa MORILLAS, Universidad de Almería, Ingeniería Química Dpt., Almería, SPAIN**

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Session reference: 1BV.1.3

Subtopic: 1.2 Agroforestry Residues and By-Products

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Comparison of Ecuadorian Native Chlorella M3 and M6 Growth in Flat and Cylindrical Photobioreactors Using Rural Wastewater Effluent, Aerobically and Anaerobically Treated, Outdoors with Non-Segulated

Short introductive summary:

The potential for agro-industrial development in Ecuador is very high; however, its rural areas possess limited utilities. Lately, the government has secured electricity availability for conversion processes; however, the availability of the internet, water, and the correct disposal and treatment of waste streams is minimal and low quality. This study’s ultimate objective was to give the Municipalities of rural villages a low-cost solution that generates economic revenue and promotes the biotechnological industry’s development in Ecuador rurality by using the circular economy concept. In this study, we are reporting the two more prominent algae’s behavior that showed the ability to live under harsh conditions and is native to Ecuador.

Presenter: **Cesar Miguel MOREIRA VALENZUELA, ESPOL Polytechnic University, Center of Alternative and Renewable Energy, Guayaquil, ECUADOR**

Presenter's biography:

Profesor-Researcher in the waste-to-resource area, specially in coupling biological system, such as, algae and microbial consortia for treating waste streams i.e. agricultural and municipal waste, carbon dioxide and sewage.

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Session reference: 1BV.1.4
Subtopic: 1.4 Algae and Aquatic Biomass Production Systems
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Application of Activated Carbon Treated Agricultural Digestate for Microalgae Cultivation

Short introductive summary:

Current research is dedicated to finding the solutions for large freshwater volume required for microalgae cultivation in agricultural digestate. We propose a promissing novel technique for optical density reduction in digestate by activated carbon pre-treatment. Our results show up to 78% reduction of optical density resulting in improved microalgae growth. Activated carbon pre-treatment holds a great potential for agricultural digestate application for microalgae cultivation.

Presenter: **Baiba IEVINA, Riga Technical University, Institute of Energy Systems and Environment, Riga, LATVIA**

Presenter's biography:

I am a researcher and a PhD student at the Institute of Energy systems and environment of Riga Technical university in Latvia. I am currently working on my PhD thesis on optimization of microalgae biomass production for open raceway pond cultivation.

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Session reference:	1BV.1.6
Subtopic:	1.4 Algae and Aquatic Biomass Production Systems
Topic:	1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Microalgae Biofixation Efficiency Of Carbon Dioxide Through Pressurized Planar Photobioreactor.

Short introductive summary:

In this study we tried to identify the conditions able to optimize the growth of microalgae species in pressurized planar photobioreactors (PBR) in order to maximize the microalgae biofixation of the carbon dioxide. To achieve this purpose, the algal species Scendesmus obliquus was considered, which is a green microalga that lives in freshwater environments, whith a typical eye shape. Three tests were carried out with Scendesmus obliquus using the same light intensity and providing the same CO2 flow. Of these tests the following parameters are compared: productivity, efficiency of CO2 biofixation and energy efficiency of the system. The results obtained, also in relation to other technologies evaluated in the literature, show that this technology is promising both in the high production of microalgae biomass, which can have different uses, and in the efficiency of CO2 biofixation.

Presenter: **Vincenzo RIGGIO, Politecnico di Torino, Dipartimento di Ingegneria dell’Ambiente, del Territorio e delle Infrastrutture, Torino, ITALY**

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Session reference: 1BV.1.9
Subtopic: 1.4 Algae and Aquatic Biomass Production Systems
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Growth Analysis of Typha domingensis Pers. after Being Established as a Floater Plant

Short introductive summary:

In nature, Typha domingensis Pers. (cattail) is a highly productive aquatic plant that is rooted in mud on the bottom of shallow water bodies. Controlled cultures of T. domingensis in the form green floating filters (GFFs) represent a possibility of combining water improvement with biomass production for biofuels and bio-products. In order to build GFFs, young cattails are planted on ad hoc supports, such as perforated floating trays. This way they can be grown as floating aquatic plants and take up nutrients from water. Plant adaptation to flotation is critical to succeed in GFF establishment, but at present there is little knowledge in this regard. The aim of this work is to acquire knowledge on the performance of T. domingensis during the early growth stage that follows its establishment in a floating system for biomass production. Green floating filters based on Typha domingensis Pers. (cattail) for water cleaning and biomass production have been studied in the framework of the LIFE 16 CCM/GR/000044 BIOMASS C+ project, co-funded by the European Commission.

Presenter: **Maria Dolores CURT, Universidad Politecnica de Madrid, Agrarian Production Dpt., Madrid, SPAIN**

Presenter's biography:

Professor at the College of Agricultural Engineering of Madrid. PhD Agricultural Engineer. Responsible for the Agro-energy Group of the ’Universidad Politecnica de Madrid’ (GA-UPM). Contributor to national and European projects and scientific articles in the field of Bioenergy and Plant Production.

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Session reference: 1BV.1.10
Subtopic: 1.4 Algae and Aquatic Biomass Production Systems
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Life Cycle Assessment of an SBR-Based Sewage Treatment Plant and Development of Algae-Based Improvement Scenarios

Short introductive summary:

The present work is focused on utilization of a comparative LCA to assess the effects of integration of algae-mediated wastewater treatment approaches (for nutrient removal and/or disinfection) with respect to an existing SBR-based sewage treatment plant. The A-WWT integration as the disinfection step (opposed to UV disinfection in existing SBR-STP) followed by its sustainability assessment by LCA serves as the principal aim of the work.

Presenter: **Ankita BHATT, Indian Institute of Technology Roorkee, Hydro And Renewable Energy Dpt., Roorkee, INDIA**

Presenter's biography:

I am a postgraduate in microbiology and currently pursuing doctorate on algae-mediated wastewater disinfection and its sustainability assessment by LCA at Hydro and Renewable Energy Department in Indian Institute of Technology Roorkee. My research expertise includes phycoremediation and bioenergy.

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Session reference: 1BV.1.11
Subtopic: 1.4 Algae and Aquatic Biomass Production Systems
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Integration of hydrodynamics into a biokinetic model for the simulation of microalgae cultivation in a photobioreactor

Short introductive summary:

The aim of this work was to integrate the influence of hydrodynamic conditions into the biokinetic model. The model can be applicate for simulation of the influence of environmental and operational conditions on the nutrients utilization for the growth of microalgae as well. Based on this biokinetic model, it is possible to optimize the operation of photobioreactors.

Presenter: **Vojtech BELOHLAV, Czech Technical University in Prague, Process Engineering Dpt., Prague, CZECH REPUBLIC**

Presenter's biography:

I am a student of Czech Technical University in Prague, Process Engineering and Universitat Politècnica de Catalunya, Environmental Engineering and Microbiology Group. I am interested in microalgae production, design of cultivation system in industrial scale and biomass pretreatment processes.

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Session reference: 1BV.1.12
Subtopic: 1.4 Algae and Aquatic Biomass Production Systems
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Production of Sulfated Exopolysaccharide from Spirulina platensis growing on palm oil mill effluent

Short introductive summary:

Sulfated EPS (sEPS) is a secondary product from microorganisme such as bacteria and microalgae that is potential to be used as an antiviral and anti-inflamatory. Recently, commerial production of sEPS is produced by using bacteria which require high cost and intensive maintenance. The production cost could be lower when blue green algae, S. platensis is cultured in a cheap medium such as POME wastewater that contains high nutrients to promote the growth. However, previous research has not been investigated the production of sEPS from S. platensis cultured on POME. It is predicted that S. platensis could produce high sEPS when nutritional and environmental factors were optimized. This research investigated the potency of Spirulina platensis cultured on palm oil mill effluent (POME) to produce high secondary product, sulfated exopolysaccharide (sEPS), under various nutritional and environmental factors.

Presenter: **M.M.Azimatun NUR, UPN "Veteran" Yogyakarta, Chemical Engineering Dpt., Sleman, Yogyakarta, INDONESIA**

Presenter's biography:

Currently, a researcher at UPN "Veteran" Yogyakarta. I`m working on the utilization of palm oil mill effluent as a medium growth of microalgae.

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Session reference: 1BV.1.14

Subtopic: 1.4 Algae and Aquatic Biomass Production Systems

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Development of a Purification Strategy for the Aqueous Phase from Biomass Pyrolysis - Recovery of Valuable Products

Short introductive summary:

The aqueous phase from biomass pyrolysis is until today mostly seen as worthless by-product. However, it can be a valuable resource for the recovery of products. For this, the composition of the aqueous phase must be known and a suitable purification strategy, adjusted to the pyrolysis feedstock, has to be developed. The aim of this investigation is to introduce a multi-level purification strategy for the aqueous phase gained from the thermo-catalytic reforming of sewage sludge which allows also the recovery of products. The purification strategy consists out of an electrooxidation step, a decarbonisation step and an air stripping step. By means of this, hydrogen, calcium carbonate and ammonium sulfate can be recovered during the purification from the aqueous phase. In the medium term, purification strategies like this will lead to a reduction of the overall pyrolysis process costs and decrease the specific costs of targeted pyrolysis products like char, bio oil and syngas.

Presenter: **Robert DASCHNER, Fraunhofer-Institut UMSICHT, Energy Management Dpt., Sulzbach-Rosenberg, GERMANY**

Presenter's biography:

Dr.-Ing. Robert Daschner is head of department Renewable Energy at Fraunhofer UMSICHT since 2015. After his degree in mechanical engineering at the University of applied sciences in Regensburg in 2008 he finished his PhD at Technical University Munich in 2014.

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Session reference:	3BV.2.1
Subtopic:	3.2 Pyrolysis
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Scale-Up of Batch Esterification of Pyrolysis Oils with Higher Alcohols from 250-ml-Scale to 20-L-Scale

Short introductive summary:

Esterification is a possible means to cure undesirable properties of pyrolysis oils like high water Content, acidity and reactivity. The organic acids are esterified and the highly reactive aldehydes and ketones also get masked by reaction with alcohol. The water is continuouls boiled off as water/alcohol-aceotrope during the operation and can be separated, if the alcohol has a miscibillity gap with water.
After numerous orienting experiments varying the operating conditions and catalysts performed in recent years in small scale at 250 ml flasks, it is now time to scale up the process. For that, a 2-L-flask and a 20-L automated reactor are used. The influence of reactor size on product qualities like final water Content, heating value and carboxylic acid number (CAN) will be discussed in the presentation.

Presenter: **Tim SCHULZKE, Fraunhofer UMSICHT, Low Carbon Technologies, Oberhausen, GERMANY**

Presenter's biography:

I studied chemical engineering at University of Dortmund, where I received my diploma in 1992. From then on I work at Fraunhofer UMSICHT, since August 2018 as Senior Scientist in the department Biorefinery & Biofuels. My main topics are biomass gasification and pyrolysis and synthesis gas chemistry.

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Session reference: 3BV.2.2

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Wood Chips Oxidative Pyrolysis For Biochar and Syngas Generation

Short introductive summary:

Thermochemical conversion of lignocellulosic biomass such as pyrolysis and gasification is a promising technology to produce biochar, power and heat. However, economic reliability, technical efficiency and environmental impacts of this process are determined by the range of raw materials used and the valorization of by-products to be suitable to cover a broad spectrum of environmental and industrial applications.

This work aims to study a new process for biochar and gas generation from wood residue oxidative pyrolysis in a fixed bed reactor .

Presenter: **Fouzia EL ABDELLAOUI, HEIG-vd/ IGT, TIN Dpt., Yverdon Les Bains, SWITZERLAND**

Presenter's biography:

I'm an engineer in Energy, Environmental and Process Engineering, currently I'm a PhD student; my research project is about biomass pyrolysis/gasification.

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Session reference:	3BV.2.8
Subtopic:	3.2 Pyrolysis
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Sustainable Utilisation of Waste Biomass via Thermo-chemical Route in India: Findings from Case Studies, Success Stories and Solution Approach

Short introductive summary:

India is an agriculture-based economy that caters towards the long debatable food-energy nexus. Additionally, Indian forests cover nearly 24% of the total geographical area. As a result, there is an abundance of biomass both from the agricultural sector as well as from forests. Most of the times they are burned. The study focuses on the suitability of pyrolysis and gasification technology for waste biomass utilisation in the Indian context. Case study approach was taken in this case. We have developed a supply chain-based solution architecture that utilises Internet-of-Things (IoT) technology for inventorisation and monitoring of waste biomass. A brief discussion from the perspective of sustainability has also been presented.

Presenter: **Ankita DAS, Heritage Institute of Technology, MCA Dpt., Kolkata, INDIA**

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Session reference: 3BV.2.10

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Synthesis and Characterization of Phenolic Resins Based on Pyrolysis Bio-Oil Separated by Fractional Condensation and Additional Water Extraction

Short introductive summary:

The combination of fractional condensation and water extraction of biomass pyrolysis can be a simpler, low-cost, and more efficient approach to selecting bio-oil fractions with a high content of a mixture of phenol and guaiacol monomers that show the obvious advantages in the production of bio-based green polymers. It also provides some ideas for finding greener and simpler bio-oil separation methods for the synthesis of green polymers. The use of phenolic models and mimics also contributed to finding appropriate reaction conditions and understanding the reaction mechanism of bio-oil.
The feasibility of the use of aromatic compounds derived from bio-oil for the synthesis of resins has been shown. The properties of the latter are close to phenol resin. Compared with untreated bio-oil, the use of fractional condensation and water extraction pyrolysis bio-oil can significantly improve the thermal properties of BPA resin due to its high content of phenolics.

Presenter: **Jie XU, INSA Rouen, Rouen, FRANCE**

Presenter's biography:

Jie XU is a PhD student at INSA Rouen, France. Her research focuses on the synthesis of bio-oil-based green polymers.

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Session reference:	3BV.2.11
Subtopic:	3.2 Pyrolysis
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Catalytic Co-Pyrolysis of Residual Biomass and Waste Plastics to Produce Drop-In Alternative Hydrocarbons

Short introductive summary:

Pyrolysis is expected to play an increasing important role as the world transition to low carbon fuels and petrochemicals in line with global goals of reducing emissions. Catalytic co-pyrolysis of residual biomass and waste plastics will expand waste disposal options and reduce environmental footprint of underutilized carbon resources. The valorisation of lignocellulosic material via pyrolysis while feasible has been met with drawbacks, especially with regards to its suitability to be utilised within the current market demands unless improvements on quality and stability are improved drastically. This work aims to prove the potential of producing drop-in hydrocarbon by using synergistic and catalytic relationships to valorise residual biomass resources with a small portion of plastic as a positive synergistic material to aid with de-oxygenation by providing in-situ hydrogen during pyrolysis

Presenter: **Elvis Tinashe GANDA, University of Naples Federico II, Chemical, Materials and Production Engineering Dpt., Naples, ITALY**

Presenter's biography:

I am working on a Biofeedstock project, with my focus being on the thermochemical valorisation of residual biomass to produce valuable hydrocarbons. I am the winner of the Eni Awards 2018-Young Talents from Africa and through this partnership I am doing research studies at Unina Federico II.

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Session reference: 3BV.2.12
Subtopic: 3.2 Pyrolysis
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Influence of Guard Beds in the Biomass Pyrolysis Volatile Composition and Subsequent Catalytic Performance on In-Line Pyrolysis Reforming Process

Short introductive summary:

Fast pyrolysis is promising method to convert lingnocellulosic biomass into useful energy. However the catalyst deactivation has become the reaction time limiter, being the coke deposition the main species responsible for catalyst deactivation. Therefore, this study focuses on enhancement of the catalyst activity and stability in the reforming step by the modification of the biomass pyrolysis volatile stream, using some guard beds catalysts, as Al2O3 and spent FCC, elongating the reforming catalyst life. In both cases the yield of H2 obtained at zero time on stream are higher than 90%. However, differences are observed amongst the runs conducted with two guard beds with time on stream, evidencing the high influence of the pyrolysis volatile composition have on the catalyst performance and its deactivation. Using ?-Al2O3 fasted initial deactivation is observed, but a notable improvement is showed with time on stream and the deactivation is markedly attenuated. However, when spent FCC guard bed is used, is showed a complete conversion for the first 30 min on stream, and then sharply decreased attaining, associated to the high concentration of phenolic fraction.

Presenter: **Enara FERNANDEZ SAENZ, University of the Basque Country, Leioa, SPAIN**

Presenter's biography:

In 2016 I joined as a researcher in the PROCAT-VARES group with a contract financed by the project CTQ2013-45105-R with the aim of advancing in the pyrolysis and reforming with steam.
In May of the same year a become a PhD and my research is focused on the pyrolysis of biomasss.

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Session reference:	3BV.2.13
Subtopic:	3.2 Pyrolysis
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Dynamic Behaviour of a Single Biomass Particle in Bubbling Fluidised Bed Reactors: Experimental Investigation and Model Development

Short introductive summary:

Stefano is a PhD student at the University College London (UCL), working on fluidised beds applied to the thermochemical treatment of biomass and waste. He graduated from the University of L'Aquila (Italy) in 2018, with his final-year project undertaken at UCL with the Erasmus+ programme. For his final MSc project, Stefano has developed advanced imaging techniques to better understand segregation phenomena during initial gasification and pyrolysis of waste feedstock in industrial reactors. At present, the main objective of his research work is to predict the dynamic and thermal degradation behaviour of highly volatile solid feedstocks in fluidised bed reactors.

Presenter: **Stefano IANNELLO, University College London, Chemical Engineering Dpt., London, UNITED KINGDOM**

Presenter's biography:

Stefano is a new PhD student at the University College London (UCL), working on fluidised beds applied to the thermochemical treatment of biomass and waste.

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Session reference: 3BV.2.14

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Pyrolysis of Problematic Wastes - the Case of Plastic Contaminated Horse Manure

Short introductive summary:

Subject of the conference paper is the development of a reasonable and more sustainable method for disposing and utilizing problematic wastes using pyrolysis. Horse manure (HM) contaminated with plastic particles from an indoor riding area was used as an exemplary substrate. To determine suitable intermediate and final pyrolysis products, both substrates were pyrolyzed in a fixed bed reactor varying the final pyrolysis temperature. The pyrolysis products as well as the individual substrate types were analyzed and characterized. The solid char residue is proposed as a desired intermediate product for the pyrolysis of HM. Possible applications for both normal and contaminated HM pyrolysis chars were elaborated. For contaminated HM chars, sequestration pathways (BECCS) are a promising utilization solution while normal HM chars could be used as a soil enhancer.

Presenter: **Maximilian LÖFFLER, Technische Hochschule Mittelhessen, University of Applied Science, Johannesberg, GERMANY**

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Session reference: 3BV.2.15

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Integration of Hydrogen and Ammonia Energy into Combined Cycles: the FLEXnCONFU Project

Short introductive summary:

Within the strategies to achieve the European Union's carbon neutrality target by 2050, replacing fossil fuels with alternative sources such as renewables or secondary raw materials represents a prominent action line. The EU is currently dependent on natural gas (NG) to facilitate such transition, for its lower carbon footprint and greater grid stabilization capacity. However, combined cycle (CC) plants and likewise any system employing gas turbines (GTs), could potentially benefit from the integration of alternative energy sources to meet the grid's requirements at peak demand times, thus curtailing their carbon footprint significantly. Ammonia and hydrogen convey two promising energy vectors that if successfully deployed may considerably aid in the large-scale energy switch and help reduce CC plants' reliance on fossil fuels. The FLEXnCONFU project plans to demonstrate the feasibility of integrating Power-to-X (P2X) solutions in CC plants at TRL 6 and 7, realizing their full potential to diversify the supply network, making it more flexible to accommodate a carbon neutral economy.

Presenter: **Andrea HERNÁNDEZ PEDRERO, Fundación CIRCE, Zaragoza, SPAIN**

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Session reference: IBO.3.1
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Green Hydrogen Production from Biogas with Catalytic Membrane Reactor: the BIONICO and MACBETH Projects

Short introductive summary:

A viable option for green hydrogen production is the reforming of biogas. The BIONICO investigates the biogas-to-hydrogen conversion with a novel Catalytic Membrane Reactor (CMR) for process intensification. The novel reactor developed within BIONICO allows the perform the conversion and separation of H2 in a single step, with significant advantages in terms of conversion efficiency and cost reduction. The MACBETH project, based on the knowledge gained within BIONICO and within two other projects on CMRs (CARENA and ROMEO), will further develop the membrane reactor technology, bringing it to TRL 7.

Presenter: **Marco BINOTTI, Politecnico di Milano, Dipartimento di Energia, Milano, ITALY**

Presenter's biography:

I am assistant professor of “Energy and Environmental Systems” at Politecnico di Milano. My research with the GECoS Group deals with techno-economic analysis and simulation of advanced energy conversion systems, Concentrating Solar Power and other renewables.

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Session reference: IBO.3.3

Subtopic: 6.3 Advances in Hydrogen & Fuel cells in Bioenergy

Topic: 6. INDUSTRY TRACK

Comparative Framework for Alternative Fuels in the Future Aviation: Biofuels, Electrofuels, Electric Batteries and Hydrogen

Short introductive summary:

The purpose of this study is to present a framework for comparing alternative fuels for future aviation, among other within Life Cycle Assessment (LCA). First, the existing and emerging technology alternatives have been comprehensively reviewed. These include 8 pathways for biofuels, 7 for liquid electrofuels, 5 for electric batteries and 5 for hydrogen (H2) production (whether used as cryogenic H2, for fuel cells, or as a H2 source for the liquid fuel pathways) (shown in Fig. 1). Second, a semi-quantitative analysis framework has been built and used in order to rank the alternatives in terms of their priority for a full LCA. Here, this framework was applied considering two time scopes, here referred to as 2035 and 2045 scenarios.

Preliminary result, in 2035 scenario, hydroprocessed ester and fatty acid (HEFA) from oleochemical waste showed the significant pathway as the most mature and readily available option according to the semi-quantitative analysis. While in the 2045 scenario, alcoholic fermentation (AF) is likely to provide the most favorable technology solution.

Presenter: **Pimchanok SU-UNGKAVATIN, INSA Toulouse, Toulouse, FRANCE**

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Session reference: BP.1.1
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

To-Syn-Fuel Project Implements a New Integrated Process to Produce Synthetic Fuels

Short introductive summary:

The H2020 To-Syn-Fuel project aims to demonstrate a sustainable process able to transform waste biomass such as sewage sludge into renewable liquid fuels and hydrogen. The Thermo-Catalytic Reforming TCR® will be implemented in a new process integrated with hydrodeoxygenation (HDO) and pressure swing adsorption (PSA) technologies to convert a wide range of residual biomass into three main products: H2-rich synthesis gas, biochar and a liquid bio-oil that can be upgraded to green fuels capable of being used directly in automotive internal combustion engines without modification, as they fulfil EN fuel standards.

In this project, the operational capacity of TCR® is designed for up to 500 kg per hour of sewage sludge at a water content of 5-15 %. The main purpose of this unit is the long-term operation of a pre-commercial demonstrator. This is the final step of development before the technology is reaches full commercial scale. This integrated unit is going to be commissioned in beginning 2021 and subsequently operated for up to 5,000 hours and for the production of more than 200,000 liters of biocrude oil.

Presenter: **Robert DASCHNER, Fraunhofer-Institut UMSICHT, Energy Management Dpt., Sulzbach-Rosenberg, GERMANY**

Presenter's biography:

Dr.-Ing. Robert Daschner is head of department Renewable Energy at Fraunhofer UMSICHT since 2015. After his degree in mechanical engineering at the University of applied sciences in Regensburg in 2008 he finished his PhD at Technical University Munich in 2014.

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Session reference: BP.1.2

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Successful Production and Testing of On-Specification Aviation Biofuel from Hydrothermal Liquefaction and Catalytic Hydrotreating

Short introductive summary:

Aviation represents one the main contributors to global CO2 emissions and air traffic volumes can be even expected to increase in the future. A number of different solutions have been proposed in order to reduce the utilization of fossil resources for aviation, such as hydrogen or even electric. However, at the moment none of them seems to guarantee the high levels of flexibility and reliability represented by liquid hydrocarbons.
In this work we show for the first time how it is possible to produce aviation fuel from hydrothermal liquefaction (HTL) of different biomass feedstocks (e.g. algae and sewage sludge) by means of a careful choice of hydrotreating catalyst and process conditions and subsequent fractional distillation of the resulting oil. The produced fuels underwent thorough characterization in accordance to ASTM D1655, the global standard for aviation fuel, and were found fully on-spec. Finally, the produced fuels were tested in a lab-scale aviation turbine in blend with conventional Jet-A1 fuel, to prove their good “on-field” performance.

Presenter: **Daniele CASTELLO, Aalborg University, Energy Technology Dpt., Aalborg Øst, DENMARK**

Presenter's biography:

Ph.D. in Environmental Engineering at the University of Trento (Italy), then post-doctoral fellow at the University of Twente (Netherlands). Currently, post-doctoral fellow at Aalborg Univesity (Denmark) in the field of bio-crude upgrading to drop-in fuels.

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Session reference: BP.1.3

Subtopic: 3.3 Hydrothermal Processing

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Designing a Sustainable Future for the European Bioenergy System by 2050: the Agri-food System Calculator

Short introductive summary:

Our research presents the first results of a novel “Calculator” model designed to bridge the gap between sciences, policymakers and the general public and enable both groups to evaluate the sustainability of biomass, bioenergy and food production as a fully integrated system.

Presenter: **Gino BAUDRY, Imperial College London, Center for Environmental Policy, London, UNITED KINGDOM**

Presenter's biography:

Gino BAUDRY is a PhD Student at the University of Nantes. His research consists of designing supportive policy measures for the deployment of microalgae biofuels in France.He teaches courses in Energy and Climate Economics for Master degrees.

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Session reference: 4BO.4.1
Subtopic: 4.4 Biomass Strategies and Policies Towards a Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Fuel Choices for Different Transport Modes When Decarbonizing the Scandinavian Energy System

Short introductive summary:

In order to meet future climate targets, aviation and shipping as well as road transport need to reduce their climate impact. The amount of renewable fuels needs to increase in all sectors. Biomass-based fuels, electrification, hydrogen and so called electrofuels are being developed for different parts of the transport sector. This study assesses what fuels and propulsion technologies that are most cost-effective for aviation, shipping and road transport in the future in the Scandinavian countries in an energy system context given carbon reduction requirements and what factors that influences the prerequisites for different options in these sectors.

Presenter: **Julia HANSSON, IVL Swedish Environmental Research Institute, Climate & Sustainable Cities, Göteborg, SWEDEN**

Presenter's biography:

Dr Julia Hansson at IVL Swedish Environmental Research Institute, Sweden aims to provide perspectives on future bioenergy use and trade and renewable fuels for transport in a European policy context using energy system and policy analysis.

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Session reference: 4BO.4.2
Subtopic: 4.4 Biomass Strategies and Policies Towards a Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Towards National Baselines For Assessing Future Bioeconomy Strategies: Uncovering the Key Parameters & Cause-Effect Relationships in Leading Global Future Scenarios

Short introductive summary:

The transition to low-fossil carbon bioeconomy requires a variety of long-term infrastructure investments. Therefore, for a robust national bioeconomy strategy planning, taking future conditions into account, especially using multiple background futures instead of one single projection can be beneficial, in building time-dependent inventories for environmental assessments such as Life Cycle Assessments. In this study, we reviewed six internationally well-recognized global environmental scenario studies and one intelligence report to evaluate to which extent these could directly be used for national strategic assessments towards GHG neutrality. Unlike existing reviews that focus on the outcomes or the key drivers that influence the outcomes of the scenarios, this study focuses on revealing and comparing the causal logics assumed in the narratives of the scenarios and aim to increase the transparency of the underlying assumptions of the studies. Causal loop diagrams were constructed for individual studies. From this, key variables with most causal connections and the direction of their causal relationships were discovered.

Presenter: **Seung Hye LEE, INSA Toulouse, Toulouse, FRANCE**

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Session reference: 4BO.4.3

Subtopic: 4.4 Biomass Strategies and Policies Towards a Bioeconomy

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

A Guideline to Create Regional Bioeconomy Hubs

Short introductive summary:

Many regions across Europe have prepared their bioeconomy strategies in recent years to support the deployment and implementation of sustainable bioeconomy both at national and regional level. Lessons learned from regions with existing strategies, pave the way for others that are now on the development of their bioeconomy strategies. In the framework of the H2020 project POWER4BIO this work aims to provide with a step-by-step guidance to establish and consolidate regional hubs as central platforms to engage stakeholders in the strategy development process. Besides an extended literature review, guided interviews were carried out with regions with existent bioeconomy strategies and the main phases of the establishment of a network and essential aspects were identified and described.

Presenter: **Laura GARCIA, DBFZ, Leipzig, GERMANY**

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Session reference: 4BO.4.4

Subtopic: 4.4 Biomass Strategies and Policies Towards a Bioeconomy

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Entrained Flow Reactor Gasification - Influence of Operating Conditions and Temperature on Gasification Efficiency

Short introductive summary:

The present abstract presents the results of an experimental study of biomass entrained flow reactor gasification in a pilot-scale reactor. Moderate pressure and temperature conditions are especially investigated.

Presenter: **Sylvie VALIN, CEA Grenoble, LITEN/DTBH/L2CS Dpt., Grenoble, FRANCE**

Presenter's biography:

Sylvie VALIN holds a PhD (1999) in Energetics from the Institut National Polytechnique de Grenoble, France. She has been working as a research engineer on biomass gasification at CEA since 2004. Her research activity mainly concerns biomass and waste pyrolysis and gasification.

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Session reference:	2BO.5.1
Subtopic:	2.5 Gasification for Synthesis Gas Production
Topic:	2. BIOMASS CONVERSION FOR BIOENERGY

Influence of Process Operating Conditions in the Sorption-Enhanced Gasification of the Organic Fraction of Municipal Solid Waste (MSW)

Short introductive summary:

In this work, a sorption-enhanced gasification (SEG) process is studied using the organic fraction of a Municipal Solid Waste (MSW) as feedstock in a 30 kWth bubbling fluidised bed (BFB) reactor. Experiments using steam-to-carbon ratios in the range of 1 to 1.5 molH2O/molC with different sorbent-to-biomass proportions and gasification temperatures were conducted in a 30 kWth bubbling fluidized bed reactor. Solid residence time in the reactor was modified through the biomass and CO2 sorbent flow rates fed to the reactor.
The influence of each operating variable in the syngas composition as well as in the yield and composition of the tar produced has been determined through these experiments. Moreover, it has been calculated char conversion in the gasifier for the different experiments performed with the objective of elucidating a semi empirical model for predicting such conversion as a function of the gasification temperature and solid residence time in the reactor.

Presenter: **Carlos ORDÓÑEZ MILLÁN, CSIC, Environmental Sciences Dpt., Baena, SPAIN**

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Session reference: 2BO.5.2
Subtopic: 2.5 Gasification for Synthesis Gas Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Autothermal Catalytic Reforming of Pyrolysis Oil: Results of a 10 kW Oxygen Blown Gasifier

Short introductive summary:

In this work, the autothermal catalytic reforming of pyrolysis oil for syngas production is investigated.

A newly built, oxygen blown 10 kW gasifier is used for the conversion of five different FPBOs derived from five different biomass materials (clean pine wood, eucalyptus, arundo, sorghum and a lignin-rich residue of a 2G bioethanol plant)

Presenter: **Evert LEIJENHORST, BTG Biomass Technology Group, RTD Dpt., Enschede, THE NETHERLANDS**

Presenter's biography:

Evert Leijenhorst works since 2006 as process engineer at BTG Biomass Technology Group BV. Main activities involve the fast pyrolysis of biomass and gasification of pyrolysis oil. Graduated as Chemical Engineer at the University of Twente, obtained his PhD at the University of Ghent.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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Session reference: 2BO.5.3

Subtopic: 2.5 Gasification for Synthesis Gas Production

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Effective Removal of Biomass Tar Using Highly-Active Metal Catalysts with Non-Thermal Plasma

Short introductive summary:

Tar formation in biomass gasification is undesirable due to the decreased energy efficiency and increased maintenance cost of downstream equipment. The hybrid non-thermal plasma-catalysis system is considered to be a promising alternative, since it overcomes both feedbacks of easy catalyst deactivation for catalytic reforming and formation of undesirable liquid byproducts for plasma reforming. Therefore, a hybrid dielectric barrier discharge (DBD) plasma-catalysis system was applied for the steam reforming of toluene as tar model compound. To enhance hydrogen production and conversion of toluene, SiO 2 and ZSM-5 supported Fe-based catalysts with different Fe loadings of 0.5, 1, 3, 5 wt.% prepared by thermal fusion method were employed for catalytic steam reforming of toluene. Catalytic steam reforming of toluene was conducted in DBD plasma at 300 ? at N 2 atmosphere. Toluene conversion (around 93%) over both Fe/SiO 2 and Fe/ZSM-5 catalysts with 5% Fe loading and yields of H 2 (above 1.70 mol/mol) over both catalysts with 0.5% Fe loading were achieved

Presenter: **Yifei SUN, Beihang University, School of Energy and Power Engineering, Beijing, P.R. CHINA**

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Session reference: 2BO.5.4
Subtopic: 2.5 Gasification for Synthesis Gas Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Development of a Techno-Economic Model for Assessment of an Integrated Pyrolysis and Fermentation Plants for Production of Bio-Oil and Ethanol

Short introductive summary:

The cost of producing renewable products derived from bio-oil is not attractive when compared to the petroleum-derived products. Reducing the production cost of bio-oil derived products is gaining significant interest. The production of ethanol from bio-char and non-condensable gases which are produced during pyrolysis process is a potential pathway to lower the production cost of bio-oil and hence its derivatives. In this study, we developed an integrated syngas fermentation plant model with a pyrolysis plant model to produce bio-oil and ethanol from wood, using process models simulation. Ethanol is produced from the fermentation of syngas derived from gasification of biochar produced in pyrolysis and pyrolysis non-condensable gases. A techno-economic model was developed to evaluate the production cost of the bio-oil. The impact of the produced ethanol on bio-oil production cost was investigated. Two scenarios were considered and the results were compared in terms of yields and production costs. In the first scenario, the non-condensable gases are combusted for heat generation and in the second one, the non-condensable gases alongside syngas are jointly converted into ethanol.

Presenter: **Temitayo GIWA, University of Alberta, Edmonton, CANADA**

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Session reference: 3BO.6.1

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Lignocellulosic Multi-Product Biorefinery: Evaluation of Economic and Environmental Hotspots and Value Creation

Short introductive summary:

A biorefinery involves a series of processing steps aimed at adding value to each intermediate output. Often, the main conversion processes have to be complemented with a comprehensive infrastructure serving all energy and ecological needs of a biorefinery due to the remote location. As a result, the value creation process may boost costs and environmental burdens added at each processing step. In this paper, we address the issue of the in-line analysis of value creation and the accumulation of costs and environmental burdens in a biorefinery. We analyzed two lignocellulosic biorefineries allowing sugar- and lignin valorization pathways. Our methodology involves matrix notation to track the accumulation of economic and environmental attributes along the biorefinery value creation chains. The results highlight the significance of biomass' expanding share and the conspicuous role of infrastructure on the total final product cost and GHG emission profile, and emphasize the imperfection of biomass pretreatment concept, as well as lignin cake drying and solvolysis processes. The proposed method is worth being applied to the analysis of new biorefinery concepts and integration

Presenter: **Svetlana OBYDENKOVA, Maastricht University, Eindhoven, THE NETHERLANDS**

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Session reference: 3BO.6.2

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Advances in the Techno-Economic Assessment to Identify the Ideal Plant Configuration of a New Biomass-To-Liquid Process

Short introductive summary:

The EU-project COMSYN (Compact Gasification and Synthesis process for Transport Fuels) is aiming at reducing the biofuel production costs significantly by up to 35 % compared to alternative fuels. To achieve this ambitious goal, the consortium pursues two major approaches:
• Firstly, combining multiple high-efficient process steps, such as a new gasification concept (developed by VTT) together with a hot gas filtration and a FT-microreactor (developed by INERATEC).
• Secondly, investigating decentralized production sites of FT-products in combination with a centralized fuel upgrading concept at existing refineries.
To allow the definition of the ideal process configuration in dependance to the chosen production site the techno-economic assessment methodology used by DLR has been extended. The results of these new advances will be shown using the different COMSYN process configurations.

Presenter: **Simon MAIER, DLR - Institute of Engineering Thermodynamics, Stuttgart, GERMANY**

Presenter's biography:

Working as a research scientist at DLR e.V. since 09/2017.
My main topics are:
- flowsheet modelling of production routes for alternative fuels.
- supervising and extending the inhouse tool TEPET for technical, economical and ecological evaluation of different processes.

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Session reference:	3BO.6.3
Subtopic:	3.6 Biorefineries
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Defining Small-Scale Biorefineries Based on a Multi-Factorial Statistical Typology

Short introductive summary:

Small scale biorefineries are modalities of biorefineries that are yet to be defined and distinguished from the large scale. This work introduces an approach to defining the small scale biorefineries based on a multi-factorial analysis of existing facilities, taking into account the technical, economic and logistic characteristics that define biorefineries. It highlights as well the trade-offs between these factors and how they contribute in the viability of biorefineries.

Presenter: **Aicha AIT SAIR, INRAE, Nantes, FRANCE**

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Session reference: 3BO.6.4

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Agricultural Residues in Greece: Quantitative and Qualitative Characterization for Assessing the Most Promising Materials for Biogas Production

Short introductive summary:

Greece is an agricultural country and significant percentage of its biomass consists of agricultural and animal waste. In Greece, only a small percentage of biomass is currently used to cover electrical energy needs. On the other hand, huge amounts of agricultural residues and animal manures are being disposed of uncontrollably in the environment or in landfills, while farmers most of the times prefer to burn the residual biomass in the field. The present work presents the qualitative and quantitative characteristics of all agricultural residues produced in Greece in a unique and comprehensive way for the whole country.

In this work, an extensive literature review was conducted from 1983 until 2020 on primary agricultural waste that includes crop residues that are left on the fields, on secondary agricultural waste that includes liquid and solid waste streams from agro-industrial plants and on animal manures. In our literature review, the residues were divided into three main categories, namely agricultural residues, animal manures and agro-industrial residues.

Presenter: **Vasiliki P. ARAVANI, Elke, University of Patras, PATRA, GREECE**

Presenter's biography:

Vasiliki P. Aravani is a PhD candidate since 2019 in the Department of Environmental Engineering at University of Patras. She has domestic and international work experience in the fields of Environment and Quality Control. Her PhD work concerns the energy management of agricultural residues.

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Session reference: 1BV.3.1
Subtopic: 1.2 Agroforestry Residues and By-Products
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Characterization of Biomass Pellet Made from Agriculture Residue: Pearl Millet Cob

Short introductive summary:

I am a Ph.D. scholar at the Indian Institute of Technology Delhi. My working area is gasification.

Presenter: **Praveen KUMAR, IIT Dellhi, CRDT Dpt., South Delhi, INDIA**

Presenter's biography:

I am a Ph.D. scholar at the Indian Institute of Technology Delhi. my working area is gasification.

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Session reference: 1BV.3.2

Subtopic: 1.2 Agroforestry Residues and By-Products

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Stationary Forestry Chipper for Olive Pruning Harvesting

Short introductive summary:

Olive pruning could represent an important biomass resource for energy production considering that over 2600 Gg of dry matter represent the annual amount of biomass that could be obtained from olive groves just in Italy. Different experiences of pruning harvesting are reported in literature, especially related to shredders towed by tractors while limited knowledge is available on harvesting logistics based on stationary chippers.The aim of the present paper is to analyze machine performance of a forestry stationary chipper applied to pruning harvesting for what concerning work productivity, quality of the comminuted product and harvesting operating costs. The study results innovative because fills a gap in the literature where little information is currently available.

Presenter: **Alessandro SUARDI, CREA- Council for Agricultural Research and Economics, Centro di ricerca Ingegneria e Trasformazioni Agroalimentari, Monterotondo RM, ITALY**

Presenter's biography:

Temporary Research Associate at CREA-ING
Field of research:
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- Life Cycle Assessment

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Session reference:	1BV.3.3
Subtopic:	1.2 Agroforestry Residues and By-Products
Topic:	1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Comparison Between Oil Extraction Tecnhiques from Hemp Seed: Cold Press Techniques and Ultrasound Assisted Maceration (UAM) Method

Short introductive summary:

The renewed interest in Cannabis sativa L. is supported by many of studies and data highlighting the beneficial properties of its seeds, which constituted an important source of nutrition for thousands of years in Old World cultures. Today, despite the multiple clinical evidence, there is still not a full awareness of their nutritional and therapeutic benefits. This renewed interest in hemp seed is based on the awareness that this small plant entity is a rich but untapped source of nutrients and non-nutrients, whose daily intake, consumed as it is or in products derived from it (Oil and flour), could provide nutritional and functional support to human body.

Presenter: **Maura SANNINO, Università Federico II di Napoli, Dipartimento di Agraria, Napoli, ITALY**

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Session reference: 1BV.3.4
Subtopic: 1.2 Agroforestry Residues and By-Products
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Potential Use of Briquetting Techniques for Cereal Chaff

Short introductive summary:

The recovery of threshing by-products is experiencing positive considerations on more crops not only cereal. CREA has been working on these issues for some years and developed a specific tool for separating and collected secondary threshing products. To improve adeguate logistic chain this study want to evaluate the possibilities of briquetting techniques to improve final product density to improve handling and reduce transport costs. The tests were carried out on cereal chaff samples collected during the wheat harvest in current agricultural season in the Emilia Romagna region (Italy).

Presenter: **Alberto ASSIRELLI, CREA - Research Center for Engineering & Agro-Food Processing, Monterotondo - RM, ITALY**

Presenter's biography:

Dr. Alberto Assirelli has a PhD in Agricultural Engineering in 1997 and start working in the Department of Economics and Agricultural Engineering at the University of Bologna, continuing his works in other public and private research centers.
Researcher in the Agricultural Engineering Unit (CREA-ING) of the Agricultural Research and Experimental Council (CREA), in Monterotondo (Roma).
Author of more than 400 publications in the fields of agricultural mechanization with particular reference to the development and testing of new machinery for food, feed and energy crops.

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Session reference: 1BV.3.5
Subtopic: 1.2 Agroforestry Residues and By-Products
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Development of Agriculture Residue Pellet (Pearl Millet Cob) Production Cost and Optimum Size

Short introductive summary:

i am research scholar.My work on agriculture waste to energy conversion

Presenter: **Praveen KUMAR, IIT Dellhi, CRDT Dpt., South Delhi, INDIA**

Presenter's biography:

I am a Ph.D. scholar at the Indian Institute of Technology Delhi. my working area is gasification.

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Session reference: 1BV.3.8

Subtopic: 1.2 Agroforestry Residues and By-Products

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Bioactive Compounds Achieved from Residues of the Apricot Tree (Prunus Armeniaca L.) and Olive Tree (Olea Europaea L.): New Prospective in the Industrial Sector

Short introductive summary:

The aim of the study is the valorization of biomass from orchards, in the specify the biomass from apricot tree (Prunus armeniaca L.), olive tree (Olea europaea L.) for produce natural compounds with nutraceutical scope.

Presenter: **Paola CETERA, National Research Council, Institute of BioEconomy, San Michele all'Adige (TN), ITALY**

Presenter's biography:

Currently works as a researcher at the CNR-IBE, San Michele all'Adige (TN). Main research interests are: valorization of biomass; characterization and application of by-products obtained from different wood species and wood characterization by using different parameters of TH process.

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Session reference: 1BV.3.9
Subtopic: 1.2 Agroforestry Residues and By-Products
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Process Optimization of Pectin Extraction from Opuntia Spp and Characterization

Short introductive summary:

Opuntia spp. is considered a promising crop to surpass the climate change effects in agriculture as it is a xerophytic plant which is particularly adapted to arid lands (e.g. Mediterranean area and North Africa) and severely degraded soils that are unsuitable for traditional crops. It is a spiny succulent plant of the Cactaceae family and the mucilage from the palms of the plant (cladodes) is rich in polysaccharides (e.g. pectin) capable to form viscous solutions. Once the cladodes are poorly utilized, and considered as a by-product, the aim of this work was to optimize an efficient and sustainable method to extract pectin from this biomass to be used as a biobased material in a circular economy approach. Moreover, application of the extracted pectin to substitute fossil based products, e.g. plastics in the food packaging, will contribute to accomplish the targets of the European Green Deal in terms of reducing fossil-based packaging waste and reducing dependence on non-renewable, unsustainable resources, helping to decarbonize the economy.

Presenter: **Ana Luisa FERNANDO, Universidade Nova de Lisboa, Ciências e Tecnologia Biomassa Dpt., Caparica, PORTUGAL**

Presenter's biography:

Ana Luísa Fernando holds a PhD in Environmental Sciences. Associate Professor at Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa.Main scientific areas: energy crops, remediation of contaminated soils, valorization of agro residues.

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Session reference: 1BV.3.12
Subtopic: 1.2 Agroforestry Residues and By-Products
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Artificial Neural Network Model for Predicting Pressure Drop in Pipeline Hydro Transportation of Agricultural Residues

Short introductive summary:

The large-scale adaptation of biomass-based power generation facilities is hindered by the high cost and high congestion associated with feedstock transportation by trucks. A well sought-after solution to this is pipeline hydro transport of biomass, this technology benefits from economies of scale that enable bio-based facilities to operate at higher capacities. To design pipelines for hydraulic conveying of biomass, accurate prediction of pressure gradient as a function of slurry specification, slurry velocities, and pipe diameter are needed. In this study, the experimentally developed data for pipeline transportation of agricultural residue-water mixtures from literature was used to develop an artificial neural network (ANN) model to predict the longitudinal pressure gradients in the slurry flow. Furthermore, the developed ANN model was compared with nonlinear least square regression (NLS) model, which is an already existing pressure loss prediction model for agricultural residue-water slurries. The study shows that the ANN model is a far superior model in predicting longitudinal pressure gradient for agricultural residue-water mixtures.

Presenter: **Omex MOHAN, University of Alberta, Mechanical Engineering Dpt., Edmonton, CANADA**

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Session reference: 1BV.3.13
Subtopic: 1.2 Agroforestry Residues and By-Products
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Collection of Crop By-Product: Experience on Wheat Chaff

Short introductive summary:

Among the agricultural residues, cereal chaff has gained interest due to its availability and properties both for energy purposes and for animal feeding. Chaff is made up of seed glumes, seed husk and rachis. This material can be estimated in about 7 % of the threshed product (40 % are seeds, 48 % straw, 5 % stubble). According to EUROSTAT, more than 300 Mt grain is harvested yearly in EU28 (EC, 2007) and considering a mean chaff to grain ratio of 0.17, more than 52 Mt yr-1 could be available to be collected in Europe. During cereal harvesting, the chaff is normally dispersed in the field together with straw and other fine residues retained by the combine sieves, such as un-threshed heads, short straw, leaf material, weed seeds and whole or cracked kernels from the harvested crop. This paper will show a new approach aimed at managing and valorizing this biomass product.

Presenter: **Simone BERGONZOLI, Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, CREA-IT, Treviglio (BG), ITALY**

Presenter's biography:

Agronomist, Phd in agricultural engineering I work since 2010 in crop harvesting, biomass feedstock and energy crops

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Session reference: 1BV.3.15

Subtopic: 1.2 Agroforestry Residues and By-Products

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Eucalyptus Storage Performance after Debranching

Short introductive summary:

Short and medium rotation coppice (SRC and MRC) have been identified as important possibility for bioenergy plantations at global level. Harvesting and producing large amount of biomass in limited time is no longer complicated thanks to modern machine technology, but the concentrated availability of wood fuel often does not go in line with the demand for energy in cases where this demand is high and steady all along the year. This lack of alinement implies the need to find storage solutions to buffer fluctuations in supply and demand.
This paper will show a new approach aimed to store and valorize this biomass.

Presenter: **Simone BERGONZOLI, Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, CREA-IT, Treviglio (BG), ITALY**

Presenter's biography:

Agronomist, Phd in agricultural engineering I work since 2010 in crop harvesting, biomass feedstock and energy crops

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Session reference: 1BV.3.16
Subtopic: 1.2 Agroforestry Residues and By-Products
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Performance and Work Quality of the Chaff Collection in Sweden: a Case Study

Short introductive summary:
Grain chaff could provide 54.8 Mt of additional annual potential biomass in Europe. In the framework of the AGROinLOG H2020 Project, the chaff collection system developed by Thierart company was tested in Sweden to evaluate the amount of biomass collectible, the harvesting losses and performance, and the economic feasibility of the system. During the test was highlighted the critic aspects that influence the residue harvesting losses and were detected the possible enhancements to ensure good machine performances and higher biomass production.

Presenter: **Alessandro SUARDI, CREA- Council for Agricultural Research and Economics, Centro di ricerca Ingegneria e Trasformazioni Agroalimentari, Monterotondo RM, ITALY**

Presenter's biography:
Temporary Research Associate at CREA-ING
Field of research:
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Subtopic: 1.2 Agroforestry Residues and By-Products
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Confinement Role on Biomass Handling: Farm to Process in Riverina Region, New South Wales, Australia.

Short introductive summary:

1. PhD in Mechanical Engineering (2019 - Ongoing), University of Newcastle, Australia.
2. Master of Philosophy Research (MPhil) (2012) Mechanical Process Engineering,
The University of Greenwich, United Kingdom.
3. Master of Science (MSc) (2008) Process Technology and Business Management,
The University of Warwick, WMG, United Kingdom.
4. Bachelors of Technology (Hons) (2002) Food Engineering, Ladoke Akintola
University of Technology (LAUTECH) Nigeria.
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(LAUTECH) Nigeria.

Presenter: **Aminu OWONIKOKO, University of Newcastle, Mechanical Engineering Dpt., Newcastle, AUSTRALIA**

Presenter's biography:

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Session reference: 1BV.3.18
Subtopic: 1.2 Agroforestry Residues and By-Products
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

A Generalized Model for Description of Biomass Decomposition and its Application

Short introductive summary:

In the present work, we developed a generalized model in terms of a new variable for the description of biomass pyrolysis for all the commonly used reaction models. The expression of the new model for the first order reaction mechanism is consistent with the standardized general extreme value distribution. As validation and application, the generalized model has been used to analyze biomass pyrolysis. The new model more accurately predicts the conversion rate of the pyrolysis process in a simpler way, compared to the conventional Arrhenius model.

Presenter: **Tianbao GU, Aalborg University, Energy and Technology Dpt., Aalborg Ø, DENMARK**

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Session reference: 3BV.4.1
Subtopic: 3.2 Pyrolysis
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Torrefied Wheat Straw as Adsorbent of Methylene Blue from Wastewater

Short introductive summary:

The aim of this study was to develop a promising and competitive biosorbent with the abundant of source, low price, and environmentally friendly characteristics, to remove dyes from wastewater. The wheat straw modified by torrefaction was proved efficient to be used to remove Methylene Blue from aqueous solution.

Presenter: **Dimitrios SIDIRAS, University of Piraeus, Industrial Management and Technology Dpt., Piraeus, GREECE**

Presenter's biography:

Prof. D. Sidiras, Dep. Industrial Management & Technology, Sch. Maritime and Industrial Studies, Univ. Piraeus; 5-year Diploma and PhD in Chemical Engineering, NTUA; Scopus: 67 publications, 1079 citations, h-index=15; Google Scholar 117 publications, 1873 citations, h-index=17.

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Session reference: 3BV.4.2
Subtopic: 3.2 Pyrolysis
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Pyrolysis of Residual Biomass to Generate Different Energy Vectors and Bio-Products

Short introductive summary:

The objective of this work was to study the slow pyrolysis process of different residual biomass, namely acacia (Acacia longifolia), Gorse (Ulex minor), Giant reed (Arundo donax), Olive pomace, Eucalyptus sawdust, Eucalyptus bark

Presenter: **Luís TARELHO, Universidade de Aveiro, Environment and Planning Dpt., Aveiro, PORTUGAL**

Presenter's biography:

Professor/Researcher in Environmental Engineering at Dep. of Environmental and Planning, and at the CESAM, University of Aveiro, Portugal. Research in the field of thermochemical conversion of solid fuels (coal, biomass, solid wastes, sewage sludge).

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Session reference: 3BV.4.3

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

How Can Biomass Pyrolysis Sustainably Contribute to Climate Change Mitigation?

Short introductive summary:

Biomass plays an important role in decarbonisation strategies in various sectors in the EU. Pyrolysis is regarded as versatile technology that is mostly considered to feed into fuel product streams. Technology is advancing constantly and maturity is coming within reach. We discuss the options for pyrolysis as part of possible future decarbonisation scenarios, in which various technological routes and sectors are competing for the limited resource biomass.

Presenter: **Heiko KELLER, IFEU - Institute for Energy and Environmental Research Heidelberg, Heidelberg, GERMANY**

Presenter's biography:

Since 2011 Research associate at ifeu, Heidelberg, current position: senior project manager
2015-2019 Lecturer at Karlsruhe Institute of Technology (KIT), course on life cycle assessment
2006-2010 PhD in biophysics (University of Technology Dresden, Max Planck Institute of Molecular Cell Biology)

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Session reference:	3BV.4.4
Subtopic:	3.2 Pyrolysis
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Processing of Biomass Derived Bio-Oils for Large-Scale Fischer-Tropsch Synthesis of Transportation Biofuels

Short introductive summary:

As decarbonization becomes increasingly important for the transition of the global energy production through sustainable and environmental friendly paths, scientists and policy makers throughout the word recognize the necessity to exploit the vast unused potential of lignocellulosic biomass; the most abundant renewable organic resource in earth. Wood, grass and agricultural residues are domestic resources which can bolster independence on fossil carbon and fuel imports by large scale production of liquid biofuels through the so called "Biomass-To-Liquid" (BTL) technology. The successful implementation of these BTL policies depends on the effective optimization of both the technological and economic aspects involved in biomass valorization.

Presenter: **Nikolaos CHARISIOU, Laboratory of Alternative Fuels and Environmental Catalysis, University of Western Macedonia, Chemical Engineering Dpt., Kozani, GREECE**

Presenter's biography:

Dr. Nikolaos Charisiou is researcher in the Department of Chemical Engineering of the University of Western Macedonia. His research work has been published in 46 research publications in Peer Reviewed Journals, which has been acknowledged with more than 1126 citations and an h-index of 18 (Scopus).

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Session reference: 3BV.4.6

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Characterization of Liquid by-Products from Slow Pyrolysis of Woody Biomass

Short introductive summary:

In the present work, birch and spruce wood chips were pyrolyzed in a fixed bed reactor under different pyrolysis conditions, with change of pyrolysis temperature program (i.e., highest heating temperature and residence time), purge flow (i.e., with and without gas purging) and constraint of volatiles and tarry vapors flow in the reactor. The liquid by-products were condensed, collected and analyzed for further treatment, upgrading and utilization. A gas chromatograph equipped with a mass spectrometer (GC-MS) and a gas chromatograph equipped with a thermal conductivity detector (GC-FID) were used to study the families of lighter chemicals in the liquid by-products. Karl Fischer titration and other analytical methods were used for the characterization of the liquid by-product. The results showed that its organic composition is dominated by acetic acid, levoglucosan, and oxygenated aromatic compounds consisting mainly of phenol and phenol derivatives. Change of pyrolysis conditions caused small changes in the chemical composition of liquid by-products from pyrolysis of birch wood. The liquid by-products from pyrolysis of birch and spruce wood are slightly different, which i

Presenter: **Liang WANG, SINTEF Energy Research, Thermal Energy Dpt., Trondheim, NORWAY**

Presenter's biography:

Liang Wang is a research scientist at SINTEF Energy Research in Trondheim Norway. His research focuses on thermal conversion and utilization of biomass and wastes for renewable energy and green fuel production and substainable metal prodcution processes.

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Session reference:	3BV.4.7
Subtopic:	3.2 Pyrolysis
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Improving Bio-Oil Properties through Fast Pyrolysis of Olive Pomace

Short introductive summary:

The valorization of organic wastes through fast pyrolysis appears to be a highly promising option for decreasing pollutants and reducing consumption of natural resources. The operating conditions of fast pyrolysis can easily be adjusted to maximize bio-oil production, as well as the quality of the obtained products. Olive pomace, one of the major subproduct of the Mediterranean, area is suspected to be valorized. The main product obtained through fast pyrolysis of olive pomace were phenolics, derived from the decomposition of its high lignin content. Therefore, pretreatment processes and the use as a catalyst of ashes from the olive oil extraction process have been studied to valorize olive pomace as renewable and natural resource.

Presenter: **Angel ALCÁZAR RUIZ, University of Castilla-La Mancha, Ciudad Real, SPAIN**

Presenter's biography:

Angel Alcazar Ruiz is a chemical engineering. He is currently a PhD student at the University of Castilla-La Mancha (UCLM), working on the valorization of agro-industrial biomasses and residues for value-added bioproducts, simulation of thermochemical processes and life cycle analysis.

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Session reference:	3BV.4.8
Subtopic:	3.2 Pyrolysis
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Digital Upgrade of Decentralized Pyrolysis Plants for Industry 4.0 Environments

Short introductive summary:

To integrate decentralized pyrolysis plants for an Industry 4.0 environment, four steps are necessary. The four steps range from a pure monitoring (1) of plants, a remote controllability via network (2) and an interconnection of plants (3) to controlling this plant network by means of Artifical Intelligence-based, open models (4). The steps 1 and 2 are described in this presentation.
First, the automation of the plant was expanded and adapted. It is explained exemplarily, in which areas changes had to be made to make the plant completely remote controllable and remote maintainable. In addition, the selected network tools and protocols are presented and problems encountered and their solutions are reported. Finally, the running system is described and how it can now be connected to a virtual plant park.

Presenter: **Samir BINDER, Fraunhofer-Institut UMSICHT, Sulzbach-Rosenberg, GERMANY**

Presenter's biography:

Samir Binder holds a degree in aeronautical engineering. Since 2009 he has worked as head of the department of Renewable Energy and head of operations at the Fraunhofer Institute for Environmental, Safety, and Energy Technology UMSICHT in Sulzbach Rosenberg/Germany.

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Session reference: 3BV.4.10

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Process Design and Techno-Economic Assesment of Pyrolysis of Olive Mill Waste Water Sludge

Short introductive summary:

In this work, a lab scale model of pyrolysis of olive mill waste water sludge is up-scaled to an industrial scale and techno-no economic analysis is performed. Aspen Plus is used for modelling the process and Aspen process economic is used to perform techno-economic analysis. The vapor compression machine used for condensing the bio-oil vapors is replaced by sorption machine and the results are compared for both process designs. The system performance is evaluated on the basis of thermal efficiency and minimum fuel selling price.

Presenter: **Muhammad Shoaib Ahmed KHAN, University of Lorraine, Nancy, FRANCE**

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Session reference: 3BV.4.11
Subtopic: 3.2 Pyrolysis
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Evaluation and Products Characterization of Mango Seed Shell and Kernel Conventional Pyrolysis

Short introductive summary:

In this study, the conversion of mango seeds in biochar, bio-oil, and biogas by conventional pyrolysis was evaluated at a wide temperature range (400, 500, 600 and 700°C) and for the different components of the seeds (shell, kernel, and 1:2 mixture). Characterization of biomass (ultimate analysis and calorific value) was made. Pyrolytic products were obtained at the optimum temperatures found. Characterization of biochar (ultimate analysis and calorific value), bio-oil (GC-MS, calorific value and distillation curve) and biogas (composition and calorific value) was also carried out at the optimal temperatures. Biomass fed had a significant effect in production yields, whether temperature had no significant effect over the bio-oil production. At optimum temperatures, bio-oil composition differed between biomasses due to its composition, biogas of kernel pyrolysis had a greater energy value due to the higher temperature set and biochars of the three biomasses fed had similar properties and compositions. High moisture content in bio-oil made it unsuitable for biofuels production unless further treatment is made.

Presenter: **Juan Camilo MAHECHA-RIVAS, Universidad de los Andes, Bogotá, COLOMBIA**

Presenter's biography:

Last semester Environmental Engineering and Chemical Engineering student of the University of the Andes with complementary studies in Portuguese Culture and Language, from Bogotá, Colombia. Interests oriented in waste valorization and environmental surface water modelling.

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Session reference: 3BV.4.13
Subtopic: 3.2 Pyrolysis
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Seaweed and Used Fishing Nets Thermal Conversion into Valuable Energy Products

Short introductive summary:

Water pollutants with plastic wastes and the ongoing eutrophication process have ecological and social consequences and are significant problems of water pools ecosystem and environment. Thermal treatment offers many opportunities for the Baltic Sea Region to recycle low-quality resources and wastes into renewable, high-quality biofuels. This study will investigate the micro- and laboratory-scale properties of seaweed and used fishing nets during thermal degradation and catalytic thermal degradation reactions. The functional groups of volatile compounds, which are the most influential for product formation during pyrolysis will be analyzed. Also, analysis by chromatographic methods of the gaseous and liquid products during the pyrolysis reactions at the laboratory-scale bench will be maintained.

Presenter: **Justas EIMONTAS, Lithuanian Energy Institute, Kaunas, LITHUANIA**

Presenter's biography:

I am Justas Eimontas, working in Lithuanian Energy Institute, Laboratory of combustion processes. Also, I am a Ph.D. student at the Lithuanian Energy Institute in the field of thermal engineering.

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Session reference: 3BV.4.14

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

CO2 Uptake Using Activated Biochar from Palm Oil Tree Residues

Short introductive summary:

Palm oil residues (empty fruit bunches and kernels) were carbonised, activated and characterised. The biochar obtained through carbonisation was physically and chemically activated to produce porous materials; these were then characterised through BET analysis to determine their specific surface and the total pore volume. The CO2 uptake of the different activated materials was evaluated at different temperatures

Presenter: **Cristina MOLINER, University of Genova, Genova, ITALY**

Presenter's biography:

She got her PhD in 2016 by a co-tutored thesis at Università di Genova(UNIGE) and Universitat Politecnica de Valencia (UPV).She got her degree in Chemical Engineering in 2011 and her M.Sc. in Internal Combustion Engines in 2014 both at UPV. Her research is mainly on the field of biomass gasification

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Session reference:	3BV.4.15
Subtopic:	3.2 Pyrolysis
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Flameless Heat from Pellets with Zeroflame

Short introductive summary:

ÖkoFEN, with its headquarters in Upper Austria, is considered Europe’s pioneer and specialist for pellet heating systems with over 30 years of experience in renewable heating. In recent years, the company has already presented innovations such as pellet condensing technology and a pellet boiler with an integrated Stirling engine for electricity production. ÖkoFEN now presents another milestone in the field of heating with wood pellets. With the new ZeroFlame-Technology the company achieves dust emissions close to zero.

Presenter: **Stefan ORTNER, OkoFEN Pellet Heating, R&D Dpt., Niederkappel, AUSTRIA**

Presenter's biography:

CEO and shareholder, ÖkoFEN global headquarters in Austria
more than 10 years of experience in product management, R&D, marketing, developing and managing export markets for pellet heating systems
Degree in Engineering, University of Applied Sciences Upper Austria, Austria

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Session reference: IBO.2.1
Subtopic: 6.2 Advances in Small Scale Thermochemical Conversion
Topic: 6. INDUSTRY TRACK

Chp with Biomass-Updraft Gasifiers - 10 Years Flowing Against the Current

Short introductive summary:

ReGaWatt GmbH designs and builds highly efficient energy systems based on all sorts of lignin based biomasses. The core technological component is an updraft gasifier with a fuel input capacity ranging from 1 to 5 MW.
By combining this very robust gasifier with different modules for clean combustion, gas cleaning units, gas engines, ORC plants, heat recovery etc., the Kombi Power System® was born.
References are found in Germany, Switzerland and the Netherlands.
After 10 years of development, pilot plants and commercial 2nd generation plants, we are now driven by making the Kombi Power System more cost-efficient and fuel flexible. For this purposes, a small test gasifer unit, fully equipped with gas cooling and ESP has been designed and erected. In this facility, we now have also the opportunity to test and evaluate special customer fuels.

Presenter: **Klaus RÖHRMOSER, ReGawatt, Abensberg, GERMANY**

Presenter's biography:

1996, after completing his studies in Munich, Klaus Röhrmoser worked as a project manager and finally from 2008 as authorized officer at Gammel Engineering GmbH. Since 2010, he is CEO of the company ReGaWatt GmbH and was among other things responsible for the development of the “Kombi-Power-System”.

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K. Röhrmoser, ReGaWatt, Abensberg, GERMANY

Session reference: IBO.2.2

Subtopic: 6.2 Advances in Small Scale Thermochemical Conversion

Topic: 6. INDUSTRY TRACK

Purowin Technology - Ultra-Low Dust Emissions without Filter for Wood Chips and Pellets as Fuel

Short introductive summary:

Small-scale residential biomass combustion for space heating and warm water production holds a considerable share on the total energy production from biomass. As one of the main technologies for a reduction of the GHG and based on the objectives of the European Green Deal it is expected that the market potential for small-scale biomass boilers will further increase within the next years. One of the main-disadvantages of conventional technology of biomass-combustion in residential heating appliances compared to fossil fuel fired systems are still the PM emissions. The increase of biomass utilisation in residential heating must be combined with a decrease of harmful emissions by substituting old appliances by new ones and introducing new ultra-low emission technologies. Thus, new and sustainable technologies for residential heating with high efficiency and low emissions (with a special focus on dust) are required to meet this goal.

Presenter: **Gerhard GERG, Windhager Zentralheizung Technik, Innovation Dpt., Seekirchen, AUSTRIA**

Presenter's biography:

- Studies of mechanical engineering on the TU Graz
- Research Department of Wolf Klimatechnik GmbH
- Technical manager in different fields of engineering
- Head of Research at Windhager Zentralheizung Technik GmbH
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Session reference:	IBO.2.4
Subtopic:	6.2 Advances in Small Scale Thermochemical Conversion
Topic:	6. INDUSTRY TRACK

Biogas 3 Times Higher Volume 2030 by Sustainable Feedstock Production. Biogas Full Integration for Transportation and Heavy Industries. Biomethan in the European Gas Grid and Biogas-CO2 for Power to X with Wind and Solar Scale Up Cases

Short introductive summary:

Sustainable Biomass as feedstock's for large-scale increase of the European biogas production. Sustainable biodegradable wastes and residues of biological origin from primary agriculture and food sectors among others, but as well - Terrestrial and Aquatic biomasses. Biogas can without harming the nature and food/feed sectors grow from today's 20 mill. TOE (2020) to 3 time's higher production in 2030 in EU. Biogas from sustainable lignocellulosic and manure based biomasses need pre-treatment. This has to be low cost and robust processes. Case examples of integration of low cost biomasses from the agricultural, farming and food sector, will be discussed.

Presenter: **Jens Bo HOLM-NIELSEN, Aalborg University, Energy Technology Dpt., Esbjerg, DENMARK**

Presenter's biography:

Head of Bioenergy and Green Engineering Center at Department of Energy technology at Aalborg University, Denmark
1st University Degree 1980. M.Sc.: Agricultural Systems, Crops & Soil Science, from KVL, Royal Veterinary & Agricultural University, Copenhagen, Denmark. 2nd University Degree 2008. Ph.D. degree from Aalborg University - Thesis: Process Analytical Technologies for Biogas Systems. Esbjerg, Denmark. Years of experience in the field of Biorefinery concepts and Biogas production - Anaerobic Digestion. Implementation projects of Bioenergy Systems. Extended studies in Biomass Resources.Experience of a variety of EU and UN projects.Organizer of international conferences, workshops and training programs in Europe, Central Asia and China.

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Session reference: BP.2.1
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Advances in Biomass Gasification for the Production of Bioheat, Bioelectricity and Biofuels

Short introductive summary:

Current barriers to increase the use of bioenergy for different applications are first discussed. Then, recent advances on gasification-based technologies to overcome these barriers reached at TU Graz together with several partners are presented.
Gasification-based fuel bed concepts integrated in biomass combustion can significantly reduce emissions for bioheat production. Advances are presented for modern biomass boilers, significantly reducing nitrogen oxides and particle matter emissions as well as increasing the feedstock flexibility; and micro-gasifiers for traditional biomass utilization, significantly reducing the emissions of unburnt products.
Gasification-based processes have as well the possibility to score high electrical efficiencies and to synthetize several products as second generation biofuels. Advances are presented on primary and secondary measures for reducing the presence of contaminants as tars, including the influence of gasification medium or the catalytic use of char for tar cracking; and in applications of the producer gas, including gas cleaning and direct coupling with a solid oxide fuel cell to maximize electricity production.

Presenter: **Andrés ANCA-COUCE, Graz University of Technology, Institute of Thermal Engineering, Graz, AUSTRIA**

Presenter's biography:

Dr. Andrés Anca-Couce is co-leader of the "Sustainable, clean and bioenergy systems" group at TU Graz. He conducts experimental and numerical research on thermo-chemical biomass conversion, with a multi-scale description, and its integration into renewable bioenergy and biorefinery concepts.

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Session reference:	BP.2.2
Subtopic:	2.4 Gasification for Power, CHP and Polygeneration
Topic:	2. BIOMASS CONVERSION FOR BIOENERGY

Growing Selected Industrial Crops on Marginal Lands for Bioenergy and Biobased Products

Short introductive summary:

The present abstract is presenting a research project named MAGIC (www.magic-h2020.eu) that will be completed at the end of 2021 and where selected industrial crops are being grown on marginal lands for biobased products and bioenergy.

Presenter: **Efthymia ALEXOPOULOU, CRES - Center for Renewable Energy Sources and Saving, Biomass Dpt., Pikermi Attikis, GREECE**

Presenter's biography:

She is an agriculture engineer grantuated from the Agricultural University in Athens (AUA) with PhD on the “Adaptability and biomass productivity of the non-food crop Kenaf in Greece”. She is responsible for Energy Crops Unit in Biomass Department of Center for Renewable Energy Sources.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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Session reference: 1BO.7.1

Subtopic: 1.3 Biomass Crops and Energy Grasses

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Camelina Seeds Harvesting: Evaluation of Work Performance of a Combine Harvester in Two Experimental Fields in Italy and Spain

Short introductive summary:

Camelina sativa (L.) Crantz is an interesting oil crop for multipurpose uses and its cultivation is gaining growing attention in Mediterranean context. This species is suitable for cultivation in marginal lands and feasible to crop rotation with cereals. Camelina seeds are currently harvested by a combine harvester equipped with cereal header. Considering the tiny dimension of the seeds, which can lead to substantial seed loss, proper assessment of mechanical harvesting is a key issue for the correct development of effective camelina seeds supply chain.

Presenter: **Walter STEFANONI, CREA-IT, Monterotondo (RM), ITALY**

Presenter's biography:

Research activities in the crops for energy production

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Session reference: 1BO.7.2
Subtopic: 1.3 Biomass Crops and Energy Grasses
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Environmental and Economic Trade-Offs of Introducing Winter Camelina in the Upper Midwest of the USA: a Review

Short introductive summary:

The introduction of winter camelina [Camelina sativa (L.) Crantz] as cash cover crop in the dominant maize [Zea mays L.]-soybean [Glycine max (L.) Merr.] cropping system is a promising option in the upper Midwest of the USA. Studies show that using camelina as a winter cover crop in double and relay-cropping systems can curb the negative environmental impact of maize-soybean rotation. However, the overall economic sustainability of a relay- or double cropping system with camelina is the most critical aspect so far. Relay-cropping soybean into standing camelina can lead to significant yield reductions of soybean yield, which might not be compensate by the additional camelina oilseed production. Such yield variability presents a risk for the grower, and represents a main barrier to the use of camelina in the upper Midwest, along with a lack of market for the oilseed. Further studies are needed to identify a more sustainable cropping system with camelina as a cover crop.

Presenter: **Andrea CECCHIN, North Dakota State University, Plant Sciences Dpt., Fargo, USA**

Presenter's biography:

PhD in environmental sciences form Ca' Foscari University of Venice (Italy). I am currently Postdoctoral Research Fellow at the Department of Plant Sciences at North Dakota State University, where I am studying the environmental impact of agricultural systems.

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Session reference:	1BO.7.4
Subtopic:	1.3 Biomass Crops and Energy Grasses
Topic:	1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

A Kinetic Model for CO2/O2 Gasification of Fruit Pruning and its Char Characterisation

Short introductive summary:

Fruit pruning is a regional woody biomass resource that can be used as livestock beddings, composts, and fuels. In particular, its use as a fuel source for small-scale gasification combined heat and power is expected due to high efficiency. However, the conventional kinetic model does not adequately fit the experimental reactivity in the later phase of the pruning gasification. In this study, fruit pruning char were characterised and the reaction kinetic model for CO2/O2 gasification was proposed. From the results, the instantaneous reactivity of fruit pruning, park pruning, and timber waste were classified into 3 patterns depending upon biomass form due to ash composition. The new n-th order kinetic model was proposed and validated by comparing the conventional MRPM and RPM. The higher goodness-of-fit was obtained for higher reactivity and higher K content.

Presenter: **Kenji KOIDO, Forestry and Forest Products Research Institute, Dpt. of Wood Properties and Processing, Tsukuba, JAPAN**

Presenter's biography:

Dr. Kenji Koido is a Senior Researcher at Forestry and Forest Products Research Inst.(FFPRI). He earned Ph.D. in Engineering from Nagoya University. He started the research about biomass gasification at BTRC, AIST. He continues the investigation at Tokyo Univ. of Science, Fukushima Univ., and FFPRI.

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Session reference: 2BO.8.1
Subtopic: 2.4 Gasification for Power, CHP and Polygeneration
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

In-situ Activation of K-feldspar by Fuel Ash Layers in DFB Steam Gasification

Short introductive summary:

Olivine is currently used as bed material in dual fluidized bed (DFB) steam gasification due to its catalytic activity towards the water-gas-shift (WGS) reaction and tar reforming. However, traces of heavy metals in olivine make the disposal of bottom ash more complex and costly. The search for a heavy metal-free alternative is, therefore, of major interest. As a widely available mineral, K-feldspar was chosen for studies for its suitability as replacement for olivine, with special focus given to its catalytic activity and activation by fuel ash layers. The performed experiments showed an activation by fuel ash caused by the formation of layers on K-feldspar. These are promising preliminary results for the future use of K-feldspar as bed material for DFB steam gasification. Further research is necessary regarding the long-time behaviour of K-feldspar before a final recommendation can be given regarding its suitability as DFB steam gasification bed material.

Presenter: **Katharina FÜRSATZ, TU Wien, Forschungszentrum für Energie und Umwelt, Wien, AUSTRIA**

Presenter's biography:

2016 - today Junior Researcher, BEST – Bioenergy and Sustainable Technologies GmbH, Research and development in the field of biomass gasification, focused on the interaction of bed material and biomass ash

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Session reference: 2BO.8.2
Subtopic: 2.4 Gasification for Power, CHP and Polygeneration
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Detailed CFD Simulations of the Fuel Bed of an Updraft Gasifier and Comparison to Experimental Results

Short introductive summary:

A detailed CFD analysis of the fuel bed of a pilot-scale (nominal fuel power 450 kW) updraft gasifier powered by softwood chips (spruce) is presented, and the results are compared to measurement data. The CFD model allows an in-depth analysis of the conversion process in the gasifier bed, as well as a detailed description of tar formation, which is of great relevance regarding the subsequent gas treatment. The simulation results show good agreement with the measured data for the composition of the producer gas, and for the temperature profiles inside the fuel bed. Furthermore, the simulation allows the identification of the main conversion zones for drying, pyrolysis, charcoal gasification and combustion inside the fuel bed.

Presenter: **Claudia BENESCH, BIOS Bioenergiesysteme, Research Dpt., Graz, AUSTRIA**

Presenter's biography:

Claudia Benesch studied Chemistry at the University of Vienna, did her PhD at the Technical University of Munich and since April 2008 works as a senior project engineer at BIOS BIOENERGIESYSTEME GmbH in the Computational Fluid Dynamics department.

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Session reference: 2BO.8.3

Subtopic: 2.4 Gasification for Power, CHP and Polygeneration

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

The fate of Nitrogen in a Biomass CHP Plant based on fixed-bed Gasification, a Gas Cleaning Unit and a SOFC

Short introductive summary:

As result of R&D work performed during the last decade, ultra-low emission biomass furnace and boiler concepts have been introduced into the heating and CHP market. With these technologies, typically the CO and OGC emissions can be reduced close to zero. When applying extremely staged combustion technologies (e.g. updraft gasifiers directly coupled with gas burners), also particulate matter emissions can be kept at very low levels below 10 mg/MJ (related to the NCV of the fuel) without application of any filter. However, regarding NOx emissions still secondary measures are needed to reach significant emission reductions. Within the Horizon 2020 project FlexiFuel-SOFC a new, highly efficient and fuel-flexible micro-scale biomass CHP technology has been developed consisting of a small-scale fixed-bed updraft gasifier, a gas cleaning system and a solid oxide fuel cell (SOFC). R&D performed during this project has revealed that such a system can, due to the system specific NOx precursor transformation pathways occurring in the different plant components, produce heat and electricity at virtually zero emissions, also regarding NOx.

Presenter: **Ingwald OBERNBERGER, BIOS Bioenergiesysteme, Graz, AUSTRIA**

Presenter's biography:

Managing Director of the Austrian R&D company BIOS BIOENERGIESYSTEME GmbH, teaching at Graz University of Technologyand member of the Editorial Board of the international scientific journal Biomass and Bioenergy.Author of 6 books and more than 200 scientific publications in the field of energetic biomass utilisation.

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Session reference:	2BO.8.4
Subtopic:	2.4 Gasification for Power, CHP and Polygeneration
Topic:	2. BIOMASS CONVERSION FOR BIOENERGY

Biorefinery Concept: Waste Biomass Fractionation to Biobased Platform Chemicals and their Selective (De)Functionalization

Short introductive summary:

The work presented is devoted to the biomass fractionation into its general polymeric units and further chemocatalytic upgrading of each obtained polymer unit (cellulose, hemicellulose, and lignin) to the final platform and added value chemicals with the aim of development of an adaptable biorefinery.

Presenter: **Brigita HOCEVAR, National Institute of Chemistry, Catalysis and Chemical Reaction Engineering Dpt., Ljubljana, SLOVENIA REPUBLIC**

Presenter's biography:

I am a postdoc researcher at the National Institute of Chemistry in Slovenia. My research topic is catalytic hydrodeoxygenation of compounds, a representative in the cellulose part of lignocellulosic biomass.

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Session reference:	3BO.9.1
Subtopic:	3.6 Biorefineries
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

A Biorefinery for Orange Waste Valorization

Short introductive summary:

In this work, rhe compositional analysis of orange residues is presented. The production of biogas and bioethanol from these residues was evaluated in comparison to conditions where pectin and essential oils are removed. The compositional analysis showed that orange waste contains considerable amounts of hemicellulose (28.0 ± 0.77%), pectin (26.4 ± 0.35%), and extractives (18.7 ± 0.58%). The maximum methane production was obtained using the untreated residue (291 ± 2.7 mL CH4/gVS), which produced 4.5 times more methane than the inoculum alone. The production of ethanol and glycerol is enhanced due to the presence of essential oils and pectin in comparison to the other conditions. A maximum concentration of 43.9 ± 5.5 mg/L of ethanol and 1.8 ± 0.08 mg/L of glycerol were obtained using the untreated residue. Main phytochemical substances were identified in the extracts showing the possibility to produce biogas and bioethanol in conjunction with the retrieval of oils, terpenes and polyphenols.

Presenter: **Andres ECHEVERRI, Universidad de los Andes, Bogotá, COLOMBIA**

Presenter's biography:

Born in Bogotá, studied at San Carlos School, then chemical engineering and chemistry at Los Andes University. Passionate about reserch, innovation and creativity.

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Session reference: 3BO.9.2

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

A Green Approach to Produce Cellulose Nanofibers and Biobutanol from Eucalyptus Cellulose Pulp via the Biochemical Pathway

Short introductive summary:

The integrated production of biofuels and value-added products from the different components in lignocellulosic biomass has emerged as a goal for lignocellulosic biorefineries to achieve economic self-sustainability. Cellulose nanofibers (CNF) represent a renewable nanobiomaterial with potential applications in material science and biomedical engineering. CNFs are typically produced by mechanical pretreatment from delignified cellulosic biomass. However, the high energy consumption associated to the mechanical process can be reduced by incorporating another chemical or enzymatic treatment. Enzymatic treatment represents an environmentally clean alternative to chemical pretreatment. The production of CNF via the biochemical pathway using hydrolytic enzymes allows the production of sugars that can be converted in biofuels by microbial fermentation, such as biobutanol. Therefore, the recovery of a fermentable sugar stream during CNF production results critical. The aim of this study was to investigate the integrated production of CNF and biobutanol using eucalyptus cellulose pulp as feedstock employing enzymatic pretreatment, fermentation, and ball milling pretreatment.

Presenter: **Florencia CEBREIROS, Universidad de la República, Bioingeniería Dpt., Montevideo, URUGUAY**

Presenter's biography:

Florencia Cebreiros, M.Sc., works as research associate and lecturer in the Bioengineering Department at the Faculty of Engineering (UdelaR, Uruguay). She is currently PhD student in Chemical Engineering Program, focusing on biofuels and biomaterials production from lignocellulose in a biorefinery.

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Session reference: 3BO.9.4
Subtopic: 3.6 Biorefineries
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Bioenergy Retrofit for First Generation Ethanol Facilities - a Spanish Case Study

Short introductive summary:

The retrofitting of an existing cereal-based first-generation ethanol facility in Babilafuente (Spain) to produce advanced ethanol in the same facility is analysed. The retrofitting plant is simulated in Aspen Plus, using pilot-scale experimental results and data from the existing 1G-ethanol for 2G and 1G ethanol production, respectively. Based on simulation results, the energy efficiency or the retrofitted plant is evaluated and it is compared with the existing 1G-ethanol plant.

Presenter: **Ana Isabel SUSMOZAS, CIEMAT, Energy Dpt., Madrid, SPAIN**

Presenter's biography:

Ana Susmozas is a postdoctoral researcher in the Biofuels Unit of CIEMAT. Her work focusses on the simulation and techno-economic analysis of bioenergy systems.

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Session reference: 5BV.5.2
Subtopic: 5.1 Strategies for Biomass Integrated into Energy Systems
Topic: 5. BIOENERGY INTEGRATION

Agrowaste Supply Chains from Reeds in Local Communities

Short introductive summary:

A supply chain for reeds cutting, collection, processing and storage was set up and operated by Novaci Municipality. Baled reeds were fed to an installed straw boiler at the Municipality's kindergarten, which was formerly heated by electric heat panels. In this way, Novaci Municipality has reduced its energy bills, solved the flooding problem and exemplified the use of local, sustainable biomass for energy production.

Presenter: **Myrsini CHRISTOU, Center for Renewable Energy Sources and Saving, Biomass Dpt., Pikermi, GREECE**

Presenter's biography:

Agriculture engineer, MSc, leader of CRES Biomass department.Over 25 years of experience as coordinator and scientific responsible in a range of European and nationalRTD projectson technical evaluation of several biomass feedstocks in integrated biomass value chainsfor energy and biorefinery concepts.

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Session reference: 5BV.5.3
Subtopic: 5.1 Strategies for Biomass Integrated into Energy Systems
Topic: 5. BIOENERGY INTEGRATION

Decarbonising Kenya's Domestic & Industry Sectors through Bioenergy: Biomass Resource Potential & GHG Performances

Short introductive summary:

This presentation will introduce research focusing on Kenya, a case study of a country with a large agricultural sector, rising energy demands and a current reliance on fossil fuels and traditional bioenergy for its energy supply. The research also has specific focus on assessing the potential of bioenergy for decarbonising the tea industry – tea leaf processing has notably high energy demands requiring 4 - 18 kWh per kg tea product, which compares to 6.3 kWh required to produce to equivalent weight of steel . The presentation will address two key questions: 1)To what extent can the land and agriculture sector provide low carbon fuels opportunities to reduce modern bioenergy technologies to reduce reliance on fossil fuels and traditional bioenergy sources; 2) Can modern bioenergy technologies provide options to decarbonise both domestics and industry sectors.

Presenter: **Andrew WELFLE, University of Manchester, Tyndall Centre for Climate Change Resarch, Manchester, UNITED KINGDOM**

Presenter's biography:

Andrew Welfle is a Research Fellow within the Tyndall Centre for Climate Change Research at the University of Manchester UK. Andrew's research interests are biomass resource modelling, sustainability, the global trade of biomass trade for energy end uses, the GHG performance of bioenergy.

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Session reference: 5BV.5.4
Subtopic: 5.1 Strategies for Biomass Integrated into Energy Systems
Topic: 5. BIOENERGY INTEGRATION

Optimisation of Diesel Generator´ s Configuration and Performance for Micro-Grids in Developing Countries

Short introductive summary:

More than 7000 mini-grids, mostly solar or solar hybrid (diesel/PV) will be implemented globally to increase access to electricity in rural areas. Diesel generators (gensets) are widely used within mini-grids and off-grid systems for rural electrification as they have low capital costs, fuel flexibility, and higher power output compared to spark ignition (SI) engines. Nevertheless, their poor performance is a common flaw that increases the operating cost of the system and alters the gensets' environmental impact. The flaw is caused by the sizing and selection techniques during the planning stage. The flaw might be worsened by the share of renewable energy technologies included in hybrid microgrids if special attention is not given to limit the gensets' output power, to keep them within the recommended operating range. This research aims to develop a cost optimisation model, centred in the generator's performance, to improve genset's operating conditions within diesel/PV hybrid microgrids, to minimise the genset's operating costs and environmental impact by using biofuels.

Presenter: **Nina Victoria RANGEL ORTIZ, University of Leeds, Leeds, UNITED KINGDOM**

Presenter's biography:

Nina Rangel is a PhD student in the School of Chemical and Process Engineering at the University of Leeds. Her research is dedicated to diesel generators optimisation for better biofuel inclusion in off-grid systems.

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Session reference: 5BV.5.5

Subtopic: 5.1 Strategies for Biomass Integrated into Energy Systems

Topic: 5. BIOENERGY INTEGRATION

Flagship Plants in Bioeconomy: What Can We Learn from 2G Ethanol Pioneers?

Short introductive summary:

The first second-generation ethanol (2GE) plants have faced major operational difficulties. Among the 6 main projects that went into operation in the mid-2010s, only 3 are still operational today. It has been challenging for pioneers to stabilize production and operate regularly.
The ability to efficiently produce 2GE means the capacity to produce the so-called second-generation sugars derived from cellulose and hemicellulose - simple and fermentable sugars C6 and C5. These sugars are the starting points for many of the products that the bioeconomy envisions as an essential part of the efficient exploitation of biomass, including biofuels, bioenergy, biochemicals and biomaterials. So, 2G technologies must be a strategic gateway to the modern bioeconomy that aims at the efficient use of available renewable biological resources. This article discusses the nature of the problems faced by the first 2GE commercial plants. The argument developed brings to the conclusion the view that, in some cases, the pioneer plants in emerging industries are somehow advanced stages of the development process itself that still require specific R&D efforts to reach regular operational stages.

Presenter: **Gustavo SOARES, UFRJ, Instituto de Economia, Niterói, BRAZIL**

Presenter's biography:

Mr. Soares is an economist with a Masters' Degree in Economics at UFRJ. He is currently a PhD candidate and his PhD thesis focuses on the Brazilian potential to develop the bioeconomy.

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Session reference: 5BV.5.7
Subtopic: 5.4 Market Implementation, Investments & Financing
Topic: 5. BIOENERGY INTEGRATION

State of Play of Bioenergy Projects and Financing Mechanisms and Opportunitiesa at EU And Member States Level

Short introductive summary:

As part of SET4BIO’s direct support activities to the Implementation Working Group of SET Plan Action 8 (IWG8), the project has developed a report presenting a detailed mapping of national and international bioenergy projects and infrastructures in the EU, as well as a thorough mapping of EU bioenergy stakeholders. The project also compiled a list of public funding mechanisms for bioenergy both at EU and Member States level and has produced the first version of a recurring report on opportunities for private financing that can be of interest to support the development of the projects defined in the Implementation Plan of IP8, dedicated to bio and other renewable fuels.
The presentation will outline the main findings of these activities and in particular it will summarize the information on National projects, national financing mechanisms and private financing opportunities in a visual and also spatially explicit way.

Presenter: **Maurizio COCCHI, ETA-Florence Renewable Energies, Bioenergy Division, Florence, ITALY**

Presenter's biography:

Agronomist with background in organic and sustainable farming. Msc in bioenergy and environment at the University of Florence. Consultant and project manager in bioenergy at ETA-Florence since 2008.

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Session reference: 5BV.5.8

Subtopic: 5.4 Market Implementation, Investments & Financing

Topic: 5. BIOENERGY INTEGRATION

Upgrading District Heating Systems in Europe

Short introductive summary:

The paper presents the results of the three years Horizon 2020 project Upgrade DH which is supported be the Euuropean Commission. The main objective of the project was to support the upgrading of large district heating systems in Europe, including the upgrading with biomass and other renewable energies.

Presenter: **Dominik RUTZ, WIP Renewable Energies, Bioenergy & Bioeconomy Unit, München, GERMANY**

Presenter's biography:

Dominik Rutz is a Senior Project Manager at WIP Renewable Energies (www.wip-munich.de) since 2005. He graduated in Environmental Science (Dipl.-Ing.) and Consumer Science (M.Sc.). His main field of experience includes the technical and non-technical analysis of bioenergy and its supporting policies in developing countries and emerging economies worldwide. He is coordinator of several EU funded projects.

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Session reference: 5BV.5.9
Subtopic: 5.4 Market Implementation, Investments & Financing
Topic: 5. BIOENERGY INTEGRATION

Indonesian Biogas Market: an Opportunity alongside B100 Program

Short introductive summary:

Indonesia is at the forefront of biodiesel development which is based on palm oil. The Government of Indonesia aims to increase the production of biodiesel to 13.9 million kilolitres by 2025. Subsequently the biodiesel target will push the expansion of the palm oil industry in Indonesia.
The demand of biodiesel will indirectly generate a huge quantity of waste materials from the palm oil production that create a major solid waste disposal problem. These residues include empty fruit bunches, mesocarp fiber, palm oil mill effluent, palm kernel cake, shells, oil palm trunk and oil palm frond. Studies have shown that waste materials from palm oil processing can be converted to renewable energy using biogas plant. However, at the moment the biogas technology market in Indonesia is still in a nascent state. This paper examines the state of biogas market in Indonesia using PESTEL analysis. This study may contribute to a better understanding of how the interaction between actors and macro-environmental analysis influences the respective sector in its relation to the development of POME-based biogas technology market.

Presenter: **Elisabeth RIANAWATI, Resilience Development Initiative, Resilience Development Initiative, Bandung, INDONESIA**

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Session reference: 5BV.5.10
Subtopic: 5.4 Market Implementation, Investments & Financing
Topic: 5. BIOENERGY INTEGRATION

Neo-Gas and Neo-Oil from Biomass - Feasible Goals for Continuing Carbon-Based Energy Production?

Short introductive summary:

Neo-Gas and Neo-Oil from Biomass - Feasible Goals for Continuing Carbon-Based Energy Production?

Presenter: **Manfred RINGPFEIL, private, Berlin, GERMANY**

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Session reference: 5BV.5.13

Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen

Topic: 5. BIOENERGY INTEGRATION

What Technical Challenges and Opportunities Do Biomethane Injection and Compressed Natural Gas Filling Stations Present to the Operation of Gas Networks?

Short introductive summary:

The EU funded Causeway project will introduce network of CNG filling stations along major road networks, supports for a fleet of CNG HGVs and a biomethane injection facility to the Irish gas industry for the first time. Given the size of the available resources and the large number of stations planned, this presents a number of technical challenges and opportunities to the operation of distribution (Dx) networks. These include changing load-balancing patterns, determining the optimum location for biomethane injection facilities and CNG filling stations, and determining the environmental costs and benefits. A representative gas Dx network, consisting of both 2 barg and 4 barg networks, for an Irish town of 17000 inhabitants in an area of high potential for both CNG and biomethane is chosen as a case study. The results found that by optimising the biomethane injection facility location and pipeline diameter, the quantity of biomethane injected into the grid as a percentage of the annual demand, could be increased from 35% to 40% when there is no CNG demand, 33% to 40% when low CNG demand is assumed, and 31% to 50% with high CNG demand.

Presenter: **Niamh KEOGH, NUI Galway, Mechanical Engineering Dpt., Galway, IRELAND**

Presenter's biography:

3rd year PhD student, Department of Mechanical Engineering, School of Engineering, NUI Galway.

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Session reference: 5BV.5.14

Subtopic: 5.4 Market Implementation, Investments & Financing

Topic: 5. BIOENERGY INTEGRATION

Combustion Behaviour and Slagging Tendencies of Kaolin Additivated Pellets from Fen Paludicultures in a Small-Scale Biomass Boiler

Short introductive summary:

Fuel quality, combustion behaviour and slagging tendencies of four fen paludicultures, i.e. Typha spp., Phragmites australis, Phalaris arundinacea and Carex spp. were tested in a 30 kW biomass boiler. All fuels were pelletized at TFZ to a diameter of 6 mm (pure and additivated with kaolin).

Mean CO emissions for pure pellets ranged from 14 mg/m³ for Phragmites to 292 mg/m³ for Typha and remained below the German emission threshold limit for straw fired boilers (400 mg/m³ at 13% O2, 1. BimSchV). NOx emissions were 3 to 6 times higher compared to the combustion of wood pellets and correlated well with N content in fuels (R^2 = 0.69). TPM emissions of pure pellets were below the emission threshold of 1. BImSchV (20 mg/m³) for Phragmites (14 mg/m³) and Phalaris (14 mg/m³), while both Carex and Typha were above the threshold with 31 mg/m³ and 115 mg/m³, respectively. In some cases, additivation of pellets with kaolin led to a small decrease of CO and TPM emissions. For Phragmites, Phalaris and Carex, extreme slag formation was detected that would lead to a boiler breakdown at long term operation.

Presenter: **Daniel KUPTZ, Technology and Support Centre in the Center of Excellence for Renewable Resources, Solid Biofuels Dpt., Straubing, GERMANY**

Presenter's biography:

Daniel Kuptz studied Forestry Science at Technical University of Munich (TUM) and did his PhD at the Chair of Ecophysiology of plants (TUM). He works as a researcher and as deputy manager in the department for Solid Biofuels at TFZ.

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Session reference: 2BV.6.1
Subtopic: 2.2 Biomass and Bioliquids Combustion for Small and Medium Scale Applications
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Experimental Study on the Fixed-Bed Combustion Process of Coal and Biomass and the In-Bed Formation of Nitric Oxide

Short introductive summary:

Fixed-bed combustion technology is a widely used technology for energy production in China, and the emission of NO is an increasing concern. In fixed-bed combustion system, the formation behavior of NO is complicated due to the unique in-bed combustion processes. The fuel bed would be divided into several distinctive regions by the propagating ignition front, and the formation and reduction of NO would occur corresponding to the in-bed conversion regions. In this work, a biomass (wood pellet) and a coal (Shenmu coal) are selected as representative fuels, and their NO formation behaviors during fixed-bed combustion are investigated both above and inside the fuel bed. The peak value of NO concentration at the ignition front confirmed that NO would be rapidly formed in this region. The NO concentration above the fuel bed was significantly lower than that at the ignition front, which indicated that NO released from the ignition front could be effectively reduced when passing through the char layer. Therefore, the overall NO release during fixed-bed combustion should be regarded as the combining effect of formation at the ignition front and reduction by the char layer.

Presenter: **Ruiqu DENG, Shanghai Jiao Tong University, Shanghai, P.R. CHINA**

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Session reference: 2BV.6.2
Subtopic: 2.2 Biomass and Bioliquids Combustion for Small and Medium Scale Applications
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Optimization of the Several Factors Affecting Performancae and Emissions in an Emulssion Burner Using Coconut Oil

Short introductive summary:

This paper investigates combustion characteristics and finds the optimal operating factors by a Taguchi method on a conventional medium power diesel facility using coconut oil as biofuel. The operating factors modified were: vegetable oil preheating temperature, secondary airflow rate and fuel flow rate.

Taguchi method decreases the number of experimental runs in the study, and displays that the best combustion with the lowest pollutant emissions were achieved for a combination of maximum fuel flow (C6), minimum airflow and 80 ºC. Under these conditions, yields of 80% and low emissions of NOx (87 ppm) and CO (44 ppm) are obtained.

Presenter: **Julio F. SAN JOSÉ ALONSO, Universidad de Valladolid, Ingeniería Energética y Fluidomecánica Dpt., Valladolid, SPAIN**

Presenter's biography:

PhD in Industrial Engineering from the University of Valladolid, Associate Professor Area Machines and Heat Engines Department of Energy Engineering and Fluid Mechanics of the University of Valladolid. With four-year periods of teaching and three administrations recognized research. Charges and administrative responsibilities:Director of the Department of Energy Engineering and Fluid Mechanics, Director of the Department of Renewable Energy at the University of Valladolid, Assistant Director for Academic ETS of Industrial Engineering at the University of Valladolid.The research activity:
a)The combustion of bioliquids, having participated in projects and contract research and disseminating the results at international conferences and published in prestigious international journals.
b)Research in buildings: energy efficiency and indoor air quality, advisor to the Ministry of Development for the drafting of the SH3 CTE.

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Session reference: 2BV.6.4
Subtopic: 2.2 Biomass and Bioliquids Combustion for Small and Medium Scale Applications
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Flue Gas Recirculation During Poultry Litter and Mixture of Poultry Litter with Woodchips Combustion in a Fixed Bed Lab-Scale Batch Reactor

Short introductive summary:

Attached.

Presenter: **Daya PANDEY, University of Huddersfield, Computing and Engineering Dpt., Huddersfield, UNITED KINGDOM**

Presenter's biography:

I am working as a Senior Lecturer at University of Huddersfield. My research focuses on waste to energy conversion, energy integration, heat recovery, energy data analytics and reducing the energy demand in the built environment.

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Session reference:	2BV.6.5
Subtopic:	2.2 Biomass and Bioliquids Combustion for Small and Medium Scale Applications
Topic:	2. BIOMASS CONVERSION FOR BIOENERGY

Permormance of New Coatings of Materials in Corrosive Environments and High Oxygen Content

Short introductive summary:

The development of new materials that withstand higher temperatures becomes a key challenge on the way forward to more sustainable to produce energy more sustainably and more efficiently. For these, it is necessary to use protective coatings to maintain good mechanical properties and also to be resistant to corrosion. Highly effective coatings for ferritic-martensitic and austenitic steels provide cost effective material solutions for flexible and more efficient, biomass plants. As a consequence, operation at higher temperatures is possible, increasing the biomass plant performance.

An energetic crop, cynara cardunculus, has been chosen as fuel given its high chlorine content and the presence of potassium in ashes. Besides, it is added a sub-bituminous coal because contains a high quantity of sulphur. A complete characterization of the fuels selected was carried out.
This work reports the results of an investigation into the corrosion behaviour of bare and coated coupons of ferritic steels and a high-alloy multipurpose austenitic stainless steel at metal temperatures of 600-620 ºC facing the conditions that arise in the generation of energy using biomass as a fuel.

Presenter: **Alberto BAHILLO, CIEMAT, Energy Dpt., Madrid, SPAIN**

Presenter's biography:

Dr Bahillo is a researcher at CIEMAT's Sustainable Thermochemical Valorization Unit. He has been working in the field of thermal conversion processes for more than 25 years. I have participated in more than 20 R&D projects financed in national and international public calls.

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Session reference: 2BV.6.6

Subtopic: 2.2 Biomass and Bioliquids Combustion for Small and Medium Scale Applications

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Future Competitive Potential of a Small-Scale Fluidized-Bed Combustion Technology Operated with Non-Woody Biomass in the German Heating Sector: an Economic Modelling Analysis

Short introductive summary:

The motivation of this study is to investigate the market potential of this small-scale fluidized-bed combustion system for an application in the heating sector. In this regard, an economic optimization model BENOPT (BioENergyOPTimisation model) was applied to illustrate the competitiveness with other heating technologies including bioenergy, fossil and other renewable (hybrid) heating technology concepts in a future and sustainable heat market scenario. Within the model, the economic feasibility of the small-scale fluidized bed technology can be examined for 19 different sub-sectors to determine the optimal allocation of biomass in the heat sector. In this regard, we will highlight possible applications for the proposed small-scale fluidized-bed combustion concept in the heat sector, and determine its possible impact to fulfill the defined GHG reduction targets within our scenario modelling.

Presenter: **Özge MUTLU, DBFZ Deutsches Biomasseforschungszentrum gemeinnützige GmbH, Thermochemical Conversion, Leipzig, GERMANY**

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Session reference: 2BV.6.7
Subtopic: 2.2 Biomass and Bioliquids Combustion for Small and Medium Scale Applications
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Characterization of Emissions from Combustion of Olive Wood Chips

Short introductive summary:

Much of the woody biomass used in combustion plants is supplied by the sector of agroforestry by-products, in order to incentivize the production of energy from waste material. This work aims to characterize the emissions produced by the combustion of olive wood chips, which is one of the main tree crops considered as a source of biomass, especially in Italy, where about one million hectares are planted with olive groves and over 32 % is present in the Puglia region. Before being chipped, the biomass was characterized in order to evaluate its physical-chemical properties, determining respectively the moisture content, the energy value (upper and lower calorific value), the ash content, and the elemental analysis. The wood chips were burned through a 35 KW th boiler, the sampling and analysis of the emissions were conducted through the systems and instruments of the LASER-B (Laboratory for Experimental Renewable Energy and Biomass Activities), at the Research Center CREA-IT of Monterotondo. The results show that the emissions in terms of COT, NOX, SO2, CO2, O2 and PM comply with the limits imposed by current legislation. The CO value is an exception, probably related to poor

Presenter: **Monica CARNEVALE, CREA-IT, MONTEROTONDO, ITALY**

Presenter's biography:

Researcher at CREA-IT (Monterotondo)
The research activity concerns the study of energy transformation of biomass.

Degree with honors in Environmental Science (University "La Sapienza" – Rome).

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Session reference: 2BV.6.8
Subtopic: 2.2 Biomass and Bioliquids Combustion for Small and Medium Scale Applications
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

New Fuel Indexes in Ash-Melting Behavior of Silica-Rich Biomass Assortments

Short introductive summary:

This research aimed to address this existing research gap. In this regard, RH and RS were collected from Italy, and a clean wood (W) sample from Germany was employed as reference material. In order to mitigate the ash-melting problem of RS, fuel pre-treatment (i.e. water washing and acid leaching) as well as blending RS with RH were investigated and described. The degree of the ash-melting was evaluated by using the sieving and disintegration method for the ash samples prepared at 600 – 1100°C in a muffle furnace. To determine relevant FIs, which have a higher correlation with ash-melting degrees obtained from the experiments, all possible combinations of chemical species (oxide-based) were defined and checked.

Presenter: **Hossein BEIDAGHY DIZAJI, DBFZ Deutsches Biomasseforschungszentrum gemeinnützige, Thermochemical Conversion Dpt., Leipzig, GERMANY**

Presenter's biography:

Hossein Beidaghy Dizaji is a PhD student at Leipzig University and a researcher at German Biomass Research Centre (DBFZ). His research focus is ash related aspects during thermochemical conversion of silica-rich biomass assortments.

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Session reference: 2BV.6.9

Subtopic: 2.2 Biomass and Bioliquids Combustion for Small and Medium Scale Applications

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

SunGas Renewables - Addressing the Need for Industrially Relevant Scale

Short introductive summary:

SunGas Renewables Inc. (SunGas) was established by Gas Technology Institute (GTI) as the commercial supplier for biomass applications of its pressurized bubbling fluidized bed (PBFB) gasifier. With a process built around this core technology, SunGas enables efficient industrial-scale production of clean chemical building blocks for synthesis into gaseous or liquid biofuels or renewable chemicals. The presentation will describe how SunGas is supporting multiple projects for conversion of wood wastes into biofuels, biochemicals, and biopower, focused now on North American opportunities. We will provide information on the key aspects of building the confidence of markets in the technology and the delivery team. The presentation will also detail the SunGas scope of supply, and the syngas volume and composition, for a typical project.

Presenter: **Vann BUSH, SunGas Renewables, Columbia, USA**

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Session reference: IBO.1.1

Subtopic: 6.1 Advances in Large Scale Gasification

Topic: 6. INDUSTRY TRACK

Implementing Advanced Gasification Commercially as Part Of an Integrated Approach to Sustainable Aviation Fuels From Biomass and Waste(part 1)

Short introductive summary:

We focus on our core competence on technology development and have formed partnerships with other world class organizations for the engineering and fabrication of the innovative equipment systems. TRI has developed a suite of innovative technologies to convert waste to drop-in fuels. We demonstrated the first commercial scale application of the technology in 2003 and since then have adapted it to woody biomass and MSW derived feedstocks. Our first commercial demonstration is at Fulcrum's Sierra biorefinery which will gasify 500 dry tons per day of MSW derived feedstock to Jet Fuel. We are the gasification technology for a number of projects in development including Velocys' biomass to jet fuel project in Natchez, Mississippi and their sorted MSW to jet fuel project in Immingham, UK. We also have an Advanced Development Center where we house a 4 dtpd integrated biorefinery that can take virtually any carbonaceous feedstock to Fischer-Tropsch liquids. We have over 13,000 hours operation on this Process Demonstration Unit.

Presenter: **Dan BURCIAGA, TRI Inc., Baltimore, USA**

Presenter's biography:

Dan Burciaga has served in executive positions where he leveraged his engineering and business education for domestic and international industrial projects, engineering and construction services and renewable energy technology development. After having founded a consulting engineering office and an industrial construction company, he took on the leadership role for commercializing a new gasification technology that could process a wide range of wastes into high-quality syngas. He assembled a highly proficient, self-directed team that is capable of achieving incredible outcomes.

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Session reference:	IBO.1.4
Subtopic:	6.1 Advances in Large Scale Gasification
Topic:	6. INDUSTRY TRACK

Implementing Advanced Gasification Commercially as Part Of an Integrated Approach to Sustainable Aviation Fuels From Biomass and Waste(part 2)

Short introductive summary:

Sustainable Aviation Fuel (SAF) is critical to the decarbonisation of one of the most challenging sectors of society. Aviation is challenging to decarbonise because liquid hydrocarbon fuel systems offer a high constant energy for propulsion, well suited to long distance flight and unmatched by current and foreseeable batteries. Aircraft, engine and operational improvements can all help, but SAF offers the only realistic prospect for reducing net greenhouse gas emissions to zero for a long-haul flight - making it indispensable in a net zero world. SAF is already approved for use at up to 50% in all commercial aircraft, and thus can begin decarbonising aviation immediately, without any changes to aircraft or airport infrastructure.

Presenter: **Neville HARGREAVES, Velocys, Business Development, Oxford, UNITED KINGDOM**

Presenter's biography:

Neville is responsible for Velocys’ waste to fuels business, including the Altalto waste-to-jet fuel plant in the UK. Neville has over 30 years' experience in the oil, renewable energy and consulting industries. He holds a PhD in Chemistry.

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Session reference: IBO.1.5
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Sustainable Feedstock for the European Bioeconomy - Performance of the Novel Miscanthus Hybrids Tested in the BBI DEMO Project GRACE

Short introductive summary:

The BBI demonstration project GRACE is a multi-actor and transdisciplinary project to demonstration 10 complete, bio-based value chains starting from crop production until the final product. Within the project a range of products is being assessed, including biobased fuels and platform chemicals, building material, composites and pharmaceuticals (Figure 1). While the bio-based products are quite divers and versatile, the feedstock used to produce
these products is focusing on hemp and miscanthus biomass. For both crops, the potential of the crop production on marginal sites, including contaminated, abandoned and low productive land, is being assessed and optimized. However, this paper focuses on the performance of novel seed-based miscanthus hybrids and presents interim results of the novel miscanthus hybrids after three vegetation periods.

Presenter: **Andreas KIESEL, University of Hohenheim, Biobased Products and Energy Crops Dpt., Stuttgart, GERMANY**

Presenter's biography:

Andreas Kiesel is Scientist at the Institute of Crop Science, Dpt. Biobased Products and Energy Crops. His field of research is novel application options of miscanthus. He started his career in the EU project OPTIMISC (289159) and is now coordinating the H2020 BBI Demo project GRACE (745012).

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Session reference:	1BO.10.1
Subtopic:	1.3 Biomass Crops and Energy Grasses
Topic:	1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Biomass from Non-Food Land: Long Term Giant Reed and Switchgrass Evaluation as Feedstock for Advanced Biofuel

Short introductive summary:

Bank of drainage canals are generally unexploited lands. They are unsuitable to conventional food crops due to periodic flooding and scatter distribution, even though the soil fertility adds agronomic value to these areas. The utilization of these lands for the production of dedicated lignocellulosic crops could contribute to increase the local availability of renewable feedstocks for advanced biofuels. Once established, giant reed and switchgrass requires extremely low input and a minimal management, and can produce quantitatively variable amounts of feedstocks along the years in function of the variable climatic conditions.
The objective of this study was to evaluate yield stability in quantitative and qualitative terms over 16 years of a giant reed and switchgrass plantation on non-food lands.

Presenter: **Andrea PARENTI, University of Bologna, DISTAL, Bologna, ITALY**

Presenter's biography:

I got a master of science in agricultural sciences on 2013 at the University of Bologna and then I worked for almost 1 year in Enza Zaden Australia. I am actually a PhD student at the Department of Agricultural Sciences of the University of Bologna, working on a european project named BECOOL.

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Session reference: 1BO.10.2

Subtopic: 1.3 Biomass Crops and Energy Grasses

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Evaluation of Cup Plant (Silphium Perfoliatum) as a New Perennial Biomass and Forage Crop for Ontario (Canada)

Short introductive summary:

There is a strong desire for development of the biogas and renewable natural gas industries in Ontario at both a government and industrial level. On-farm anaerobic digesters represent an economic opportunity for the rural Ontario economy, producing renewable energy from low-value agricultural residues and manures while also mitigating the environmental impacts of agriculture by reducing nutrient contamination and mitigating greenhouse gas emissions. Further growth of the biogas industry at farm scale requires stable, local feedstocks to be available which return higher biogas yields than are possible with manure alone. One potential solution would be establishment of perennial bioenergy crops, such as cup plant (Silphium perfoliatum L.). Cup plant has numerous advantages, including high biomass yield and provision of ecological goods and services, which make it potentially attractive as a bioenergy crop. The purpose of this project was to establish baseline data on how best to grow the crop in Ontario, determine biomass yields, and determine value of the biomass in bioenergy and animal feed applications.

Presenter: **Juan RIVERA, University of Guelph, Ridgetown, CANADA**

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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Session reference:	1BO.10.3
Subtopic:	1.3 Biomass Crops and Energy Grasses
Topic:	1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Integration of Biomass Sorghum in Current Cropping Systems of the Northern Great Plains of the USA to Enhance Ecosystem Services Delivery

Short introductive summary:

Biomass sorghum can be integrated successfully into current cropping systems in the region by intercropping, relay, or double cropping with other crops, while decreasing external inputs and enhancing ecosystem services delivery. Both double and relay systems with biomass sorghum had significantly lower N2O field emissions and nitrate and phosphate losses compared with maize in monoculture. Intercropped biomass sorghum and silage maize for biogas production have the advantage of producing similar biogas yield than that of maize in monoculture, but with lower global warming potential due to the less inputs required to grow biomass sorghum. In conclusion, more research of integrating biomass sorghum into current cropping systems is needed to produce food, feed, and energy while attaining long-term sustainability and resilience of agricultural production in the NGP.

Presenter: **Marisol BERTI, North Dakota State University, Plant Sciences Dpt., Fargo, USA**

Presenter's biography:

Dr. Marisol Berti is a professor in the Department of Plant Sciences, North Dakota State University (NDSU), Fargo, ND, USA. She has been working in NDSU since 2009. She is an agronomist by training and her research is in forages, bioenergy, and cover crops production.

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Session reference:	1BO.10.4
Subtopic:	1.3 Biomass Crops and Energy Grasses
Topic:	1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Development of a Decision-Support Tool for Resource Valorization in the Pulp and Paper Industry

Short introductive summary:

The aim of this study is to develop a decision-support tool that enables the systematic analysis of industrial processes as integrated biorefineries for improving resource valorization. The pulp and paper industry serves as a case study.

Presenter: **Julia GRANACHER, Ecole Polytécnique Fédérale de Lausanne, Sion, SWITZERLAND**

Presenter's biography:

Julia Granacher holds a Master of Science from RWTH Aachen University in Germany in Mechanical engineering and is currently working as a PhD researcher in the Industrial Process and Energy Systems Engineering group at the Ecole Polytechnique Fédérale de Lausanne in Switzerland.

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Session reference: 5BO.11.1
Subtopic: 5.1 Strategies for Biomass Integrated into Energy Systems
Topic: 5. BIOENERGY INTEGRATION

An Assessment Tool for Smart Integration of Biomass into the Energy System

Short introductive summary:

The aim of this work is to develop a goal system and derive indicators to measure how existing bioenergy concepts can contribute to the economy. For that, Analytic Hierarchy Process (AHP), and Analytic Network Process (ANP) were applied, indicator calibration was performed and expert workshops were carried out, within the framework of the SmarKt research Project.
The resulted goal system consists of a five-level hierarchical goal tree, where at the bottom level 48 derived indicators take place.
The developed system has been applied to 36 existing bioenergy concepts in Germany for the generation of power, heat or transport fuels, based on biomass residues. The quantitative results show at all five levels of the goal system, how an evaluated bioenergy concept contributes to a sustainable integration of biomass into the economy.

Presenter: **Christopher SCHMID, DBFZ, Leipzig, GERMANY**

Presenter's biography:

- Studies of Renewable Energy Management B.Sc. (2012-2016)
- Studies of Sustainable Energy Competence M.Sc. (2017- 2019)
- Research Associate at the German Biomass Research Center (DBFZ)

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Session reference: 5BO.11.2
Subtopic: 5.1 Strategies for Biomass Integrated into Energy Systems
Topic: 5. BIOENERGY INTEGRATION

Feasibility Analysis of Biomass Conversion to Intermediate Bioenergy Carriers (IBC) Systems: Novel Supply Chains for District Heating in Energy Transition Regions

Short introductive summary:

Western Macedonia (NW Greece), also known as the energy pillar of Greece, is presently in the middle of a major transition from lignite to green renewable energy sources as, in September 2019, Greece announced that the country will gradually phase out the use of lignite in power plants. This decision includes the ceasing of operations of the existing Public Power Corporation (PPC) lignite units by 2023, except Ptolemaida's unit VI, which will be closed by 2028.
This prospect, apart from being a serious blow to this region's GDP and employment (the economic activity in Western Macedonia is heavily dependent on PPC's activities), is also a key blow to the municipal district heating companies in the areas of Amyntaio, Ptolemaida and Kozani. DETEPA (district heating company of Amyntaio), in order to face the closure of the local Combined Heat and Power (CHP) plant, implemented a 30 MWth biomass-fired district heating plant to completely cover the demands of the 3,000-5,000 residents of the area.

Presenter: **Tzouliana KRAIA, CERTH, CPERI Dpt., Thessaloniki, GREECE**

Presenter's biography:

I am a Mechanical Engineer with a demonstrated record of achievements in energy research. My credentials include a Master Degree in Energy Systems, a PhD in Hydrogen production from the H2S that is contained in Black Sea waters and a Postdoc position in biomass gasification technologies.

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Session reference: 5BO.11.3
Subtopic: 5.1 Strategies for Biomass Integrated into Energy Systems
Topic: 5. BIOENERGY INTEGRATION

Experiences and Changes in Testing and Development Activity of Bio Heating Sector in Finland During 2010-2020

Short introductive summary:

The publication will provide an overview of the operation of the boiler testing laboratory and its development, and discusses the change in the bioheating sector in Finland during 2010-2020. The boiler testing environment locates in Central Finland, and is part of JAMK University of Applied Sciences.

Presenter: **Hannariina HONKANEN, JAMK University of Applied Sciences, School of Technology, Jyväskylä, FINLAND**

Presenter's biography:

Ms Hannariina Honkanen, Lic.Sc. (Tech.), principal lecturer and bioenergy specialist, has worked at JAMK University of Applied Science since 2009. She has been working for education and training, but also in national and international projects and energy and environment technology related assignments. She has been involved in building two master's programmes in JAMK, and has references in teaching e.g. in coordinating several continuing education programmes for academic unemployed people in Central Finland. Honkanen's special competence is in energy use of Nordic biomasses: solid bio fuel management and fuel characteristics, bioenergy production in Nordic climate and emission control. Before career in JAMK, during 2002-2008, Ms Honkanen worked in Lappeenranta University of Technology with education and several energy and environmental technology related EU projects.

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Session reference:	5BO.11.4
Subtopic:	5.1 Strategies for Biomass Integrated into Energy Systems
Topic:	5. BIOENERGY INTEGRATION

Multiscale Analysis of the Influence of Hydrothermal Pretreatment: Consequences on Lignocellulosic Biomass Recalcitrance

Short introductive summary:

The hot water pretreatment is an eco-friendly process, which reduces the hemicellulose content, to increase the enzymatic conversion capacity of lignocellulosic biomass. Its impact on lignocellulosic biomass is the subject of numerous studies but the physico-chemical modifications induced on different properties of LB and the links with enzymatic hydrolysis are still unclear. The objective of this work is to combine global biochemical and physico-chemical analyses (composition and 13C CP/MAS NMR) with cellular scale analyses using imaging and microscopy approaches to study the effect of hot water pretreatment according to cell variability.

Presenter: **Amandine LEROY, INRAE, Nantes, FRANCE**

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Session reference: 3BO.12.1

Subtopic: 3.5 Bio-Alcohols from Sugars, Starch and Lignocellulosic Biomass

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Comparison of Different Pretreatment Strategies for an Effective Fractionation of Municipal Forestry and Greening Wastes

Short introductive summary:

Municipal Forestry and Greening Wastes (MFGW) are a lignocellulosic biomass with widespread availability and constant generation in urban settlements, being a potential feedstock for its use in a lignocellulosic biorefinery. The use of MFGW has traditionally been limited to the production of biogas through anaerobic digestion or composting: the aim of this work is to provide new alternatives for its conversion towards high value-added products by means of a sequential fractionation of the structural components of the biomass through chemical processes. Fractionation of the components was carried out by subjecting the biomass to different chemical pretreatments: steam explosion and organosolv process. Steam explosion was carried out at 195 ºC for 10 min with 60 mg H_2SO_4/g dry biomass. Organosolv processes were studied by using a mixture of acetic acid and hydrogen peroxide at 80 ºC for 150 min with a solid-to-liquid ratio (S/L) of 1:10; and ethanol combined with n-propylamine and anthraquinone at 150 ºC for 30 min with a S/L of 1:10.

Presenter: **Pablo DOMÉNECH, CIEMAT, Advanced Biofuels and Bioproducts Unit, Energy Dpt., Madrid, SPAIN**

Presenter's biography:

MSc in Chemical and Biochemical Engineering by the Technical University of Denmark (DTU), specializing in bioenergy, biomass conversion and biorefineries. Currently working as a biofuels researcher at the Spanish Research Center for Energy, Environment and Technology (CIEMAT).

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Session reference: 3BO.12.3

Subtopic: 3.5 Bio-Alcohols from Sugars, Starch and Lignocellulosic Biomass

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Pretreated and Enzyme-Hydrolyzed Peanut Shell for Cultivation of Clostridium sp. G10

Short introductive summary:

This manuscript presented the economical and renewable substrate for biobutanol production. Peanut has been planted generally all over the world, thus, its shell was generated in large quantities at the peanut processing sites. This residue has potential to utilize as a medium for Clostridium sp. G10 previously isolated from pond sediment. The results showed that the biobutanol production from peanut shell hydrolysate and the control medium (T6 medium with glucose) was not significantly different. This finding suggested the possibility to use peanut shell hydrolysate as a medium for the production of biobutanol. Furthermore, using peanut shell hydrolysate with the addition of T6 medium, Clostridium sp. G10 could produce more butanol concentration.

Presenter: **Vorapat SANGUANCHAIPAIWONG, King Monkut's Institute of Technology Ladkrabang, Biology, Faculty of Science, Ladkrabang, THAILAND**

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Session reference: 3BO.12.4

Subtopic: 3.5 Bio-Alcohols from Sugars, Starch and Lignocellulosic Biomass

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Regional Economic Impacto of Biomass-Based Heating Plant

Short introductive summary:

The aim of the paper is to introduce the regional economic impact of biomass-based heating plant. The results will be presented with case example: heating plant (~2.5 MW) located in South-East Finland. The regional challenges, possibilities and key factors on utilising local biomass are also pointed out. The study evaluates how much income local forest biomass utilisation generates to region compared to imported fossil fuels such as natural gas or light fuel oil.

Presenter: **Antti KARHUNEN, Lappeenranta-Lahti University of Technology, LUT School of Energy Systems - Bioenergy, Lappeenranta, FINLAND**

Presenter's biography:

Antti Karhunen, M. Sc. (eng.), works as a projects researcher at LUT University Lappeenranta. His main research subjects are biomass availability and utilization, and analyzes concerning regional and national energy supply.

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Session reference: 4BV.7.1

Subtopic: 4.4 Biomass Strategies and Policies Towards a Bioeconomy

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Instruments and Activities to Foster the Replacement of Fossil Heating Systems with Renewables

Short introductive summary:
The EU H2020 project REPLACE (Contract No. 847087) aims to boost the phase-out of inefficient and old heating and cooling systems by targeting consumers, investors/owners as well as intermediaries (installers, plumbers, and chimney sweepers) and helps them to make independently informed decisions.

All activities proposed by REPLACE aim to inform and motivate consumers to replace their old and inefficient HC appliances with better, greener alternatives with the benefit of monetary savings and improvements in air-quality, comfort, safety, and security of supply. REPLACE also addresses fuel poverty and reduces the risk of a heating crisis by supporting the use of regional renewable energy sources (such as solar, ambient heat or biomass) and equipment produced in the EU (biomass boilers, heat pumps, solar collectors, DH equipment).

Presenter: **Ingo BALL, WIP Renewable Energies, Unit Bioenergy & Bioeconomy, Munich, GERMANY**

Presenter's biography:
Ingo Ball works as Project Manager at WIP Renewable Energies in the Biomass Department. He holds two degrees: Dipl. Sports Economist and B.Sc. Management of Renewable Energies.

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Session reference: 4BV.7.2
Subtopic: 4.4 Biomass Strategies and Policies Towards a Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

The Role of Bioenergy in Achieving the Carbon Neutrality Target in Finland by 2035

Short introductive summary:

This study assesses the potential for increasing bioenergy in energy production by 2035 and what role it will play in achieving the carbon neutrality target in Finland. The possibilities of additional use of bioenergy are examined both in terms of supply and use possibilities in different end-use sectors including the possibilities for Bioenergy Carbon Capture and Storage (BECCS). The study reviews the various end uses of fossil energy and assesses the potential for additional use of bioenergy. The impact of fuel changes on the entire energy system is assessed, such as the replacement of combined heat and power production by separate heat and electricity production and the replacement of fuel combustion by electrification. The study also includes a survey of university students to map out how likely a carbon neutrality target is to be considered by 2035 and what are the most important ways, including the bioenergy use, to achieve this goal.

Presenter: **Tapio RANTA, Lappeenranta University of Technology, School of Energy Systems, Lappeenranta, FINLAND**

Presenter's biography:

Tapio Ranta holds a professorship in Bioenergy Economics and has been working in Lappeenranta-lahti University of Technology (LUT University) at the School of Energy Systems since 2003. He has specialized in forest biomass supply systems and logistics, biomass markets, and trade.

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Session reference: 4BV.7.4
Subtopic: 4.4 Biomass Strategies and Policies Towards a Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Strategies and Technologies to Achieve a European Fossil-Energy-Free Agriculture - H2020 AgroFossilFree

Short introductive summary:

The aim of the project is to create a framework under which critical stakeholders will cooperate to evaluate and promotecurrently available fossil-energy-free strategies and technologies (FEFTS) in EU agriculture to diminish in the short term and eliminate in the long run fossil fuels use in any farming process from cradle to farm gate, while maintaining yield and quality of the end-product.
Such a framework will contribute in closing the gap between the available FEFTS either commercial or from applicable research results with the everyday EU agricultural practices by promoting effective exchange of novel ideas and information between research, industry, extension and the farming community so that existing research and commercial solutions can be widely communicated, while capturing grassroots level needs and innovative ideas from the farming and related industry communities. Financing opportunities for de-fossilizing EU agriculture will be investigated and highlighted.

Presenter: **Thanos BALAFOUTIS, CERTH, IBO, Thermi, GREECE**

Presenter's biography:

Researcher, Agricultural Engineer, MSc in Agricultural & Environmental Engineering, PhD in biofuels production and use in agricultural tractors, 25 peer-reviewed journal papers, over 50 conference papers, over 30 research project participation as principal researcher.

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Session reference: 4BV.7.6
Subtopic: 4.4 Biomass Strategies and Policies Towards a Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Introduction of the "Pre-Ranking" Approach as a Multicriteria Analysis Method for Assessing the Suitability of Composts

Short introductive summary:

Currently, there is not a universally accepted method for assessing the quality and the usability of compost by means of a standardized method. This study presents the development of a Multicriteria Analysis Tool for the Assessment of Composts as Soil Amendments. The commonly measured compost parameters - i.e. pH, C/N/, RI, GI, and conductivity – are used as input criteria for our assessment. In addition, several scenarios are being used that incorporate different acceptable limits of the previously mentioned criteria. In this framework we developed, and we introduce in this study the “pre-ranking” approach were the input parameters are converted into adjusted values that can be ranked and thus the minimization and the maximization become possible. The utilized Multicriteria method of analysis is PROMETHEE II and the data are inserted and analyzed by the software Visual PROMETHEE. In total six different types of compost were assessed, and three different scenarios were considered and compared. The integrated improvements of adjusted weighting factors and adjusted input values change significanlty the overall ranking.

Presenter: **Stergios VAKALIS, University of the Aegean, Environment Dpt., Mytilene, GREECE**

Presenter's biography:

Stergios is an Assistant Professor at the Department of Environment of the University of the Aegean in the field of "Energy Management and Low Carbon Technologies". In the Laboratory of Energy Management, he works on waste gasification, energy modeling, the assessment of fuel characteristics.

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Session reference: 4BV.7.7
Subtopic: 4.4 Biomass Strategies and Policies Towards a Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Lesson Learned from Biofuel Implementation in Indonesian and Malaysia

Short introductive summary:

This paper discusses the extent to which there are conditions and constraints that do not support biodiesel development, and how the government of Indonesia and Malaysia respectively navigate through the challenge to reach the set targets of biodiesel implementation.

Presenter: **Elisabeth RIANAWATI, Resilience Development Initiative, Resilience Development Initiative, Bandung, INDONESIA**

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Session reference: 4BV.7.8

Subtopic: 4.4 Biomass Strategies and Policies Towards a Bioeconomy

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Unravelling The Bioeconomy - A Scientific Publication Semantic Similarity Analysis

Short introductive summary:

In the last decade, the term bioeconomy has gained space both in scientific publications and in national strategies and plans as a path to a sustainable, low carbon economy. However, the search for the term in scientific databases still fails to capture its entire field, as it is a new and crosswise theme (D'AMATO et al., 2017). Another challenge of studying the bioeconomy at a global level is the influence of each countries' regional characteristics on the scope of the bioeconomy. Thus, the objective of this work is to identify what are the main fields of studies considered as part of the bioeconomy, and to analyse how regional characteristics influence the definition of these fields. To achieve this objective, scientific publications of the Web of Science database were analysed with a semantic similarity methodology by the analysis and visualization softwares developed by CGEE, InsightNet (iN) and InsightNet Browser (iNB), respectively.

Presenter: **Daniella SANTOS E SILVA, Centro de Gestão e Estudos Estratégicos, Rio de Janeiro, BRAZIL**

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Session reference: 4BV.7.10
Subtopic: 4.4 Biomass Strategies and Policies Towards a Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Technical-Economic Assessment of Small Scale Biomass Thermochemical Plant Producing Heat, Electricity and Hydrogen

Short introductive summary:

The study presents a technical-economic assessment of small Biomass-to-Energy plant based on a detailed process model. The products targeted are heat, electricity and hydrogen. The relevance of this work is to provide to stakeholders an evaluation of the opportunities to develop this type of processes to produce renewable energy and mitigate climate changes.

Presenter: **Rémi DEMOL, FJV, NANCY, FRANCE**

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Session reference: 4BV.7.11
Subtopic: 4.4 Biomass Strategies and Policies Towards a Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Simulation of Fermentable Sugar Production from Sugarcane Bagasse: a First Approach to the Biotechnological Process of Xylitol

Short introductive summary:

This study discusses the biological route of xylitol production which is based on the fermentation of the sugar cane bagasse hydrolysate. The simulation of the hydrolysis process was implemented by means of the Aspen Plus tool, for which a data base containing the most used laboratory-scale operation conditions by the Group of Applied Microbiology and Bioprocesses (GMBIO) of the Escola de Engenharia de Lorena Universidade de São Paulo (EEL-USP) was compiled. Furthermore, the most common process sequence used was identified which allowed to use the information about experimental yields and process conditions to perform the simulation of the different stages required to obtain the C5 hydrolysate. These were subsequently verified with the experimental data of the collected database, finding that the simulation did not show significant differences in the concentrations of sugars of interest and some of the toxic components produced. This simulation is the first approach to model de biotechnological production process of xylitol.

Presenter: **Joaquin DIAZ RENDON, Universidad de Los Andes, Chemical Engineering Dpt., Bogota, COLOMBIA**

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Session reference: 3BV.8.2

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Bioprofiling and Isolation of Succinic Acid Producing Bacteria from Cow Dung for their Adaptation in a 'one-Pot' Bioconversion of Corn Cob to Succinic Acid

Short introductive summary:

The aim of this research was to bio-profile the bacterial microbiota of cow dung and isolate succinic acid (SA)-producing bacteria for future use in a proposed 'one-pot' bioconversion system of pretreated corn cob to SA. Bio-profiling was carried out using a metataxonomic sequencing approach and the identified SA-producing bacteria were isolated using a selective growth medium, containing glucose, yeast extract, peptone and citrate buffer, at pH 7.2. Bromocresol green (pH indicator), which served as a first attempt to screening acid producing bacteria for organic acids within the pH range 3.8- 5.4, was also added to the isolation growth medium. Thin-layer chromatography (TLC) was used to confirm production of succinic acid and also presence of other by-products (such as, lactate, acetate, ethanol and formate) expected from the reductive tricarboxylic acid cycle. High-performance liquid chromatography (HPLC) was then used for their quantification. The concentration of ZnCl2.4H2O was then added to the growth medium at variable concentrations, to evaluate the survival ability of the bacterial isolates.

Presenter: **Moloko MOSHOKOA, University of Pretoria, Chemical Engineering Dpt., Johannesburg Area, South Africa, SOUTH AFRICA**

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Session reference: 3BV.8.3
Subtopic: 3.7 Bio-Based Chemicals and Materials
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Evaluation of Bioactivities of Musa sp. Aerial Parts Extracts

Short introductive summary:

This research aims to study bioactivity of aerial parts extract from four cultivars of banana; Musa sp. that has been multipurpose plant in Thailand. The determination of phytochemical exhibited that Musa (AA) ‘Lep Mue Nang’ extract had the highest contents of flavonoid and tannin as 515.69 mg QE/g extract and 874.93 mg TAE/g extract, respectively, whereas Musa (AA) ‘Khai’ extract presented the highest level of total phenolic content as 958.49 mg GAE/g extract. Analyzed the efficacy of free radical scavenging by using DPPH radical scavenging assay reveal that the highest antioxidant activity found in Musa (AA) ‘Khai’ extract showed IC50 at 5.76 mg/ml. Cytotoxicity studied of extracts against HeLa cell line by MTT assay at the maximum concentration 10000 µg/ml found that Musa (AA) ‘Khai’ extract had the most cytotoxicity at 82.08%. According to the bioactivities results, Musa (AA) ‘Khai’ extract has potential for remedy aspects to add value of this plant.

Presenter: **Suttijit SRIWATCHARAKUL, King Mongkut's Institute of Technology Ladkrabang, Biology Dpt., Bangkok, THAILAND**

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Session reference: 3BV.8.5

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Purification and Chemical Characterization of Bioactive Compounds Obtained from Exhausted Olive Pomace

Short introductive summary:

The exhausted olive pomace (EOP) is the main residue generated in the olive-oil sector, and a relevant raw material for a biorefinery centered in the Mediterranean region. This material, very rich in phenolic compounds, is a recognized low-cost source of relevant bioactive compounds that can easily be obtained by aqueous extraction, which is a significant environmental advantage over other raw materials that require the use of organic solvents. Nevertheless, the selective recovery of these compounds from the aqueous extract is still understudied.
In this work, membrane-based processes (ultra- and nanofiltration) were used and studied in detail to selectively separate high and low-molecular weight phenolics and sugars. Ultrafiltration (UF) enabled a significant rejection of phenolic compounds, conversely to glucose, whose rejection was always below 15%. The relevance of the subsequent use of a nanofiltration (NF) was found to be dependent on the ultrafiltration conditions.

Presenter: **Irene GÓMEZ CRUZ, Universidad de Jaén, Ingeniería Química Ambiental y de los Materiales Dpt., Jaén, SPAIN**

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Session reference: 3BV.8.6
Subtopic: 3.7 Bio-Based Chemicals and Materials
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Design of a Surface Cleaning Product from Mango Residues

Short introductive summary:

A surface cleaning product was designed from mango by-products. Acetic acid is believed to have antiseptic properties, for that reason it was obtained by means of dark fermentation (MixAlco) process in thermophilic conditions using mango shell as substrate and separated using liquid-liquid extraction with butyl acetate as solvent, which was established as the most suitable cost-effective solvent by Aspen Plus simulation. Two different inoculums were evaluated in the fermentation: ground and brine, both stemmed from Zipaquirá Salt Mine. Surfactant properties were earned by saponification of mango seed oil, which was obtained by supercritical extraction with carbon dioxide using isopropyl alcohol as cosolvent. The final product was designed using proportions based on another commercial surface cleaning product. Finally, its antiseptic efficiency was evaluated with Pseudomonas aeruginosa and Staphylococcus aureus growth; in the same way, its cleaning efficiency was determined with a lux meter visual method. This study demonstrates how valorization of fruit waste residues provides useful everyday products for the future bioeconomy.

Presenter: **Maria Camila RODRIGUEZ-FERNANDEZ, Universidad de los Andes, Cundinamarca Dpt., Zipaquirá, COLOMBIA**

Presenter's biography:

My name is María Camila Rodríguez Fernández, I am 22 years old. I studied Chemical Engineering and Environmental Engineering at Universidad de Los Andes and I adquired Roberto Rocca Scholarship due to highest GPs among students of Engineering Faculty.

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Session reference: 3BV.8.9
Subtopic: 3.7 Bio-Based Chemicals and Materials
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Caproic Acid Fermentation from Syngas Improves with the Addition of Biochar and Activated Carbon

Short introductive summary:

This work shows how biochar and activated carbon can enhance the production of hexanoic acid from ethanol and acetic acid in syngas fermentation effluent.

Presenter: **Stef GHYSELS, Ghent University, Green Chemistry and Technology, Thermochemical Conversion of Biomass Research Group, Gent, BELGIUM**

Presenter's biography:

Stef Ghysels graduated as bioscience engineer, specialized in chemistry and bioprocess technology at Ghent University.
Afterwards, Stef Ghysels started as PhD and teaching assistant at the department of Green Chemistry and Technology, at the research group of Thermochemical Conversion of Biomass.

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Session reference:	3BV.8.10
Subtopic:	3.7 Bio-Based Chemicals and Materials
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Microwave-Assisted Degradation of Biomass with the Use of Acid Catalysis

Short introductive summary:

The aim of the study was to assess the effectiveness of microwave pretreatment combined with acid catalysis in the decomposition of various types of biomass (pine and beech chips and hemp stems). It was clearly demonstrated that sulfuric acid was a catalyst enabling the most effective decomposition of the tested plant biomass, guaranteeing the highest concentrations of simple sugars released. Microwave radiation combined with 1% v/v sulfuric acid provided high glucose concentrations of 89.8±3.4, 170.4±2.4 and 164.6±4.6 mg per one gram of pine chips, beech chips and hemp stems, respectively. In turn, the use of nitric acid promoted the degradation of hemicellulose, which resulted in high concentrations of galactose and xylose, i.e. 147.6±0.6, 163.6±0.4 and 134.9±0.8 mg per one gram of pine chips, beech chips and hemp stems, respectively, while glucose levels remained relatively low. Our studies confirmed the usefulness of the combined use of microwaves and acid catalysis in the degradation of softwood, hardwood and non-wood plant biomass. It should be emphasized that obtaining high concentrations of released simple sugars (as potential substrates in biosynthesis), while

Presenter: **Grzegorz KLOSOWSKI, Kazimierz Wielki University, Biotechnology Dpt., Bydgoszcz, POLAND**

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Session reference: 3BV.8.12

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Optimization of alkaline extraction from olive tree pruning biomass

Short introductive summary:

Olive tree pruning biomass (OTPB) is one of the most abundant lignocellulosic materials in the Mediterranean countries. OTPB is an interesting source of energy, OTPB is burnt in the field with no revenue (Contreras et al., 2020). This biomass is also suitable for the production of bioethanol and other bioproducts (Fernandes-Klajn et al., 2018). OTPB presents a high content of components extractives (non-structural material) (Gómez-Cruz et al., 2020; Contreras et al., 2020) and for the former use, the redution the extractives content could be advantageus (Ballesteros et al., 2011). The objective of this work is to reduce the content of extractives in OTPB through alkaline extraction to improve its subsequent utilization and at the same time to obtain a liquid stream rich in phenolic compounds, which are highly valuable. Thus, the alkaline conditions were optimized using a Box-Benhken experimental design (BBD), obtaining the optimal conditions at 110ºC, 1.4% NaOH and 30 min. Then, the extracted solid was pretreated with diluted sulfuric acid (164ºC, 0.9% H2SO4 for 10 min), which enabled the fractionation of extracted OTPB for further valorization.

Presenter: **Irene GÓMEZ CRUZ, Universidad de Jaén, Ingeniería Química Ambiental y de los Materiales Dpt., Jaén, SPAIN**

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Session reference: 3BV.8.13

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Potential HMF Production Through Thermochemical Conversion, and Bioprocessing Routes

Short introductive summary:

Green technology is widely recognized due to the significant changes it can bring to the world from a sustainability point of view. The use of clean technology for the production of value-added products from biomass waste is one of the ways to achieved sustainability. The introduction of hydroxymethylfurfural (HMF) as one of the promising value-added products has been gaining immense attraction due to its various applications in the research area. In the presence of HMF, it can help reduce the dependency on non-renewable resources. Thus, this paper aims to discuss recent research on the potentials of HMF production through thermochemical conversion and bioprocessing routes.

Presenter: **Aida Syafiqah ABDUL MANAF, Centre for Biochemical and Biofuel Research, Chemical Engineering Dpt., Seri Iskandar, Perak, MALAYSIA**

Presenter's biography:

Aida Syafiqah is a Master's Student in Chemical Engineering study at University Technology PETRONAS. Currently at the early stage of working on the microwave-assisted conversion of glucose into hydroxymethylfurfural in the presence of a low transition temperature mixture.

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Session reference: 3BV.8.14

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

A Biorefinery Concept for Valorisation of Pomegranate Peel and Seed Using Green Technologies

Short introductive summary:

The main objective of this research was to produce value-added products from food industrial wastes, pomegranate (Punica pomegrante L.) peel and seed using green extraction techniques (Soxhlet-, stirred-, ultrasound assisted- and supercritical carbon dioxide extraction) in laboratory and pilot scales. Peel extracts and seed oil were obtained, which possess different compositions, which were evaluated by HPLC and GC methods. The antioxidant and antimicrobial properties of peel and seed extracts were investigated. Furthermore, peel extracts were applied as stabilizer in polyethylene processing, replacing synthetic industrial polymer stabilizer.
Based on our results, the applied technologies and processes a biorefinery concept for the application of pomegranate by-products was outlined using ASPEN Plus simulation software. The feasibility and the economic aspect of a scaled up biorefinery was modelled using own experimental data, thermodynamic models and phase equilibrium parameters from literature.

Presenter: **Erika VAGI, Budapest University of Technology and Economics, Chemical and Environmental Process Engineering Dpt., Budapest, HUNGARY**

Presenter's biography:

Assistant professor (from Sept 2017-) at Budapest University of Technology and Economics, at the Department of Chemical and Environmental Process Engineering (Budapest, Hungary). Between 2015-17 as an quality engineer at ADS Ltd. (Sopron, Hungary), from 2007-2012 Research scientist at IRL, New Zeala

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Session reference: 3BV.8.15
Subtopic: 3.7 Bio-Based Chemicals and Materials
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Influence of the Chemical Treatment on the Reinforcing Behaviour of the Fibre Obtained from the Olive Tree

Short introductive summary:

The objetive of this work is to carry out a study on the influence of the treated fibre obtained from olive tree on the manufacture process and the properties of polymer biocomposites resulting of using this fibre as reinfocement of a polypropylene (PP) matrix. Different types of chemical treatments involving vinyltrimethoxysilane (VMS) were carried out with the aim of custimising the surface of the natural fibre to favour its interaction with the polymer matrix. Moreover, fibres subjected to different alkali pretreatment prior to the silanisation procedure was also obtained in order to study possible synergistic effects. Fourier Transform Infrared Spectroscopy (FT-IR) analysis elucidated that chemical treatments modified the surface of the fibre. The resulting biocomposites showed better mechanical behaviour in terms of tensile and flexutal properties.

Presenter: **Sofía JURADO CONTRERAS, Universidad de Jaén, Chemical, Environmental and Materials Engineering Dpt., Jaén, SPAIN**

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Session reference: 3BV.8.16

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Polyhydroxyyalkanoates (PHA Productivity by Mixed Microbial Cultures with Different Ratios of Two High Organic Content Wastewater

Short introductive summary:

One of the potential bio-degradable plastics is Polyhydroxyalkanoates (PHAs). The initial substrates to produce PHAs are mostly organic acids which could be found in many organic wastewaters. These can be used by mixed microbial culture to produce PHAs. The main purpose of using these waste streams as sole substrates is to effectively reduce the production cost of PHAs. However, it is necessary to degrade large molecules of carbon sources into useful organic acids by acidification pre-treatment. In this study, the ratios of the effluent from sucrose and molasses waste acidification fermenters were set at the ratios of 1:0, 1:1, 3:1, 1:3 resulting the produced PHAs concentrations of 18.33%, 24.21%, 26.88% and 32.48%, respectively.

Presenter: **Ming-Yan SHEN, Feng Chia University, Institute of Green Products, Taichung, TAIWAN**

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Session reference: 3BV.8.18

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Co-Processing Pyrolysis Oil Biocrude in an Fcc to Produce Renewable Fuels

Short introductive summary:

Honeywell UOP has developed a commercially tested, low-cost technology solution to produce second-generation renewable transportation fuels using existing refining assets. The technology solution uses an existing petroleum refinery’s fluid catalytic cracking (FCC) unit to co-process a biomass-based pyrolysis oil renewable biointermediate liquid produced by fast pyrolysis of lignocellulosic biomass using the Envergent Technologies RTP™ process. A summary of work completed and overview of near term plans for the technology will be reviewed.

Presenter: **Dan SZEEZIL, Honeywell, Des Plaines, USA**

Presenter's biography:

Dan Szeezil is the Product Marketing Manager for Renewable Fuels at Honeywell UOP. Dan holds a Master of Science in Environmental Management & Sustainability from Illinois Institute of Technology and a Bachelor of Science in Electric Engineering from University of Illinois at Urbana-Champaign.

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Session reference: IBO.4.2

Subtopic: 6.4 Advances in Fast Pyrolysis

Topic: 6. INDUSTRY TRACK

Pioneer in Refining Advanced Biofuels

Short introductive summary:

Green Fuel Nordic Oy is a biorefining company based in Finland. Our business model is based on utilising innovative, commercially used pyrolysis technology in the production of an advanced bio-oil. We use renewable, domestic forest biomass as our resource, which opens a new refinement path for this precious forest fortune.

Using existing technology speeds up the commencement of refinery operation and starting commercial bio-oil production, also allowing for distributed energy production. Green Fuel Nordic plans to build multiple bio-oil refineries close to the resource in the near future. At the same time, our company strives to achieve the goals set for renewable energy production while helping boost energy self-sufficiency

Presenter: **Timo SAARELAINEN, GFN Lieksa, Lieksa, FINLAND**

Presenter's biography:

Timo Saarelainen is the Chief Executive Officer (CEO) and the founder of the Green Fuel Nordic Oy. Timo’s impressive over 30-years international career includes technical, commercial, senior business leader and executive management positions in Europe, Americas and Asia-Pacific.

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Session reference: IBO.4.4

Subtopic: 6.4 Advances in Fast Pyrolysis

Topic: 6. INDUSTRY TRACK

A Subsurface Water Retention System to Collect Rain Water and Curb the Desertification

Short introductive summary:

The increasing demand for sustainable food and non-food biomass production is challenging farmers all over the world, particularly in those areas whom are short in water supply. Besides, the constant spreading of desertification in the Mediterranean region makes this cultivations even difficult. In fact, the main problem related to desertification is the reduction of rainy events in a given region, although the annual rainfall remains constant. Hence, surface water reservoirs are accessible only for a limited period of the year forcing farmers to rely on belowground water, which is expensive and, sometimes, impossible to carry out. In the framework of MediOpuntia Project, a possible strategy to harvest rain water in arid and semiarid regions of the world, is represented by the installation of subsurface water retention systems (SWRT) made of impermeable U-shaped barriers laid 80-100 cm belowground with aim to prevent water loss due to percolation. In addition, also soil nutrients loss is prevented as they will be collected by the membranes and kept available to roots after major rainy events. So far, the market still lacks the availability of machineries capable to lay i

Presenter: **Luigi PARI, CREA- Council for Agricultural Research and Economics, Centro di ricerca Ingegneria e Trasformazioni agroalimentari, Monterotondo RM, ITALY**

Presenter's biography:

Dr. Luigi Pari has a PhD in Agricultural Engineering in 1990 and start working as researcher in the Agricultural Engineering Unit (CRA-ING) of the Agricultural Research and Experimental Council (CRA), in Monterotondo (Roma). In 2002 he became Scientific Director of the Non Food Agriculture - Energy Crops Group (PANACEA), coordinating the activities of 18 researchers, which main activity is to develop new agricultural machineries prototype for energy crops harvesting and logistic.
Authors of more than 200 scientific publications, he was scientific responsible of more then 30 research projects, funded by European Union, Italian Ministry of Agriculture and private enterprises

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Session reference: 1BO.13.1
Subtopic: 1.6 Innovative Biomass Production for Energy Integrated into Traditional Agri-Forestry Systems
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Can Short Rotation Coppice Willow Provide a Practical, Economically and Environmentally Sustainable Solution for Balancing the Objectives of the Water-Energy-Production Nexus in Agriculture?

Short introductive summary:

I am the Project Leader (8 years) for Agri-Environmental Technologies for the Agri-Food and Biosciences Institute in N.Ireland (AFBI). Before this, I worked for a SME (7 years) where I fully interfaced with farmers and environmental regulators to develop energy crop diversification and the crop's integration with waste water pollution management, installations of renewable heat systems and full financial appraisals. My current work is very much aligned with linking the Water-Energy-Food Nexus and how to implement biomass plantations in the context of intensifying agriculture with waste management and water quality protection. This explores the circularity of managing diffuse runoff (Phosphorus & Nitrogen) via biomass plantations using LIDAR and terrain modelling to target interventions to intercept hydrological connectivity with environmental water. The direct recycling of organic waste from sectors including agriculture, agri-food processing, sewage and landfills are also being developed and are likely to form an increased solution of choice and improve our overall environmental sustainability.

Presenter: **Chris JOHNSTON, Agri-Food and Biosciences Institute, Agri-Environmental Technologies, Belfast, UNITED KINGDOM**

Presenter's biography:

Chris Johnston - Project Leader – Agri-Environmental Technologies - leads the research which underpins land-based renewable energy systems at the Agri-Food and Biosciences Institute (AFBI); areas relevant to renewable energy & waste water mgmt.

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Session reference: 1BO.13.2

Subtopic: 1.6 Innovative Biomass Production for Energy Integrated into Traditional Agri-Forestry Systems

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Relay Cropping for Enhanced Food and Dedicated Lignocelulosic Feedstock Availability

Short introductive summary:

Relay cropping for enhanced food and dedicated lignocelulosic feedstock availability
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Relay cropping is an innovative cropping systems where food/feed crops and dedicated lignocellulosic crops could be produced in the same land and growing season without competition issues. The objective of this study was to evaluate the effects of a dedicated lignocellulosic legume crop on relay planted wheat productivity. Wheat grain yield, bread making quality, and straw production were improved, while the cumulated biomass yield (sunn hemp biomass + wheat straw) arrived to comparable productivity levels of some high yielding perennial grasses (i.e. giant reed). These results suggest that relay cropping could be a sustainable cropping systems to integrate food and dedicated biomass crops production.

Presenter: **Walter ZEGADA-LIZARAZU, University of Bologna, Agricultural Science Dpt., Bologna, ITALY**

Presenter's biography:

Walter Zegada-Lizarazu has a Ph.D. in Crop Science (Nagoya University, Japan). Currently is a assistant professor at the Department of Agricultural Sciences of Bologna University. He has been working on agronomic and ecophysiological aspects at root/canopy levels and carbon dynamics of energy/industrial crops since 2000. He has been involved in several FP7-EU Projects on industrial crops for energy end uses.

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Session reference: 1BO.13.3
Subtopic: 1.6 Innovative Biomass Production for Energy Integrated into Traditional Agri-Forestry Systems
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Evaluation of Trace Elements Fate in Contaminated Biomass Fractions for Clean Biofuel Production

Short introductive summary:

Phytoremediation and biofuel production can meet eachother and be part of the same project, only if there is a full evaluation of biomass quality, both for yelds and sustainability of the final product. With the research we started we are intentionated to quantify the amount of trace elements in the different biomass portions used in many biofuel production processes, and after that develop biomass purification methods.

Presenter: **Adriano PALMA, CREA, Crea-IT, Monterotondo, ITALY**

Presenter's biography:

Graduated in Environmental Science, I am a research fellow at CREA-IT studying agricolture biomass characterization and emissions evaluation at boiler's stack8

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Session reference: 1BO.13.4
Subtopic: 1.6 Innovative Biomass Production for Energy Integrated into Traditional Agri-Forestry Systems
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Screening of a High Tolerance Marine Yeast for the Bioconversion of Seaweed Hydrolysate to Bioethanol

Short introductive summary:

This study investigates a novel marine yeast strain that displays high tolerance to typical bioethanol substrates and inhibitors. The utilisation of this strain for the bioconversion of seaweed hydrolysate to bioethanol shows potential for a high ethanol yield.

Presenter: **William TURNER, University of Huddersfield, School of Applied Sciences, Huddersfield, UNITED KINGDOM**

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Session reference:	3BO.14.1
Subtopic:	3.5 Bio-Alcohols from Sugars, Starch and Lignocellulosic Biomass
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Cloning and Heterologous Expression of Exo-Cellulase Gene cbhA in Bacillus Licheniformis for Direct Production of 2,3-Butanediol from Biomass

Short introductive summary:

Bacillus licheniformis strain 24, a non-pathogenic 2,3-BD producer, was subjected to genetic improvement by heterologous expression of a gene encoding extracellular cellulase. CbhA is the main enzyme of cellulosome of Hungateiclostridium thermocellum JW20, a strain isolated from cotton. The sequence analysis of cbhA revealed a multidomain structure of the protein consisting of N-terminal carbohydrate-binding module, an immunoglobulin-like beta-barrel domain, a catalytic glycoside hydrolase family (GH9) domain, fibronectin type III (Fn3) modules, carbohydrate-binding module, a highly acidic linker region, and C-terminal dockerin domain. CbhA is exclusively an exocellulase, capable to bind crystalline cellulose.
PCR fragment with Mw 3.6 kb containing cbhA was obtained using the primer pair F1_Nde 5'ga attc cat atg atg aaa ttt aga agg tca att tgt ac 3' and R1_Hind 5' gcc c aag ctt tta tcg att ggc aat tct tct atg 3' with introduced restriction sites and cloned into the vector pBS (5938 bp), a shuttle for E. coli and Bacillus and containing replication origins for Gram-positive and Gram-negative bacteria.

Presenter: **Penka PETROVA, Bulgarian Academy of Sciences, Institute of Microbiology, Sofia, BULGARIA**

Presenter's biography:

My main activities are in the area of microbiology and molecular biology. My best expertise is connected with the search for novel enzymatic activities and strains improvement for new properties acquiring. I have publications in microbiology, molecular biology or biochemistry.

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Session reference: 3BO.14.2
Subtopic: 3.5 Bio-Alcohols from Sugars, Starch and Lignocellulosic Biomass
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Predicting Lignocellulosic Recalcitrance to Optimise Biofuel Production

Short introductive summary:

Recalcitrance of lignocellulose is caused by its structural and chemical complexity. Predicting its transformation, in particular enzymatic hydrolysis of lignocellulose into monosaccharides, is very challenging and also critical for optimizing production of biofuels then building versatile and economically viable biorefineries. Until now, many different features controlling recalcitrance have been highlighted but many studies are controversy and measurement of most of these features requires time-consuming lab analysis. We have investigated new spectral, chemical and physical features and have tested them on various biomass species with different pretreatments to see how they could be correlated to saccharification yield.

Presenter: **Gabriel PAËS, INRAE, FARE Laboratory, Reims, FRANCE**

Presenter's biography:

Dr Gabriel Paës is a Research Director involved in various research projects dealing with lignocellulosic biomass valorisation into biofuels and biomaterials, with a strong experience in multiscale analysis of lignocellulose enzymatic recalcitrance.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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Session reference: 3BO.14.3

Subtopic: 3.5 Bio-Alcohols from Sugars, Starch and Lignocellulosic Biomass

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Pilot-Scale Ethanol Production from Lignocellulosic Biomass at High Solid Loading.

Short introductive summary:

In this work, we tested and adapted a strategy previously developed at the laboratory level to reach high solid loadings (20%) in the lignocellulosic enzymatic saccharification. This work is our first attempt to scale up the high solid loading strategy (HSLS) and produce lignocellulosic ethanol at 250 L bioreactor from corn stover (CS), barley straw (BS), and wheat straw (WS) as biomasses. Biomasses were pretreated by autohydrolysis in a pilot-scale pretreatment continuous tubular reactor [1]. Pretreated biomasses were hydrolyzed using Cellic CTec3 Novozyme®. The saccharification yield reached were 80.2, 60.6, and 57.3% for BS, WS, and CS, respectively. The yeast Saccharomyces cerevisiae ethanol Red® was used to produce bioethanol from hydrolysates. The final ethanol concentrations were 21.5, 27.3, and 23.9 for CS, WS, and BS; these results correspond to volumetric ethanol productivities of 1.1, 1.0, 1.2 g/Lh, respectively.

Presenter: **Lorena AMAYA-DELGADO, Centro de Investigacion y Asistencia en Tecnologia y Diseno del Estado de Jalisco AC., Industrial Biotechnology Dpt., Zapopan, MEXICO**

Presenter's biography:

Dr. Lorena Amaya completed her doctorate in Biotechnology and Bioengineering. She works developing processes for the production of second-generation biofuels and high added value metabolites. She studies the physiological behavior of yeasts under stressed conditions during fermentative processes.

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Session reference: 3BO.14.4

Subtopic: 3.5 Bio-Alcohols from Sugars, Starch and Lignocellulosic Biomass

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Exploring the Properties of the New Bio-Based and Circulated Textile Materials

Short introductive summary:

Title: Exploring the properties of the new bio-based and circulated textile materials
Textile industry consumes huge amount of natural resources and produces waste enormously. The industry needs to move towards circularity. Therefore, there is a need to have better understanding of the physio-mechanical properties of circular textile materials. The article describes the properties of 20 different bio-based and circular textile materials and compares these results in the properties of non-circular materials, thus identifies the differences and similarities in the physio-mechanical characteristics.
The article consists the testing results of 20 different innovative and reformed bio-based and circular materials. The results are compared to the non-circular similar materials, so called control samples. The testing pattern covers several material property tests: tensile properties (breaking strength, ultimate elongation, tensile breaking force), folding, creasing and dimensional changes due to washing and drying as well as resistance to surface wetting, drying properties and burning behavior.

Presenter: **Kirsi KNUUTTILA, JAMK University of Applied Sciences, Institute of Bioeconomy, Jyväskylä, FINLAND**

Presenter's biography:

Knuuttila (M.Sc. (Tech)) works as the bioeconomy specialist in Institute of Bioeconomy. Her expertise areas are wood energy supply chains, resource wisdom and international RDI collaboration. She has edited Finnish Wood Energy book (2003).

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Session reference: 4BV.9.3
Subtopic: 4.5 Resource Efficient Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

The coffee grounds: insights by coffee shops

Short introductive summary:

Coffee is one of the most valuable primary products in the world trade (Blinovà et al., 2017) and according to the International Coffee Organization (2020) its global production in 2019/20 is estimated at about 169.34 million bags; however, in 2020 world coffee consumption is expected to decrease by 0.5% to 167.81 million bags as the covid-19 pandemic continues to put pressure on the global economy and greatly limits out-of home coffee consumption (ICO, 2020). In general, coffee production cause many wastes (as coffee grounds) that could be used for many purposes, as production of fuel pellets (Picchio et al., 2020), substrate for biogas, bioethanol or biodiesel production, composting material for agricultural purposes, substrate for mushroom production, etc. (Blinovà et al., 2017). The waste reuse is gaining more and more importance due to both the waste environmental impact (Du et al., 2018) and the growth world population that will reach 9.7 billion individuals in 2050 (United Nations, 2019).

Presenter: **Simone BERGONZOLI, Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, CREA-IT, Treviglio (BG), ITALY**

Presenter's biography:

Agronomist, Phd in agricultural engineering I work since 2010 in crop harvesting, biomass feedstock and energy crops

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Session reference: 4BV.9.4

Subtopic: 4.5 Resource Efficient Bioeconomy

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

An Italian Circular Economy Model

Short introductive summary:

Concerns about emissions from fossil fuel use have stimulated renewable energy adoption, which included bioenergy and its crop residue (Palmieri et al., 2017). Among crop residues, prunings have a significant potential in bioenergy production either for their availability or for the biomass quality as fuel source (Picchi et al., 2018). In Europe, more than 13 million tons of pruning biomass are yearly available from permanent crops (olive grows, vineyard and orchard); about 80% of them are located in the Mediterranean area, particularly in Italy and Spain (Dyjakon et al., 2019). In Italy, it is estimated that an annual quantity of pruning biomass about 2.6 Mt comes only from the olive groves (Pari et al., 2018), and in particular in Apulia Region where about 33 % of the Italian olive groves are concentrated (ISTAT, 2019). Despite it is an abundant biomass resource, the exploitation of tree prunings for energy purposes is still limited, due mainly to logistics-related constraints (Gebresenbet et al., 2018).

Presenter: **Simone BERGONZOLI, Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, CREA-IT, Treviglio (BG), ITALY**

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Session reference: 4BV.9.5
Subtopic: 4.5 Resource Efficient Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

The Role of Sawmill by-Products in the Context of an Austrian Bioeconomy

Short introductive summary:

Bioeconomy strategies incentivise an increased use of wood resources in a variety of applications. However, an overexploitation of forests must be avoided by fostering the use of by-products for instance. The sawmill industry as core element of the wood-based sector produces large amounts of wood chips and sawdust, which are valuable by-products. Hence, the role of such by-products in the network of wood-based value chains is of interest. We aim at empirically analysing interlinkages and price influences of by-products in wood-based value chains in Austria. Results show that sawdust prices are mainly influenced by the wood pellet market, as pellets are the main value-adding use of sawdust. The cost structure of wood chips is more complex: It is influenced by pellets and chipboard prices and on the other hand cointegrated with sawlogs and pulpwood.

Presenter: **Marilene FUHRMANN, BEST - Bioenergy and Sustainable Technologies, Wieselburg-Land, AUSTRIA**

Presenter's biography:

Marilene Fuhrmann is Junior Researcher at BEST - Bioenergy and Sustainable Technologies Gmbh since 2019. In the Area Sustainable Supply and Value Chains she is working on techno-economic assessments and market analysis.

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Session reference: 4BV.9.6
Subtopic: 4.5 Resource Efficient Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Promoting the Enhancement of Valuable Crops for the Utilization in Agro-Industrial Market: The Carob

Short introductive summary:

The paper carried out through a qualitative study aims to highlight the need to promote renewed interest in the carob crop resulting from the new uses of the fruit, whose pulp was once used for human food and overall animal feed, but above all for the seeds, currently a very interesting source of gum used as food stabilizer, thickening agent and emulsifier (E410), as well as for pharmaceutical and medicinal purposes. The rediscovery and use of ancient plants that have best adapted to their growth territory is of crucial importance to preserve biodiversity and promote sustainable agricultural practices in a bioeconomy perspective. The carob tree is just only one of the several opportunities in this direction. Such an approach should bring together all actors across territories, promoting resource efficient value chains. It will require addressing the systemic challenges that cut across the different sectors, including synergies and tradeoffs, to facilitate the deployment of a long-term vision of the pathways needed to enhance bioeconomy models.

Presenter: **Mario TESTA, University of Salerno, DISA-MIS DPT., Fisciano (SA), ITALY**

Presenter's biography:

Mario Testa is Associate Professor of Business Management at University of Salerno, PhD in Marketing. He specialized in Business Ethics at the Center for Business Ethics at Bentley University, in Boston (USA) and his main research topics are the Sustainability and CSR issues.

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Session reference:	4BV.9.7
Subtopic:	4.5 Resource Efficient Bioeconomy
Topic:	4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Development of Grass-Based Circular Business Models for Rural Value Chains

Short introductive summary:

A total of 21% of the EU-28 area is covered by grassland. Part of the grass biomass remains underultilized. The development of innovative grass-based business models will help to generate value from this underutilized resource. Four examples will be presented. The aim of this study is to assess current natural, demographic, social, and competitive environments in Europe for innovative grass-based business models and where possible to illustrate changes over time.

Presenter: **Sonja GERMER, Institute for Agricultural Engineering and Bioeconomy, Technology Assessment and Substance Cycles, Potsdam, GERMANY**

Presenter's biography:

Sonja Germer (Geographer with a PhD in Geoecology) started to work at ATB in 2012. Her scientific work focuses on the impacts of land use or land management on nutrient and water fluxes and, hence, on the environment. This includes research on sustainable innovatios for biomass production.

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Session reference: 4BV.9.8
Subtopic: 4.5 Resource Efficient Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Cellulosic Biomass Developed Technology for Low Temperature Beer Fermentation: Continuous Brewing

Short introductive summary:

This technology is targeted to the brewing industry and is based on the exploitation of cellulosic biomass. We have developed a novel bioprocess enabling beer production at extremely low temperatures by adding psychrophilic yeast culture (AXAZ-I yeast strain) immobilized on tubular cellulose (TC) and wort. This novel technique not only reduces production costs, as less energy is expended, but also increases product quality and exploits cellulosic biomass.

Presenter: **Konstantina BOURA, University of Patras, Chemistry Dpt., Patras, GREECE**

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Session reference: 4BV.9.9
Subtopic: 4.5 Resource Efficient Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Cellulosic Biomass Developed Technology for Making Sulfite-Free Wine at Home

Short introductive summary:

Lignocellulosic biomass is a versatile and abundant substance that can be used in many ways, one of them is wine making at home. Winemaking throughout the centuries has been a complex, time-consuming process, utilizing the natural fermentation process to produce fine wine. The wine produced has a fine aroma, a great taste and an acceptable clarity without the need for any further processing for precipitation of suspended solids.

Presenter: **Agapi DIMA, University of Patras, Chemistry Dpt., Patras, GREECE**

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Session reference: 4BV.9.10
Subtopic: 4.5 Resource Efficient Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

High-Quality Biogenic Silica Production from Rice Husk and Rice Straw

Short introductive summary:

A combined energy and biogenic silica production from rice husk (RH) and rice straw (RS) under controlled conversion conditions would be a promising approach to produce low-cost silica. The previous studies in this subject have only been designed based on one influencing factor alone (OFAT) in literature. As a result, the simultaneous investigation of the influencing factors based on statistical experiments has not been performed in detail yet. Therefore, based on the Design of Experiments (DoE), the aim of this study is to screen six influencing factors concerning their impact on the quality of biogenic silica. The silica purity, amount of remaining inorganic impurities, carbon content, and BET specific surface area (BET SSA) of the remaining ashes were determined as DoE analysis responses. The results were further statistically evaluated using a Principal Component Analysis (PCA) and the Design-Expert 12 software package. The result of PCA showed that pretreatment alone could classify the ash samples, and it has maximum influence on ash purity and porosity. The other influencing factors have only a limited impact on the properties of studied ashes.

Presenter: **Hossein BEIDAGHY DIZAJI, DBFZ Deutsches Biomasseforschungszentrum gemeinnützige, Thermochemical Conversion Dpt., Leipzig, GERMANY**

Presenter's biography:

Hossein Beidaghy Dizaji is a PhD student at Leipzig University and a researcher at German Biomass Research Centre (DBFZ). His research focus is ash related aspects during thermochemical conversion of silica-rich biomass assortments.

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Session reference: 4BV.9.11
Subtopic: 4.5 Resource Efficient Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Cellulosic Biomass Develop Technology for Beer Making at Home

Short introductive summary:

A powder-based product has been developed enabling consumers to use a home brew kit to produce high quality beer using refrigerator at home.

Presenter: **Iris PLIONI, University of Patras, Department of Chemistry,, Rio Achaias, GREECE**

Presenter's biography:

PhD student in Chemistry.Diploma in Chemistry and Master in Synthetic Chemistry from Department of Chemistry, University of Patras, Greece. Participation in 1 research projects (funded).

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Session reference:	4BV.9.12
Subtopic:	4.5 Resource Efficient Bioeconomy
Topic:	4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Exploration of Biomass for the Production of Bioethanol: "Economic Feasibility and Optimization Studies of Transforming Maize Cob into Bioethanol as a Substitute for Fossil Fuels"

Short introductive summary:

Maize cobs popularly disposed of as waste after consumption of maize in Nigeria may be of significant economic value because of its transformation into bioethanol, a substitute for fossil-fuel in the economic recovery era. On this basis, this present study explores the feasibility of the transformation of maize cobs and develops a model for the prediction of net profit (NP) and return on investment (ROI) in addition to evaluating the conditions for attaining optimal benefit. The transformation of Maize cobs was achieved through series of processes, and profitability of the process of bioethanol production was assessed from which it was discovered that such transformation of maize cobs to bioethanol would be unprofitable in light of the loss (negative return) that would be realized from the process by producers. On the other hand, using the relevant tools, the NP and ROI were optimized with a range of conditions for raw materials, subsidy, and tax rate range in the study. Based on its findings, the study recommends support to producers through subsidies and other financial support in reducing production costs, and appropriate incentives should be put in place by government

Presenter: **Toyese OYEGOKE, Ahmadu Bello University, Chemical Engineering Dpt., Zaria, NIGERIA**

Presenter's biography:

Toyese OYEGOKE, a registered and licensed chemical engineer by the Centre of Regulation of Engineering in Nigeria (COREN), is an expert in the area of biofuels and renewable energy including computational catalysis, process modeling, design, simulation & economics. Currently running his Ph.D.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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Session reference: 4BV.9.13
Subtopic: 4.5 Resource Efficient Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Renewable Energy Sources for Farms in Finland and In Russia- Current Situation, Potential and Development Prospects

Short introductive summary:

The Aim of the research and educational project Russian-Finnish Bioeconomy Competence ?entre – BioCom is to promote energy efficiency and renewable energy sources in agriculture. Farms could possess major instruments for mitigation and adaption to climate change and for development towards a bioeconomy. Farms produce food but also different kind of biomasses and side flows and they have space for mounting of applications of renewable energy production (e.g. solar energy). In Finland, farms are also forest owners. Forestry helps farms to balance their economy, but gives them also important roles in carbon sequestration. Also new kinds of tillage techniques provide methods for carbon sequestration and could form a new kind of earnings logic for farms in the future.

Presenter: **Tuija RANTA-KORHONEN, South Eastern Finland University of Applied Sciences, Forest, Environment and Energy Dpt., Mikkeli, FINLAND**

Presenter's biography:

At the moment I work as a R&D Specialist and Project Manager in South Eastern Finland University of Applied Sciences.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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Session reference: 4BV.9.15
Subtopic: 4.5 Resource Efficient Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Status of Biomass if Consumption of Peat And Coal Will Be Restricted in Finnish CHP Plants

Short introductive summary:

In Finland, the aim is to phase out the use of coal by 2029 and to reduce the dependency on peat. Behind this are international and national targets to increase the use of renewable energy sources. The aim of the paper is to analyze how Finnish CHP plants are prepared if shortages in availability of domestic solid fuels such as wood fuels and peat occur.

Presenter: **Mika LAIHANEN, Lappeenranta-Lahti University of Technology, School of Energy Systems - Bioenergy, Lappeenranta, FINLAND**

Presenter's biography:

Mika Laihanen, M.Sc. (Eng.), works as a project researcher at LUT University Lappeenranta. His main research subjects are biomass availability, utilization and regional energy balances.

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Session reference: 4BV.9.16

Subtopic: 4.5 Resource Efficient Bioeconomy

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

"ProBio" an Ambitious Project to Implement More High Quality Compost in Organic Farming in Germany

Short introductive summary:

„ProBio“ – an ambitious project to implement more high quality compost in organic farming in Germany.
The aim of the project „ProBio“, which startet in summer 2019, is to provide a scientific evidence base and process framework in order to increase the use of certified quality compost (organic and green waste from private households) in organic farming and to support sustainable farming practices.
The potential for using compost from organic and green waste is not currently being realised, despite the high demand for macro- and micronutrients in organic farming, especially on arable farms without livestock raising.
In particular, the project will help to optimize compost production in fermentation and composting plants so that the high compost qualities required in organic farming are produced. Agronomic (e.g. crop growth) and environmental effects (e.g. carbon capture) of different compost types will be evaluated under differing site and cultivation conditions in organic farming. Application recommendations will be developed based on scientific research and practical application. Comprehensive investigations in field trials and in composting plants will be supplemented

Presenter: **Christian LETALIK, C.A.R.M.E.N., Energy Dpt., Straubing, GERMANY**

Presenter's biography:

Christian Letalik, Dipl. Ing- agr., TUM graduate in 1989
Operating manager, responsible for composting plants and biomass heat plants. Project manager at C.A.R.M.E.N. reg. ass. Board member of the Bavarian Compost Quality Assurance Organisation and the German Wood Ash Quality Assurance Organisation

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Session reference: 4BV.9.17

Subtopic: 4.5 Resource Efficient Bioeconomy

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

DesalinationoOf Saline WaterfFrom Food Waste Biochar: Temperature Swing Solvent Extraction

Short introductive summary:

Food waste has been both social and environmental concerns due to its increasing amount. Our research group have worked on the development of renewable enrgy resources based on food waste. The conversion of food waste into co-firing material for use in thermoelectric power plants is two-step process: pyrolysis of food waste and demineralization of food waste biochar. Demineralization process leads to production of wastewater containing high amount of salts. Therefore, efficient desalination of wastewater is required for sustainable production of food waste biochar. In this study, we tested temperature swing solvent extraction approach by using two types of solvents. Further information is available in Poster presentation.

Presenter: **Yoonah JEONG, Korea Institute of Civil Engineering and Building Technology, Land, Water and Environment Research Dpt., Goyang-Si, REPUBLIC OF KOREA**

Presenter's biography:

I am a researcher, working at Korea institute of civil engineering and building technology (KICT). My research area is based on environmental chemistry, especially focused on partitioning behaviour of chemicals such as sorption.

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Session reference: 4BV.9.19
Subtopic: 4.5 Resource Efficient Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

How Viable Are MSW-Derived Bio-based Solvents: a Techno-Economic and Environmental Sustainability Analysis

Short introductive summary:

Daniel Chernick is a PhD student at the University of Leeds interested in the production of bio-based solvents from wastes.

Presenter: **Daniel CHERNICK, University of Leeds, School of Chemical and Process Engineering, Leeds, UNITED KINGDOM**

Presenter's biography:

I'm a third year doctoral researcher (2nd year PhD) at the University of Leeds' Bioenergy CDT, working on producing bio-based solvents from wastes

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Session reference: 3BV.10.1

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Extraction of Pectin from Mango (Mangifera Indica) Peels

Short introductive summary:

In this study the effect of temperature (70 – 90°C), pH (1.5 – 2.5), and time is evaluated (60-120min), using samples of 5g of mango peels. Pectin was weighed after extraction to obtain a percentage of recovery in comparison to initial mango peels added to the process. FTIR spectroscopy was employed to identify changes in the structure of the samples. Once the condition with best yield was found, the extraction process was evaluated using 100g of dried mango to evaluate the process on a higher scale varying the amount of ethanol employed for the process in relationship with amount of citric acid solution employed. The best conditions found for pectin extraction were pH 1.5, 120 min, and 90°C. Additionally, the best ratio between the volume of citric acid solution and ethanol was 1:2. From these results, it was demonstrated that pectin extraction from mango peels is a viable alternative with respect to its traditional extraction from orange peels and apple pomace.

Presenter: **Margarita.Rosa MANTILLA-MANTILLA, Universidad de los Andes, Barrancabermeja, COLOMBIA**

Presenter's biography:

My name is Margarita Rosa Mantilla Mantilla. I am 22 years old. I was born in Bucaramanga, Colombia. I studied chemical engineering at Universidad de Los Andes. I joined the AIChE student chapter in 2016 as a member of the Chem-E-Car team and the board of directors.

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Session reference: 3BV.10.2
Subtopic: 3.7 Bio-Based Chemicals and Materials
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

H2 Free Synthesis of Biobased Adipates from Aldaric Acids

Short introductive summary:

The sustainable process for the production of bio-based adipic acid was developed under the Ph.D. research, which was done at the National Institute of Chemistry.

Presenter: **Brigita HOCEVAR, National Institute of Chemistry, Catalysis and Chemical Reaction Engineering Dpt., Ljubljana, SLOVENIA REPUBLIC**

Presenter's biography:

I am a postdoc researcher at the National Institute of Chemistry in Slovenia. My research topic is catalytic hydrodeoxygenation of compounds, a representative in the cellulose part of lignocellulosic biomass.

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Session reference: 3BV.10.3

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

HUMIC - Production of Humic Acids from Compost for their Use in the Remediation of Contaminated Land and as Biostimulants in Agriculture.

Short introductive summary:

HUMIC is a CIRCULAR ECONOMY PROJECT that can be replicated on a large scale: humic acids are extracted from the compost produced from organic waste which, when suitably modified, become products with high added value, to be used in remediation processes, in the agronomic sector or in other sectors.

Presenter: **Riccardo SPACCINI, Biosearch Ambiente, Alpignano, ITALY**

Presenter's biography:

Associate Professor of Agricultural Chemistry and Assistant director of Cermanu - University of Napoli Federico II.
Research topics: Humic substances, Biomass recycling; Soil Remediation; NOM-plant interaction
Publications: scientific papers (100), book chapter (6) h-index: Scopus 34, WOS 32

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Session reference:	3BV.10.4
Subtopic:	3.7 Bio-Based Chemicals and Materials
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Production of C4 Dicarboxylic Acid from Furfural Derived from Liquid Hot Water Hydrolysate of Quercus Mongolica

Short introductive summary:

Aim of this study is to produce C4 dicarboxylic acid from furfural which produced from lignocellulosic biomass. To extract pentose from lignocellulosic biomass, liquid hot water (LHW) treatment which has advantage of extracting hemicellulose from lignocellulosic biomass was adopted. Then, extracted hemicellulose mainly composed of xylose in liquid hydrolysate is converted to furfural via acidic dehydration. And finally, additional hydrogen peroxide was added to oxidize furfural to C4 dicarboxylic acid. All process was conducted without additional purification

Presenter: **Jong-Hwa KIM, Seoul National University, Environmental Material Science Dpt., Seoul, REPUBLIC OF KOREA**

Presenter's biography:

Jong-Hwa Kim studied on pretreatment of lignocellulosic biomass, conversion of sugar to furanic compund such as furfural, 5-HMF, EMF, catalyst synthesis for pretreatment or conversion of sugar to bio-plastic precursor.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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Session reference: 3BV.10.5

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Effect of Varied Organosolv Lignin Characteristics on Physicochemical Properties of Lignin-PLA Blend

Short introductive summary:

As biomass-based bioplastics have drawbacks such as thermal stability and UV shielding properties, there are many researches concerning this. Organosolv lignin was produced by varied reaction conditions and was fractionated to increase the selectivity of molecular weight and polarity. After that, lignin-PLA blend was made and analyzed physicochemical properties.

Presenter: **Young-Min CHO, Seoul National University, SEOUL, REPUBLIC OF KOREA**

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Session reference: 3BV.10.6

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Optimization of Extraction of Silica from Pulp Waste Using Empirical Modelling Approach

Short introductive summary:

The aim of this study was to extract silica (SiO2) from pulp waste (PW) by treating it with sodium hydroxide (NaOH) and to optimize the SiO2 extraction from the waste material via empirical modelling approach using Response Surface Methodology (RSM) approach.

Presenter: **Ntombikayise BHENGU, University of Pretoria, Chemical Engineering Dpt., Johannesburg, SOUTH AFRICA**

Presenter's biography:

A Ph.D. student in Chemical at the University of Pretoria, with a BSc in Chemistry, Honors in Materials Sciences from the University of Cape Town, and an MSc in Chemical Engineering from the University of the Witwatersrand.

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Session reference: 3BV.10.8

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Doped Cerium Oxide Catalysts for Oxidative Coupling of Methane Rreaction- Effect of Lithium and High Valance Sm3+ Dopant

Short introductive summary:

Substituting fossil based methane with CH4 obtained from renewable sources (e.g., biogas) can go some way towards alleviating the threat posed by global climate change. Bio-methane (bio-CH4) can be used in the residential sector, as transportation fuel or as energy carrier in the electricity sector following well established methods for its storage and transfer. However bio-methane may also be converted into value-added chemicals, such as olefins (ethylene and acetylene), aromatics (benzene and toluene), and oxygenates (methanol). The methane oxidative coupling (OCM) reaction is as a promising pathway for the conversion of CH4 and the direct production of higher hydrocarbons (C2). During the OCM reaction, CH4 and oxygen react on a catalyst surface at between 700 and 850 °C to form C2H6 (main product), which can be dehydrogenated in a second step to ethylene (C2H4).

Presenter: **Maria GOULA, Laboratory of Alternative Fuels and Environmental Catalysis, University of Western Macedonia, Chemical Engineering Dpt., Kozani, GREECE**

Presenter's biography:

Maria Goula is Professor of Catalysis in the Dept. of Chemical Engineering of the University of Western Macedonia and director of the Laboratory of Alternatives Fuels & Environmental Catalysis. Prof. Goula is author of 62 publications, which have received over 2117 citations (h-index=22, Scopus).

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Session reference: 3BV.10.9
Subtopic: 3.7 Bio-Based Chemicals and Materials
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Characterization of Colombian Cashew Nut Shell: Renewable Source of Valuable Chemicals

Short introductive summary:

Colombian cashew nut shells have not been characterized. However, this biomass has the potential to be used in a wide range of applications due to its chemical composition, thermal properties and amount of production. The cashew nut crops in colombia are increasing and it is expected that the harvested area will be two times more than now in the next years. This work seeks to perform a complete characterization of this biomass in order to present the potential of cashew nut production chain in Colombia.

Presenter: **Luis Jorge CRUZ REINA, Universidad de Los Andes, Chemical Engineering Dpt., Bogotá, COLOMBIA**

Presenter's biography:

PhD researcher in chemical engineering. MSc in biotechnology area applied to lignocellulosic biomass feed-stock.

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Session reference: 3BV.10.10

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Fly Ash from Biomass Combustion in Bubbling Fluidized Bed Combustors: Stabilization to Enhance Its Properties for Soil Application.

Short introductive summary:

Fly ashes from a 50 MWth biomass thermal power plant using a bubbling fluidised bed combustor were characterized and stabilized by hydration, granulation and self-hardening processes. The raw ashes and the respective granules produced were left exposed to atmospheric air conditions during 3 months inside a pavilion and then characterized.
The results obtained showed Si as the chemical element in higher concentration in the ashes, followed by Ca, Al and K by decreasing order of abundance. The ash, and respective granules, leaching solutions had alkaline pH (10 to 12) and electrical conductivity around 12 mS/cm. Ca was the element in higher concentration in the leaching solutions, followed by K and Cl by decreasing order of abundance.
After ash treatment by hydration followed by granulation and self-hardening, the pH, conductivity and concentration of some chemical elements, e.g., Ca, present in the ash leaching solutions decreased. On the other hand the concentration of K and Cl increased.
The treatment process studied is effective in improving ash derived material quality considering its application on soil and contributes to support proper management of biomass ashes.

Presenter: **Luís TARELHO, Universidade de Aveiro, Environment and Planning Dpt., Aveiro, PORTUGAL**

Presenter's biography:

Professor/Researcher in Environmental Engineering at Dep. of Environmental and Planning, and at the CESAM, University of Aveiro, Portugal. Research in the field of thermochemical conversion of solid fuels (coal, biomass, solid wastes, sewage sludge).

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Session reference: 3BV.10.15

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Synthesis of High-Density Fuel Candidates by Formal Cycloaddition of A-Pinene and Benzaldehyde

Short introductive summary:

Terpenes which are the most abundant secondary metabolites in nature have been considered as one of the promising resources to produce synthetic fuels. In this study, silica-supported phosphotungstic acid (PTA/SiO2) was used for the synthesis of the cycloaddition product from a-pinene and benzaldehyde. Among various factors, reaction temperature and benzaldehyde/a-pinene ratio significantly affected the yield of the desired product. The fuel properties of the cycloaddition product will be analyzed.

Presenter: **Sang-Youn LEE, Seoul National University, Wood Science Dpt., Seoul, REPUBLIC OF KOREA**

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Session reference: 3BV.10.19

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

BACTOFUEL: BACterial Conversion of CO2 and Renewable H2 inTO FUEL

Short introductive summary:

BACTOFUEL(BACterial conversion of CO2 and renewable H2 inTO BioFUELs) is a EU project that wants to demonstrate at TRL5 the possibility to produce butanol from H2O, sunlight and CO2, combining two technologies. The first one consists in a photocatalytic reaction to produce h2 by water splitting using atomic quantum clusters that enhance the catalytic reaction by absorbing not only in the UV but in the visible. The second technology is to transform CO2 and h2 from a bacterium that has been genetically modified by CRISPR-Cas. We will modify the bacteria to make them more suitable to produce butanol, optimizing the energy to get more product. Coupling these two approaches we will be able to create a kit that could avoid CO2 emissions by transforming it into added value products. The EU has provided the project with an additional tool, MI-DICE project, a parallel project that give us the tools to boost the technology to market. A feasibility study and a Tech-to-market plan is reviewed every week and examined every six months by the EU, giving us "go" or "no go" once seen the progress done. That will increase the options to reach commercialisation faster than expected.

Presenter: **Ignacio HERRAEZ, Nanogap Sub Nm Powder, Commercial Dpt, AMES, SPAIN**

Presenter's biography:

I work as sales manager at NANOGAP, Spanish R&D company in the field of nanomaterials. I am graduated as Msc in chemical engineer, and currently undertaking a Msc in Biotechnology. More than 8 years of experience within the industry as application manager providing technical & commercial support.

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Session reference: IBO.5.1

Subtopic: 6.1 Advances in Large Scale Gasification

Topic: 6. INDUSTRY TRACK

Widening the Feedstock Pool: Recycling Carbon for a Blue Sky Future

Short introductive summary:

We must treat deployment of new fuels to address climate change in the same way as COVID vaccines - pursuing all possible technology solutions with an eye to the future. Innovation and Industrial biotechnology hold the key, with a variety of new approaches being commercialized to reduce carbon and produce the things we use in our daily lives.

We currently recycle metals, plastics and paper - so why not recycle carbon?

There is an abundance of carbon locked in wastes from agriculture, forest, unsorted, unrecyclable municipal wastes and in gaseous byproducts of certain manufacturing processes. Biotechnology enables us to convert carbon pollution into everyday products, turning our carbon problem into an economic opportunity keeping the skies and oceans clean and blue for all!

Presenter: **Jennifer HOLMGREN, LanzaTech, Chief Executive Officer, Skokie, USA**

Presenter's biography:

Dr. Jennifer Holmgren is CEO of revolutionary carbon recycling company, LanzaTech. Prior to joining LanzaTech, Dr. Holmgren was VP and General Manager of the Renewable Energy and Chemicals business unit at UOP LLC, a Honeywell Company. She was one of the key drivers of UOP's leadership in aviation biofuels, and under her management, UOP technology became instrumental in producing nearly all of the initial fuels used by commercial airlines and the military for testing and certification of alternative aviation fuel. Today, under Dr. Holmgren's guidance, LanzaTech is working towards developing a variety of platform chemicals and fuels, including the world's first alternative jet fuel derived from industrial waste gases. Dr. Holmgren is the author or co-author of 50 US patents and more than 30 scientific publications. In 2003, she was the first woman awarded the Malcolm E. Pruitt Award from the Council for Chemical Research (CCR). In 2010, she was the recipient of the Leadership Award from the Civil Aviation Alternative Fuels Initiative (CAAFI) for her work in establishing the technical and commercial viability of sustainable aviation biofuels. In 2015 Dr. Holmgren and her team at LanzaTech were awarded the U.S. Environmental Protection Agency Presidential Green Chemistry Award and she was awarded the BIO Rosalind Franklin Award for Leadership in Industrial Biotechnology. Sustainability magazine, Salt, named Dr. Holmgren as the world's most compassionate business woman in 2015. In October 2015, Dr. Holmgren was awarded the Outstanding Leader Award in Corporate Social Innovation from the YWCA Metropolitan Chicago. Dr. Holmgren was named as #1 of the most 100 influential leaders in the Bioeconomy and LanzaTech was named the Hottest Company in the Bioeconomy by Biofuels Digest for 2016-2017. She currently serves on The National Renewable Energy Laboratory (NREL) Biofuels Advisory Committee and is on the Governing Council for the Bio Energy Research Institute in India. The institute has been set up by the DBT (Department of Biotechnology, Indian Government) and IOC (Indian Oil Corporation).

Dr. Holmgren holds a B.Sc. degree from Harvey Mudd College, a Ph.D. from the University of Illinois at Urbana-Champaign and an MBA from the University of Chicago. Dr. Holmgren is a member of the National Academy of Engineering.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

Co-authors:

J. HOLMGREN, Lanzatech, USA

Session reference: IBO.5.2

Subtopic: 6.5 Advances in Low Carbon Fuels

Topic: 6. INDUSTRY TRACK

Algae Platform for Biofuels, Food Ingredients and Materials

Short introductive summary:

Human civilization is facing greater demand for energy, clean water, food, nutrition and health solutions. RIL's biology platform can sustainably meet these challenges. Algae with fundamental understanding of photosynthesis kinetics can efficiently convert CO2, sea water and sunlight to renewable products in open ponds and photo-bio reactors. Our non-GMO algae cultivation, harvesting and conversion technology is most competitive for bio-crude production that economically meets regulatory biofuels requirements in EU.
Advances in synthetic biology like CRISPR is one of the important pillars of 4th Industrial revolution, where biological, digital and physical platforms are merging to create sustainable products. AI/ ML digital tools with CRISPR help efficiently engineer algae improving productivity to create products such as spider silk, functional proteins, etc.

Presenter: **Ajit SAPRE, Group President (R&D) Reliance Industry limited, INDIA**

Presenter's biography:

Ajit has more than 40 years of experience in the hydrocarbon, and renewable energy business, and technology development. He received his PhD from the University of Delaware and MBA from Cornell University. Ajit has strong background in processes/ catalyst development, reaction engineering, biotechnology, and modeling and computing. He has published more than 100 technical papers, one book and has more than 50 U.S. patents to his credit.

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Co-authors:

A. SAPRE, Group President (R&D) Reliance Industry limited, INDIA

Session reference: IBO.5.4

Subtopic: 6.5 Advances in Low Carbon Fuels

Topic: 6. INDUSTRY TRACK

Axens' Renewable Technology Suite: an Indicator of Sustainable Carbon Footprint Reduction

Short introductive summary:

The world today is facing unprecedented economic situation due to several unforeseen challenges. These challenges invoke the need to be prepared for the unknown and take proactive steps in answering them. In the same way, the chemicals and transportation fuel sectors are facing multiple challenges that are reducing their dependence on petroleum resources with cost-competitive solutions and address today's environmental concerns - sustainability and lower greenhouse gas emissions.

In Axens, we have addressed these challenges through the production of advanced biofuels from lignocellulosic biomass or vegetable oil & fats. With Green House Gas (GHG) emissions reduction of at least 90% compared to fossil gasoline, Futurol™ technology addresses these challenges through the production of cellulosic ethanol from various non-food biomasses suitable for fuel and chemical applications alike. The presentation will give a highlight of Futurol™ technology: organization of the development as well as its resulting technology offer with differentiating features and flexibility that is a stringent mandate for year-round operation.

Presenter: **Varun GINOTRA, Axens, FRANCE**

Presenter's biography:

Experienced business professional with strong background in Oil & energy business, Varun started his career in one of the global engineering, procurement, construction (EPC) company responsible for the detail engineering of various refining & petrochemical projects. In his last role, Varun was responsible for sales activities for Axens' process licensing business unit within its subsidiary. Currently, he is responsible for business development of renewables technologies for the production of biofuels and bio based chemicals.

He holds a bachelor's degree in engineering & Masters in Business Management (MBA) from Indian Institute of Technology, Delhi.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

Co-authors:

V. GINOTRA, AXENS, FRANCE

Session reference: IBO.5.5

Subtopic: 6.5 Advances in Low Carbon Fuels

Topic: 6. INDUSTRY TRACK

Role of Digestate Liquid Fraction in the Microirrigation System Performance

Short introductive summary:

The success of the use of wastewater in the irrigation depends on a wealth of factors. These include the amount of solids in the wastewater or its filtrate, the ability of the suspended material to form biofilms, the pressure of the water in the system, the type of filters and emitters, and age of the systems. Digestate from crop biomass and manure is increasingly being used, and its liquid fraction was indicated as a potential source for a wastewater irrigation. When used for irrigation purposes, information on the solid particles fractions, mostly salts, of these liquids in the irrigation systems are scarce. Aim of the present study was to test the efficiency of a commercial emitter when injected with the liquid fraction of the effluent from an agricultural biogas unit previously filtered thought a hydrocyclone system. During the test, volume, temperature, pH, turbidity and dry matter of the liquid emitted were measured

Presenter: **Simone BERGONZOLI, Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, CREA-IT, Treviglio (BG), ITALY**

Presenter's biography:

Agronomist, Phd in agricultural engineering I work since 2010 in crop harvesting, biomass feedstock and energy crops

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Session reference: 1CO.1.1

Subtopic: 1.5 Municipal and Industrial Wastes

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Vacuum Application During Fermentation for Volatile Fatty Acid Recovery

Short introductive summary:

Fermentation of organic waste has been used as part of the treatment process as well as in the production of chemicals such as ethanol, hydrogen, and volatile fatty acids (VFAs). These chemicals have marketable value as standalone chemicals or as raw materials for other goods such as plastics and energy. Within the Wastewater treatment plant, VFAs produced from municipal sludge can be used as an internal carbon source for biological nutrient removal (BNR), eliminating or reducing the need for external carbon sources such as methanol or acetic acid . VFAs are also a precursor for methane production which can be used for energy generation if harnessed. However, the challenge lies in the in-situ extraction of VFAs to high quality stream from fermented sludge. This study explores the use of vacuum assisted fermentation to extract VFAs in a low solids form and enhance VFA production during fermentation of primary sludge.

Presenter: **Frances OKOYE, Ryerson University, Civil Engineering Dpt., Toronto, CANADA**

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Session reference: 1CO.1.2
Subtopic: 1.5 Municipal and Industrial Wastes
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

The Effect of Acidic Pretreatment on the Hydrothermal Carbonization of Cheese Whey Wastewater (CWW) - the Case Study of Lesvos Island

Short introductive summary:

The dairy production industry is a significant part of the local economy in Lesvos island. Among the different cheese whey waste effluents, the focus is on the cheese whey wastewater (CWW), which consists of wash (rinsing) water and various fractions of primary and secondary whey. This present study considers the overall availability and presents a thorough survey of the operating dairy production facilities in the island. Moreover, the study aims to address the degradability of cheese whey wastewater and proposes an enhanced hydrothermal treatment strategy for valorization of the waste, for the reduction of the pollution load and for the production of hydrochar. A crucial parameter of the approach is assessing the effect of acidic pretreatment of the cheese whey wastewater as a means to stop biological activity and to enhance the carbonization process.

Presenter: **Stergios VAKALIS, University of the Aegean, Environment Dpt., Mytilene, GREECE**

Presenter's biography:

Stergios is an Assistant Professor at the Department of Environment of the University of the Aegean in the field of "Energy Management and Low Carbon Technologies". In the Laboratory of Energy Management, he works on waste gasification, energy modeling, the assessment of fuel characteristics.

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Session reference: 1CO.1.3
Subtopic: 1.5 Municipal and Industrial Wastes
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Hub of Circular Cities bOOsting Platform to Foster Investments for the Valorisation of Urban Biowaste and Wastewater: Aims and Project Layout

Short introductive summary:

While EU member States are far from national and international targets that have been set for GHG emission reduction, waste reduction and transition towards a circular economy, resources like urban biowaste and wastewater still are underutilised. The HOOP Project unlocks bio-based investments by deploying local bioeconomies in Europe through a systemic and cross-cutting approach that offers Project Development Assistance (PDA) to a group of 8 cities and city clusters of diverse sizes and socio-economic contexts, distributed throughout Europe. Aim is to build the technical, economic, financial and legal expertise needed to develop concrete investments to valorise OFMSW (Organic Fraction of Municipal Solid Waste) or UWWS (Urban Wastewater Sludge) to obtain bio-based products. Each PDA will contain detailed implementation assistance and a defined Circular Business Model tailored for each participating "lighthouse" city, as well as financing mechanisms to be used for mobilising investment.
The aim of this paper is to present an overview of the project structure as well as preliminary results.

Presenter: **Hans LANGEVELD, Biomass Research, Wageningen, THE NETHERLANDS**

Presenter's biography:

I am passionate about getting more value from residues, sustainable land use and biomass production. Nearly 30 years experience in analysing cropping systems, land use and renewable energy. Background in agronomy. Founder of Biomass Research, consultant, author and chair.

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Session reference:	1CO.1.4
Subtopic:	1.5 Municipal and Industrial Wastes
Topic:	1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Incentivizing Behaviour for Circular Food Systems: Lessons from Food Waste and Farming

Short introductive summary:

We live in an era of climate crisis and steep global population growth, combined with inefficient resource use and food distribution systems, as well as high levels of food losses and waste globally. In contrast to a linear economic system, a circular economy is "restorative and regenerative by design". In this paper we integrate the concept of circular economy and the food system approach with a behavioural change perspective. For transition to take off, behavioural change from people who are part of the transition is needed. However, behaviour change often does not change by itself. For systemic behaviour change, where we move from new social norms that emerge among niche group, towards new shared social norms that are embraced by a majority, the support of instruments that incentivize behaviour supporting circular food systems plays a key role. We scrutinize case studies on the reduction of food waste and circular farming, to understand how specific, well-targeted combinations of instruments as well as other contextual and personal factors, can fuel the transition to a circular economy.

Presenter: **Gonne BEEKMAN, Wageningen University & Research, WAGENINGEN, THE NETHERLANDS**

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Session reference: 4CO.2.1
Subtopic: 4.1 Sustainability, Socio-Economic Impacts and Public Acceptance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Integrated Life Cycle Assessment of a Bioeconomy Value Chain - Evaluation of Environmental and Regional Socio-Economic Impacts

Short introductive summary:

This work is the first attempt to ingtegrate life cycle based tools such as the traditional environmental life cycle assessment intended together with a regionalized social life cycle assessment method that has been established and validated for assesing wood-based production chains. The integrated approach was implemented to evaluate alternative production scenarios for a hybrid wood-light cement panel currently in its final stages of technical development.

Presenter: **Alberto BEZAMA, Helmholtz Centre for Environmental Research, Bioenergy Dpt., Leipzig, GERMANY**

Presenter's biography:

Dr. Alberto Bezama leads the working group “Systems Analysis of the Bioeconomy” at the Department of Bioenergy. Focus of his research is the development and application of life cycle-based tools to assess the effects of implementing bio-based technologies in a regional perspective.

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Session reference: 4CO.2.2
Subtopic: 4.1 Sustainability, Socio-Economic Impacts and Public Acceptance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

The Impact of Energy Transition in Brazil under the Perspective of the Sexual Division of Labour

Short introductive summary:
The lack of access to clean fuels and efficient technologies for cooking profoundly affects the individual's living and social conditions, causing serious impacts on health, education and economic development. Currently, domestic air pollution is a risk to global environmental health and is compounded by the use of solid biomass in low-tech equipment and poorly ventilated environments.
In this context, the main objective of this study is to analyse the impacts of the energy transition in Brazil, by the replacement of fuelwood for modern fuels for cooking from the perspective of the sexual division of labour.

Presenter: **Daniela HIGGIN AMARAL, University of São Paulo, Institute of Energy and Environment, São Paulo, BRAZIL**

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Session reference: 4CO.2.3
Subtopic: 4.1 Sustainability, Socio-Economic Impacts and Public Acceptance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Eastern Africa Bioeconomy Strategy, from Regional to Global?

Short introductive summary:

Eastern Africa countries have a rich biodiversity and strong bio-resource production base. Around 30% of the region's GDP can be directly attributed to agriculture and other bioeconomy related sectors. The project Bioeconomy Strategy in Eastern Africa (BiSEA) Funded by Bioinnovate has been implemented over the last two years to develop this regional strategy, under the coordination of the Eastern Africa Science and Technology Commission (EASTECO), in collaboration with five regional partners and the national governments of Burundi, Kenya, Rwanda, South Sudan, Tanzania, and Uganda. This paper introduces the proposed policy framework and possible forms to monitor sustainability for bioeconomy in the Global South considering all sustainability pillars and governance models to include all stakeholders essential for the assessment. The framework considers the strategy level to address future policies and other sustainability assessment in the region, focusing mainly on local and regional level issues, such as trade, job creation, capacity building and policy making. This framework will also demonstrate its application in the Global South.

Presenter: **Rocio DIAZ-CHAVEZ, Stockholm Environment Institute, Africa Centre, Nairobi, KENYA**

Presenter's biography:

Dr Rocio A Diaz-Chavez is the Deputy Director for Research and Energy and Climate Change Programme Leader at SEI Africa and is affiliated to Imperial College London. Her work focuses on sustainability assessment and environmental management tools and methodologies applied to bioenergy and bioeconomy

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Session reference: 4CO.2.4
Subtopic: 4.1 Sustainability, Socio-Economic Impacts and Public Acceptance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Societal Techno-Economic Assessment of Biochar Production and Use as Soil Amendment

Short introductive summary:

I started my PhD only quite recently. However, it is the same topic as my master thesis, which was a first iteration of the societal techno-economic assessment. During my PhD I will further elaborate this methodology. Therefore, I would like to present my research plan/idea and the preliminary results from my master thesis.

Presenter: **Luca CAMPION, Hasselt University, Environmental Economics Dpt., Hasselt, BELGIUM**

Presenter's biography:

I studied at Hasselt University for 5 years. I graduated in June 2019 as a business engineer (specialization: technology in business). I started my Ph.D. in October 2019 on the same topic/project as my master's thesis. Therefore, I have some preliminary research to start with.

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Session reference: 3CO.3.1

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Separation and Condensation of Hot Vapours from Oxidative Slow Pyrolysis in Different Fractions

Short introductive summary:
In order to experimentally study the slow pyrolysis process outputs, this work investigates the oxidative slow pyrolysis of three different woody biomasses. In particular, the present work tests the use of an innovative flexible condensation unit, applied to the 50 kg/h slow oxidative pyrolysis unit. In the experimental layout, pyrolysis vapours produced from oxidative slow pyrolysis at 450-550°C, are fractionated and condensed in multiple stages at different temperatures, composed by thermally-controlled liquid inert baths (bubblers). The first stage is maintained above 100 °C to avoid water condensation, while the second cold stage is kept at 0 °C. An electrostatic precipitator (ESP) is placed between the two bubblers to recover the aerosols generated in the first stage. The main scope of the present strategy, specifically developed within H2020 BECOOL project, is to provide a feedstock - pyrolysis oil with reduced water content - suitable for gasification and downstream conversion to advanced biofuels for transports.

Presenter: **Giacomo LOMBARDI, RE-CORD, Ingegneria Industriale Dpt., Florence, ITALY**

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Session reference: 3CO.3.2
Subtopic: 3.2 Pyrolysis
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Microwave Pyrolysis for Valorisation of Animal Manure - an Alternative Approach for Manure Management and Bioproduct Recovery

Short introductive summary:

The present work focuses on the valorisation of horse manure biowaste to produce bioenergy via microwave-assisted pyrolysis technique. The thermal decomposition process is conducted by considering the effects of pyrolysis temperature, catalyst loading and carrier gas flow rate on the yield and quality of end products. Pyrolytic products derived from optimised parameters show that the energy density of bio-char increased by 38.7% with a surface area of 799.57 m2g-1. The bio-oil was found to be enriched with phenolic content while the gaseous product contained high syngas proportion (67.17 vol%). A reaction mechanism pathway for the pyrolysis of horse manure is proposed to elucidate the production route for bioenergy and valuable chemicals. A life cycle assessment (LCA) on the microwave pyrolysis of horse manure for a modelled pyrolysis plant located in Peninsula Malaysia has been conducted to evaluate the energy consumption, operation cost and environmental impact of each unit processes involved.

Presenter: **Cheng Tung CHONG, Shanghai Jiao Tong University, Shanghai, P.R. CHINA**

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Session reference: 3CO.3.3

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Pyrolysis as Option for Utilization of Residues with Focus on Nutrient Availability and Environmental Impact

Short introductive summary:

The conference paper presents the study of the nutrient availability and the environmental impact of residues from biomass utilization processes. A concept has been developed to recycle generally problematic biogenic residues to extend the value chain of these materials. The focus is set on the pyrolysis process, in which the organic compounds of the contaminated residues are decomposed at high temperatures and atmospheric pressure. Primarily the subject is set on biochar production due to the nutrients content. However, if the environmental compatibility is not feasible due to the composition according to the legislation, further applications will be examined. Furthermore, this process can also be regarded as a carbon dioxide sink since the carbon-containing products can be stored to produce negative emissions (BECCS).

Presenter: **Sven POHL, Technical University Mittelhessen, Energy Process Engineering Dpt., Giessen, GERMANY**

Presenter's biography:

Professor for Energy Process Engineering at the Technical University of Mittelhessen. Research fields: Energetic use of Biomass, Hydrogen Technologies, Environmental Protection Technologies. 12 years of professional experience in International Plant Engineering.

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Session reference: 3CO.3.4

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Model of Biomass Production in Accordance with the Need for Organic Matter in the Soil in the Czech Republic

Short introductive summary:

The article deals with the availability of organic matter for the soil while ensuring all the requirements for organic matter on the farm including energy use. Based on the available information, the need to ensure the annual entry of organic matter into the soil in the variant of the current state of crop composition on soil blocks in the Czech Republic was compared for a dose of 2 and 4 t of organic matter per hectare of arable land. Complex model for economic, energy and environmental valuation of different land use ere created. The current disposition of organic matter for the needs of field production, animal production and biogas plants is about 3.5 t of organic matter per ha. According to the current criteria, 2 t / ha is sufficient, according to other findings, the improvement of the quality of organic matter needs to be increased by 0.5 t / ha.

Presenter: **Václav VOLTR, Institute of Agricultural Economics and Information, Modelling of Agricultural Policy Dpt., Praha 2, CZECH REPUBLIC**

Presenter's biography:

Doctorate in Agricultural University, Faculty of Engineering, Fuel economy in agriculture. 10 years assistant professor at the University of Agriculture, use of agricultural machinery. Since 1994 at the Research Institute of Agricultural Economics (now IAEI) as a researcher, Main expertise of land.

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Session reference:	1CV.1.1
Subtopic:	1.6 Innovative Biomass Production for Energy Integrated into Traditional Agri-Forestry Systems
Topic:	1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Characterization of Biochar Produced from Slow Pyrolysis of Spruce Wood and Bark under Inert and CO2 Atmosphere

Short introductive summary:

Production and utilization of biochar in the agricultural sector has gained continuous interests. Biochar with unique properties can considerably improve soil fertility, increase crop yields and sequestrate carbon. Production conditions have considerable effects on yield and property of biochar. This work aimed to investigate impact of highest treatment temperature (HTT), pyrolysis atmosphere and feedstock on yield and properties of biochar produced from spruce wood and bark. Spruce wood and bark chips were pyrolyzed in a fixed bed reactor under slow heating conditions in nitrogen and carbon dioxide atmosphere. Proximate and ultimate analysis were carried out on produced biochar. The morphological characteristics and physicochemical properties of the biochar were studied using nitrogen physisorption by the Brunauer-Emmet-Teller (BET) method, Scanning Electron Microscopy (SEM), and X-ray Energy Dispersive Spectrometry (EDX). The proximate analysis results showed that fixed carbon content (expressed in wt% of dry and ash-free biochar) in the biochar samples strongly depended on the intensity of the thermal treatment and the pyrolysis atmosphere. The carbon content, higher

Presenter: **Liang WANG, SINTEF Energy Research, Thermal Energy Dpt., Trondheim, NORWAY**

Presenter's biography:

Liang Wang is a research scientist at SINTEF Energy Research in Trondheim Norway. His research focuses on thermal conversion and utilization of biomass and wastes for renewable energy and green fuel production and substainable metal prodcution processes.

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Session reference: 1CV.1.3
Subtopic: 1.6 Innovative Biomass Production for Energy Integrated into Traditional Agri-Forestry Systems
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Is It Sustainable to Produce Miscanthus X Giganteus in Sewage Sludge Contaminated Soils?

Short introductive summary:

In order to meet the 40% EU renewable energy target by 2030, the demand for biomasses is increasing sharply, thus increasing the risk of conflicts on land use due to competition for food and feed. Therefore, segregating the growth of dedicated biomass crops on marginal land is an option to overcome these conflicts, once this biomass can be categorized as a low indirect land-use change-risk feedstock. Miscanthus x giganteus is a lignocellulose rhizomatous crop being considered as a viable substitute to non-renewable energy sources. Therefore, the aim of this study was to evaluate the environmental sustainability of Miscanthus x giganteus production in sewage sludge contaminated soils, in Portugal. In this work, Miscanthus was cultivated in pilot fields with different levels of contamination: 50, 100 and 200 Mg (sludge)/ha, corresponding to half – L50, the value - L100 and twice – L200, the maximum deposition of sludge allowable by the European law.

Presenter: **Ana Luisa FERNANDO, Universidade Nova de Lisboa, Ciências e Tecnologia Biomassa Dpt., Caparica, PORTUGAL**

Presenter's biography:

Ana Luísa Fernando holds a PhD in Environmental Sciences. Associate Professor at Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa.Main scientific areas: energy crops, remediation of contaminated soils, valorization of agro residues.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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Session reference: 1CV.1.4

Subtopic: 1.6 Innovative Biomass Production for Energy Integrated into Traditional Agri-Forestry Systems

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Forest Maintenance Residues as Fuel to Provide Energy for a Middle School in Tuscany

Short introductive summary:

This paper aims to evaluate the implementation of a short biomass energy chain inside a regional park in Tuscany. The residual agro-forestal biomass, usually considered as waste, turns into the starting point for bioenergy production and for the realization of a virtuous example of a circular economy system inside the park “Il Giardino-Scornabecchi” in Pisa, where the new “Scuola in Natura” will be built in a short time. The presented paper deals with the technical, economic and environmental advantages and disadvantages of the installation of a renewable energy system that provides energy to the school and a farmhouse, already located in the area, by exploiting the residues of the park’s annual maintenance.

Presenter: **Simone PEDRAZZI, University of Modena and Reggio Emilia, of Engineering "Enzo Ferrari" - Bio Energy Efficiency Laboratory, Modena, ITALY**

Presenter's biography:

Simone holds M.Sc. and Ph.D. degrees in Mechanical Engineer at the University of Modena and Reggio Emilia. He works as assistant professor of Thermodynamics and Heat Transfer at the University of Modena and Reggio Emilia and he is a co-founder of the Bio Energy Efficiency Lab (BEELab).

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Session reference: 1CV.1.8

Subtopic: 1.6 Innovative Biomass Production for Energy Integrated into Traditional Agri-Forestry Systems

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

An Innovative System for Rainwater Harvesting and Storage Through Flexible Water Tanks

Short introductive summary:

Climate change is strongly affecting agriculture worldwide. In Mediterranean zone one of the most challenging issue is related to water deficit as a consequence of climate change. In particular, in Mediterranean Countries, we are facing a higher number of extreme rain events during winter and, on the other hand, a much more lasting and stronger drought during summer. A possible solution to increase the ability of agriculture sector to face such problems relies in being able to collect excess water during winter in order to use it for irrigation during drought period.

The present study aims to compare an innovative prototype of flexible water tank able to store rain water with the traditional artificial basin storage solutions, in order to use this for irrigation during summer period.

Presenter: **Luigi PARI, CREA- Council for Agricultural Research and Economics, Centro di ricerca Ingegneria e Trasformazioni agroalimentari, Monterotondo RM, ITALY**

Presenter's biography:

Dr. Luigi Pari has a PhD in Agricultural Engineering in 1990 and start working as researcher in the Agricultural Engineering Unit (CRA-ING) of the Agricultural Research and Experimental Council (CRA), in Monterotondo (Roma). In 2002 he became Scientific Director of the Non Food Agriculture - Energy Crops Group (PANACEA), coordinating the activities of 18 researchers, which main activity is to develop new agricultural machineries prototype for energy crops harvesting and logistic.

Authors of more than 200 scientific publications, he was scientific responsible of more then 30 research projects, funded by European Union, Italian Ministry of Agriculture and private enterprises

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Session reference: 1CV.1.9

Subtopic: 1.6 Innovative Biomass Production for Energy Integrated into Traditional Agri-Forestry Systems

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Sunn Hemp (Crotolaria Juncea L.) a Novel Multi-Purpose Crop for Alternative Cropping Systems

Short introductive summary:
This abstract is presenting the adaptability and productivity of sunn hemp, when it was grown in rotation systems with wheat, corn and other biomass crops (fiber sorghum, industrial hemp and kenaf).

Presenter: **Efthymia ALEXOPOULOU, CRES - Center for Renewable Energy Sources and Saving, Biomass Dpt., Pikermi Attikis, GREECE**

Presenter's biography:
She is an agriculture engineer grantuated from the Agricultural University in Athens (AUA) with PhD on the "Adaptability and biomass productivity of the non-food crop Kenaf in Greece". She is responsible for Energy Crops Unit in Biomass Department of Center for Renewable Energy Sources.

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Session reference: 1CV.1.10
Subtopic: 1.6 Innovative Biomass Production for Energy Integrated into Traditional Agri-Forestry Systems
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Co-composted Biochar (COMBI) Production and its Effects on Ocimum Basilicum Plants Growth.

Short introductive summary:

COMBI is a soil improver obtained from a composting process of organic material with biochar, obtained by pyrolysis or gasification, added at the beginning of the process itself. Biochar has been used for several years and many studies have shown the benefits it brings when applied to soils, while COMBI is still little studied.

This article aims to demonstrate both the effects of COMBI on the growth of Ocimum basilicum specie plants and to quantify the best quantity to be applied within the substrate.

Presenter: **Filippo OTTANI, University of Modena and Reggio Emilia, Dpt. of Engineering Enzo Ferrari, Modena, ITALY**

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Session reference: 1CV.1.15

Subtopic: 1.6 Innovative Biomass Production for Energy Integrated into Traditional Agri-Forestry Systems

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Life Cycle Assessment of Electromicrobial Production of Renewable Hydrocarbon Fuels

Short introductive summary:

As agricultural production of energy crops has a limited capacity, it cannot completely substitute fossil fuels without severely undermining food security and decreasing biodiversity. Thus, we need to utilise resources that are essentially unlimited and that are independent of agricultural or forestry land use. The EU-funded eForFuel project aims at developing an industrial biotechnology solution that uses electricity and microorganisms to convert CO2 into hydrocarbon fuels, thus providing a sustainable replacement of fossil carbons. As part of a comprehensive integrated life cycle sustainability assessment within eForFuel, we have analysed the environmental impacts associated with three renewable hydrocarbon fuels by means of screening life cycle assessment (LCA). After a brief overview of the eForFuel project, selected results will be presented showing that i) impacts of electricity generation and of providing the feedstock CO2 dominate the results, ii) CO2 emission savings are only achieved in case 100% renewable electricity is used and iii) there are significant differences between e-fuels, fossil fuels and conventional biofuels in terms of land, water and phosphate footprint.

Presenter: **Nils RETTENMAIER, IFEU - Institute for Energy and Environmental Research Heidelberg, Food and Biobased Systems Dpt., Heidelberg, GERMANY**

Presenter's biography:

Nils Rettenmaier is a senior scientist and project leader at the IFEU-Institute for Energy and Environmental Research Heidelberg. Based at the Department of Food and Biobased Systems, his main working fields are LCAs and biomass resource assessments.

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Session reference: 5CV.2.1
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Iron Silica Nanocomposites as Cu Catalysts Support for Reverse Water Gas Shift Reaction

Short introductive summary:

This work showcases the benefits of iron oxide doped mesoporous silica as support for (5 wt.%) Cu catalysts in RWGS reaction. Compared to co-impregnated Cu-Fe/SiO2 catalysts, the competitive reaction rates achieved by iron-silica nanocomposite support were associated to enhanced metal-surface interactions.

Presenter: **Mohammad Fuhad Anwar SINHA, Brandenburg University of Technology, Environmental Resources Management Dpt., Cottbus, GERMANY**

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Session reference: 5CV.2.3
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Importance of the Structure on Ni/YxCexOy Catalysts for CO2 Methanation: Fluorite Versus Pyrochlore

Short introductive summary:

This work aims at understanding the impact of the Yttria Ceria mixed oxide structure on the performance of Ni supported catalysts for CO2 methanation. Thus, the different catalytic behavior of perovskite- (Y2Ce2O7) and fluorite- (Y0.5Ce0.5O2) based catalysts has been evaluated and interconnected with the physicochemical properties exhibited by both pyrochlore and fluorite supports and their corresponding Ni catalysts

Presenter: **Mohammad Fuhad Anwar SINHA, Brandenburg University of Technology, Environmental Resources Management Dpt., Cottbus, GERMANY**

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Session reference: 5CV.2.4
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Energy Analysis on the Effect of Biogas Composition in the Sorption Enhanced Steam Reforming (SESR) for Green Hydrogen Production

Short introductive summary:

The objective of this study is to outline a comprehensive thermodynamic energy analysis of Sorption Enhanced Steam Reforming (SESR) of biogas. Preliminary estimations focus on assessing the effect of the biogas composition on the duty of the reforming reactor, and subsequently on the overall duty of the process including sorbent regeneration by calcination. Previous work from our research group (Capa et al., 2020) has already demonstrated the feasibility of the biogas SESR by experimental data alongside thermodynamic analysis.

Presenter: **Alma CAPA, INCAR-CSIC, Oviedo, SPAIN**

Presenter's biography:

Currently, I am a pre-doctoral researcher in INCAR-CSIC. Master in Chemical Engineering completing my studies with a final Master project about circular economy and residues management in the steel industry.

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Session reference: 5CV.2.6

Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen

Topic: 5. BIOENERGY INTEGRATION

The Effect of Fe Promotion in Ni-Based Catalysts for the Methanation of CO2

Short introductive summary:

CO2 methanation, also known as the Sabatier reaction, has numerous applications ranging from “Power-to-Gas” processes to biogas upgrading. The storage of surplus renewable energy as methane, which is a reliable and high energy density carrier, has certain advantages such as the avoidance of problems related to hydrogen storage and transportation, as well as the utilization of CO2 emitted from point and mobile sources to create a closed carbon cycle. Likewise, the upgrading of biogas via the methanation of its CO2-content (25-50% by volume) can lead to the production of bio-methane (bio-CH4) that can be further utilized in the chemical and petrochemical industries, or as an energy carrier in the residential and electricity sector due to its easy storage and transportation.

Presenter: **Maria GOULA, Laboratory of Alternative Fuels and Environmental Catalysis, University of Western Macedonia, Chemical Engineering Dpt., Kozani, GREECE**

Presenter's biography:

Maria Goula is Professor of Catalysis in the Dept. of Chemical Engineering of the University of Western Macedonia and director of the Laboratory of Alternatives Fuels & Environmental Catalysis. Prof. Goula is author of 62 publications, which have received over 2117 citations (h-index=22, Scopus).

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Session reference: 5CV.2.8
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

The Decarbonisation of the Energy System: Methane Steam Reform Based Hydrogen with Carbon Capture and Storage

Short introductive summary:

This paper explains the role of hydrogen production in low-carbon system and its utilization to meet the demands for energy transition. An analytical assessment of the strategies and policies related to decabonisation targets of UK and Germany has been done . An illustration featuring the demand of potential hydrogen fuel with challenges to overcome has been portrayed and some useful concluding remarks are brought and further recommendations are stated in the conclusion.

Presenter: **Mohammad Fuhad Anwar SINHA, Brandenburg University of Technology, Environmental Resources Management Dpt., Cottbus, GERMANY**

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Session reference: 5CV.2.9

Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen

Topic: 5. BIOENERGY INTEGRATION

Biogas Dry Reforming Reaction over Ni/Al2O3, Ni/CaO-MgO-Al2O3 and Ni/La2O3-Al2O3: Investigation of Carbon Deposition and Catalyst Deactivation

Short introductive summary:

Biogas is widely available as a product of the anaerobic digestion of biomass from various sources such as sewage sludge, landfill, agricultural and livestock activities [1,2]. Moreover, biogas is composed mainly of CH4 [35-75%], CO2 [25-65%], i.e., the main greenhouse gases (and small amounts of hydrogen sulfide (H2S), moisture and siloxanes). In contrast to the polluting combustion for energy/ heat, biogas can be converted to useful products such as syngas (H2/CO) via the reaction of biogas dry reforming. This experimental study reports on the catalytic activity and stability of N/Al, Ni/LaAl and Ni/modAl derived catalysts during the biogas dry reforming reaction. The supporting materials Al2O3, La2O3-Al2O3 and CaO-MgO-Al2O3 were used as commercial supports, while the Ni-based catalysts were prepared via the wet impregnation method using the appropriate nitrate solutions.

Presenter: **Nikolaos CHARISIOU, Laboratory of Alternative Fuels and Environmental Catalysis, University of Western Macedonia, Chemical Engineering Dpt., Kozani, GREECE**

Presenter's biography:

Dr. Nikolaos Charisiou is researcher in the Department of Chemical Engineering of the University of Western Macedonia. His research work has been published in 46 research publications in Peer Reviewed Journals, which has been acknowledged with more than 1126 citations and an h-index of 18 (Scopus).

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Session reference: 5CV.2.10

Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen

Topic: 5. BIOENERGY INTEGRATION

Cool GTL- a New Process for Conversion of Biogas or Recovered CO2 to Liquid Fuels

Short introductive summary:

Cool GTL is a novel process to convert biogas or other CO2 containing streams directly into high quality liquid fuels. Cool GTL can be used to convert biogas, or CO2 from any source plus hydrogen to high quality jet, gasoline and diesel fuels. Cool GTL is low cost modular system and now uses an electric reformer- reverse water gas shift reactor which cuts capital cost, reduces footprint and eliminates all CO2 emissions. In this project, our goal is to make 100 gallons of high-quality jet fuel from biogas. This project will also demonstrate the Cool GTL catalyst and process stability through long term, 24-hour operation.

Presenter: **Pedro ORTIZ-TORAL, Gas Technology Institute, Energy Conversion Dpt., Wheeling, USA**

Presenter's biography:

Dr. Ortiz-Toral manages the bioenergy development program at GTI, with a focus in process optimization. He has over 12 years of experience in biomass conversion and applied catalysis for biorenewables. He received his PhD (2011) from Iowa State University.

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Session reference: 5CV.2.12
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Remarkable Activity, Selectivity, and Stability of Innovative Ni Catalysts for the CO2 Methanation Process at Low Reaction Temperature

Short introductive summary:

At present, the most used technology to reduce CO2 emissions from industrial sources is Carbon Capture and Sequestration (CCS), which involves CO2 capture, transportation and underground storage. However, the captured CO2 could be converted into fuels and chemical, such as synthesis gas (via CH4 reforming]) or methane, following its hydrogenation (the so-called CO2 methanation reaction).
This experimental study reports on the activity and selectivity of Ni/CeO2, Ni/MxOy-CeO2 and Ni/La2O3-MxOy-CeO2 (M= Mg2+) during the CO2 methanation reaction. The supports were synthesized by a microwave assisted sol-gel method using a microwave accelerated reaction system (MARS-6), while the Ni-based catalysts were prepared via the wet impregnation method using the appropriate nitrate solutions. For the investigation of the morphological, textural and chemical structural properties of the supports and catalysts a variety of characterization techniques were performed, i.e., Raman spectroscopy, XRD, N2 physisorption-desorption, CO2-TPD, H2-TPR, H2-TPD, XPS and TEM. Carbon deposition and sintering on the active sites were investigated using TEM.

Presenter: **Maria GOULA, Laboratory of Alternative Fuels and Environmental Catalysis, University of Western Macedonia, Chemical Engineering Dpt., Kozani, GREECE**

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Maria Goula is Professor of Catalysis in the Dept. of Chemical Engineering of the University of Western Macedonia and director of the Laboratory of Alternatives Fuels & Environmental Catalysis. Prof. Goula is author of 62 publications, which have received over 2117 citations (h-index=22, Scopus).

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Session reference: 5CV.2.13
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Techno-economic Assessment of a Two-stage Biomass Gasification System for the Production of Hydrogen, FT-LIquid and Electricity

Short introductive summary:

A techno economic assessment was conducted to evaluate the economic feasibility of producing biofuels from a two-stage gasification system. Three different biofuel paths were considered i.e. hydrogen production, FT-liquid production and electricity production, with each of these plant utilizing 1000 tonnes of dry waste wood per day at a delivered feedstock cost of 50$/dry tonnes.

Presenter: **Hannah KARGBO, Newcastle University, Chemical Engineering Dpt., Newcastle upon tyne, UNITED KINGDOM**

Presenter's biography:

PhD student in chemical engineer, university of newcastle, UK.
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Session reference: 5CV.2.17
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Gasification of Waste Biomass for Hydrogen Production: Effects of Gasification Parameters

Short introductive summary:

In this study, the performance of wood pellets gasification in two-stage gasifier using steam as an oxidising agent is investigated. The effects of temperature in the gasification zone (900°C-1100°C), carrier gas type (N2 and CO2), and steam to carbon ratio (0-5.7) will be discussed. The measurements in this work include product yield, syngas composition, chemicals content in tars, and heating value. Hence, the high hydrogen gas content, produced through the two-stage gasifier using wood pellets, is achieved

Presenter: **Jirat MANKASEM, Newcastle University, School of Engineering, Newcastle upon Tyne, UNITED KINGDOM**

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Session reference: 5CV.2.18
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Simulation Study on Structure, Transport Proprerties, and Dielectric Properties of Aqueous Solutions of Bio-Molecules Used in Biofuel Cells

Short introductive summary:

Research summary
The structure, transport properties, and dielectric properties of bio-molecules, glucose, lactic acid, and glycolic acid, aqueous solution as a model for the anode of biofuel cells are investigated by molecular dynamics. The molecular structure of components of the solution and the atomic charges are optimized by the density functional theory (DFT) using Gaussian09. The distribution of constituent ions of the solution is investigated by a radial distribution function. The shape change of gluconic acid anions in the solution and the frequency distribution of each ion are also examined.

Presenter: **Shigeki MATSUNAGA, National Institute of Technology, Nagaoka College, General Education Dpt., Nagaoka, JAPAN**

Presenter's biography:

Professor of Physics in National Institute of Technology, Nagaoka College, Japan. Graduated from the Faculty of Science, Saitama Univ. in 1981. Received master’s degree at Niigata Univ. in 1983. He also received ph.D degree at Niigata Univ.

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Session reference: 5CV.2.20
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Twinning For Promoting Excellence, Ability and Knowledge to Develop Advanced Waste Gasification Solutions

Short introductive summary:

Lithuania is slowly stepping forward towards economic, technological and sustainable development in the field of Waste-to-Energy (WtE) as well as Power-to-X (PtE), especially processing of waste into alternative renewable fuels and hydrogen. This will be mostly done by sorting at Mechanical and Biological waste treatment plants and municipal solid waste incineration plants. Waste (municipal solid waste (MSW), refuse derived fuels (RDF), solid recovered fuels (SRF), various types of biomass), not suitable for recycling or recovering but still having energetic value, can be successfully utilised for energy, fuels or chemicals production via thermochemical pathway. So far, two MSW incineration plants have been in operation in Lithuania (in Klaipeda and Kaunas). One more MSW incineration plant is under commissioning in Vilnius. Therefore, some highly qualified specialists and engineers will be required to maintain their operation. Moreover, new more advanced thermochemical conversion technologies, e.g. plasma gasification, has to be developed in order to manage waste in a more sustainable way instead of direct waste incineration. Additionally, the PtX concept should be enhan

Presenter: **Andrius TAMOSIUNAS, Lithuanian Energy Institute, Kaunas, LITHUANIA**

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Session reference: 5CV.2.21
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Surface Modified Graphite Cathode Enhances the Electron Uptake of Rhodobacter Sphaeroides

Short introductive summary:

Here, we focus on the electrochemical CO2 reduction with high selectivity at low bias potential (around -0.6V vs. Ag/AgCl) by employing electrochemical system and electroautotroph R. sphaeroides 2.4.1 strain. To make R. sphaeroides as an effective biocatalyst for microbial electrosynthesis (MES), we need to improve its electron uptake ability and growth under electroautotrophic conditions. Electron uptake from extracellular sources is mainly dependent on direct cell contact via biofilm on the cathode surface. Modification of cathode materials with decorating functional groups and increasing surface hydrophilicity might benefit to the adhesion and growth of bacterial biofilm. Generally, negatively charged functional groups on the bacterial surface are responsible for the electrostatic binding of the cationic groups. To generate a positively charged electrode surface, aminopolysaccharide chitosan was coated onto the graphite felt surface. In addition, to induce covalent attachment of bacteria with electrode surface, the chitosan coated graphite felt was further modified with carbodiimide compound to provide the robust amide functionality.

Presenter: **Soo Youn LEE, Korea Institute of Energy Research, Gwangju Bio/Energy R&D Center, Gwangju, REPUBLIC OF KOREA**

Presenter's biography:

RESEARCH INTEREST
1. Bio-electrochemical systems to produce sustainable energy resources
2. Application of chemically functionalized magnetic nanomaterials
3. Bioconversion of soil pollutants to multi-functional amino acids by bacteria

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Session reference: 5CV.2.22
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Biomethane from Coffee-Roasting By-Products: Experimental and Feasibility Investigation of Two Case Studies in Italy.

Short introductive summary:

This study considers the potential termophilic anaerobic digestion of coffee-roasting by-products, and the feasibility of a full-scale plant. Two case studies in Italy are prsented and discussed.

Presenter: **Marco RAVINA, Politecnico di Torino, Environment, Land and Infrastructure Engineering Dpt., Torino, ITALY**

Presenter's biography:

Marco Ravina is post-doc researcher at Turin Polytechnic. His research activity focuses on the study of emissions into the atmosphere, at the local scale (dispersion modelling) and global scale (greenhouse gas balancing).

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Session reference: ICO.1.3
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Estimating Sustainable Aviation Fuel (SAF) Feedstock Availability to Meet Growing European Union Aviation Sector Demand

Short introductive summary:

Sustainable aviation fuels (SAF) are one method to achieve long-term decarbonization of the aviation sector. We define SAF as advanced biofuels produced from wastes and residues. SAF can also be produced via non-biogenic feedstocks such as industrial flue gas and renewable power-to-liquids. SAF made up only up only 0.05% of global jet fuel consumption in 2019 but there is growing interest to scale up production under the ReFuel EU initiative of the European Green Deal framework. This analysis estimates the potential availability of SAF in Europe in 2030 considering feedstock potential, the maturity of fuel conversion pathways, and existing uses of SAF feedstocks. It also contextualizes the availability of SAF feedstocks relative to the projected demand for aviation fuel in 2030.

Presenter: **Jane O'MALLEY, The International Council on Clean Transportation, Washington, DC, USA**

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Session reference: CP.1.1

Subtopic: 1.1 Biomass Potentials and Biomass Production Models

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Algae to Aviation Fuel: an Estimation of the GHG Emission Performance

Short introductive summary:

Due to the relevant role aviation sector is expected to play in transport decarbonisation, we would like to propose this study on the potential GHG offered by algae feedstock.
Algae to kerosene pathway has been recently added to the ICAO list of allowed alternative fuels for aviation.
We are proposing a study based on the ICAO/CORSIA GHG evaluation methodology, in light of the most recent sector technology developments.
We believe this assessment could result of great interest for many stakeholder, both from algae production side, as well as from aviation sector.

Presenter: **Matteo PRUSSI, European Commission, JRC, Unit C.2, Ispra, ITALY**

Presenter's biography:

Matteo Prussi is an Industrial Engineer, with a scientific background in renewable energy conversion technologies. He has been working in biofuels sector for more than 10 years. He is currently employed at the Renewable Energies and Sustainable Transport Unit of the EC Joint Research Center – Ispra.

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Session reference: CP.1.2
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Setting the Scene: under Which Terms and Conditions the European Saf Mandate Can Grow the Industry

Short introductive summary:

Over the last decade, the Sustainable Aviation Fuel (SAF) sector has been working hard to ensure that its fuel is a safe drop-in solution with the capacity to enable a more sustainable aviation sector.

Currently, there are only a few regions in the world where producing and using SAF on a constant basis is or can become an option. The reason why SAF can be produced and used in these regions is largely the result of existing policy mechanisms which are capable of bridging a significant part of the price gap between fossil kerosine and SAF through its incentive.

There are many aspects which need to be considered when drafting a policy framework that needs to accelerate the SAF industry with an incredible speed, whilst ensuring the sustainability of such a drastic growth path. Therefore, this session will elaborate on the challenges and opportunities of such a policy framework in the European context and the way forward.

Presenter: **Katharina ARTS, SkyNRG, Policy & Sustainability, Amsterdam, THE NETHERLANDS**

Presenter's biography:

Karlijn Arts serves as Policy and Sustainability Lead for SkyNRG. She is making sure that the social and environmental sustainability of their fuels can be guaranteed and that a solid policy framework is mobilized to accelerate the growth of the sustainable aviation fuel (SAF) industry.

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Session reference: CP.1.3

Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen

Topic: 5. BIOENERGY INTEGRATION

Advances in the Atj Pathway

Short introductive summary:

The advanced biofuel market today is limited in size but expected to grow, driven by upcoming regulations. The aviation industry will play an important role in the transition to sustainable living, including the use of sustainable aviation fuels (SAF) during recovery from and after Covid-19.There are a number of possible pathways certified by ASTM for producing SAF. The HEFA pathway has been chosen by the majority of oil companies and is expected to dominate the market in the short term. But the limited availability of the feedstocks makes this pathway just an intermediate solution. Technologies such as FT and ATJ tap into more abundant resources, including agricultural and forestry residues. While the FT pathway is still facing a technical challenge of producing syngas fit for purpose from biomass, ATJ technologies main obstacle to market is the cost of production.
To reach an affordable SAF market price, a number of technical advances in ATJ technology have been made over recent years. Of particular note are the advances made by Swedish Biofuels both in the use of new sustainable feedstocks and in new ways for its conversion. The new ASTM certification initiated by Swedish Biofuels, based on the results of engine tests of its ATJ advanced ATJ technology, will bring benefits in a reduction of SAF production costs and the possibility of making a 100 % replacement of fossil aviation fuels.

Presenter: **Angelica HULL, Swedish Biofuels AB, Managing Director, Stockholm, SWEDEN**

Presenter's biography:

Dr Angelica Hull is the founder and CEO of Swedish Biofuels, a company based in Stockholm with an established track record of major innovation in the conversion of biomass into transport fuels. Under the leadership of Dr Hull, Swedish Biofuels, with its advanced alcohol to jet (ATJ) technology, has beco a pioneer in producing neat Sustainable Aviation Fuels from woody biomass, used by engine producers and military for testing and certification. Dr Hull is author and co-author of more than 100 patents in the domain of alternative fuels and chemicals. Over last 10 yeas she has been contributing with her expertise to a number of EC initiatives for the promotion of sustainable transport fuels.

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Session reference: CP.1.4

Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen

Topic: 5. BIOENERGY INTEGRATION

Alternative Methods of Extracting Aluminum from Sludge Derived from the Metallurgical Industry

Short introductive summary:

In the aluminum industry, several byproducts are concentrated in the sludge of their water treatment plants. Due to its origins, this sludge is rich in aluminum, which can be extracted and purified. In this work, three methods of aluminum extraction are evaluated at recovering aluminum of sludge from the company Alumina® from Medellín, Colombia. First, chemical characterization was performed and it confirmed the high concentration of aluminum. The extraction was carried out whit the Bayer method, using 1:10, 1:15, and 1:20 sludge/solution ratios; and with acid chloride using 1:15 and 1:20 ratios. Extraction with isopropanol was also carried out using different ratios of catalysts and reagents. Aluminum, iron, copper, and nickel concentrations in the aqueous phase were measured to determine the recovery of the metals and the selectivity of the method. It was found that extraction with acid chloride obtained the highest recovery (99.32%) with a 1:20 ratio, however, the most selective method was the Bayer method. On the other hand, extraction with isopropanol was not successful in any test.

Presenter: **Juan Camilo MAHECHA-RIVAS, Universidad de los Andes, Bogotá, COLOMBIA**

Presenter's biography:

Last semester Environmental Engineering and Chemical Engineering student of the University of the Andes with complementary studies in Portuguese Culture and Language, from Bogotá, Colombia. Interests oriented in waste valorization and environmental surface water modelling.

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Session reference:	1CO.4.1
Subtopic:	1.5 Municipal and Industrial Wastes
Topic:	1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

An Advanced Process for Thermal Treatment of Municipal Sewage Sludge

Short introductive summary:

The novel sludge combustion process by Endev Ltd. eliminates the need for wet sludge transportation. In this process, mechanically dewatered sludge (20–25 wt% dry solids content) from an adjacent WWTP is first dried at 110 °C in a circulating mass dryer and then combusted at 850 °C in a circulating mass reactor. With a minimum residence time of two seconds, the organic fraction is completely decomposed and unwanted contaminants are eliminated during combustion. The ash – relatively high in nutrients and sufficiently low in heavy metals – can be further processed into fertilizers and used in forestry or farming. The commissioning of Endev's first commercial sludge combustion facility is underway in Rovaniemi, Finland (Fig. 1). The process is self-sufficient in terms of energy, and the excess heat extracted from the process is utilized as district heat by the city of Rovaniemi. This work reports the preliminary operating experiences from the plant. Furthermore, the potential of the proposed technology for efficient and sustainable handling of municipal sewage sludge is discussed.

Presenter: **Petteri PELTOLA, Endev Ltd., Helsinki, FINLAND**

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Session reference: 1CO.4.2
Subtopic: 1.5 Municipal and Industrial Wastes
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Investigation of the Potentials and Synergetic Effects of Co-Liquefaction of Lignocellulosic Biomass with Sewage Sludge

Short introductive summary:

The research was conducted to investigate co-liquefaction potentials of lignocellulosic feedstock with sewage sludge in order to make future scale up of HTL process and fuel production cost effective. Various ratios of two feedstock and catalysts were investigated in micro batch reactors.

Presenter: **Swanand BHATWADEKAR, Aalborg University, Aalborg, DENMARK**

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Session reference: 1CO.4.3
Subtopic: 1.5 Municipal and Industrial Wastes
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Energy Recovery Potential from Domestic Wastewater with Low Carbon and Volatile Solids Concentration: Analyses in Terms of Municipal Characteristics

Short introductive summary:

The Brazilian National Plan of Sanitation (PLANSAB) indicates, within the policy goals, an expectation to reach universal sanitation access until 2033. However, in Brazil, waste management demand improvements. In the case of domestic effluents, only 45% to 55% of the total amount is collected and treated. Given this scenario, the need to expand effluent collection and treatment services are noticed, mainly in States with precarious infrastructure. The main difficulty in expanding the service is related to the construction of new treatment plants which require high investment costs for construction and operation. However, the energy recovery of domestic wastewater can serve as an incentive to revert this scenario by reducing costs such as utilizing biogas for energy generation. Also, projects for energy recovery from waste improve the achievement of the Sustainable Development Goals (SGDs), such as Goal 3: good health and well-being, Goal 6: clean water and sanitation, and Goal 7: affordable and clean energy. Thus, the study aims to analyze the main variables related to the substrate characteristics and their impacts on biogas production potential.

Presenter: **Laís ALVES SOUZA, Universidade de São Paulo, São Paulo, BRAZIL**

Presenter's biography:

Environmental Engineer (2009-2014) with a exchange in Germany (2012-2013), developed Scientific Initiation projects by CNPq, holds a Master's degree in Energy at the Institute of Energy and Environment (IEE - USP) and works at the Environmental Sanitation Company in the State of Maranhão/Brazil.

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Session reference: 1CO.4.4

Subtopic: 1.5 Municipal and Industrial Wastes

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Smart Strategies for the Transition in Coal Intensive Regions

Short introductive summary:

Currently, 41 regions in 12 EU Member States are actively mining coal. This provides direct employment to about 185,000 people across the EU, with additional indirect jobs relying on coal production. However, the EU’s decision to move to emission-free technology is not subject to discussion and it is therefore necessary, taking into account the difficulties of these regions, to anticipate and propose the energy policy that is in line with the climate targets. Different EU member states are having an energy balance characterized by high consumption of fossil fuels – coal and oil and have to resolve the most difficult tasks to comply with European energy and climate targets. Energy policy implementation is closely linked to market implementation and financing. This opens new opportunities also for the implementation of different renewable energy projects, including biomass projects.

Presenter: **Rita MERGNER, WIP Renewable Energies, Munich, GERMANY**

Presenter's biography:

M.A. RitaMergner is a Project Manager at WIP in the Biomass Unit. She graduated in Public Management and Law and is experienced in policy analysis, formation and implementation as well as policy research in the field of renewable energies, especially in biomass.

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Session reference: 5CO.5.1

Subtopic: 5.4 Market Implementation, Investments & Financing

Topic: 5. BIOENERGY INTEGRATION

A Two-Stage Model Predictive Control Algorithm for Biogas Photovoltaic Hybrid System

Short introductive summary:

Due to the expansion of variable power generation from wind and solar energy, the demand for advanced energy system man-agement is steadily increasing. To meet the resulting challenges and ensure electricity grid stability, flexible generation units are required. In this context, the Institute of new Energy Systems at Technische Hochschule Ingolstadt is working on the research project “NETFLEX – Development of a predictive control system for the integration of biogas plants into electricity grids with a high proportion of variable power generators”, funded by the German Federal Ministry of Food and Agriculture. The aim of the project is to develop model based innovative operation strategies and a model predictive control algorithm for biogas plants to avoid short-term electricity grid overload and to contribute to grid stability in local electricity distribution grids.

Presenter: **Katharina BÄR, Technische Hochschule Ingolstadt, Institute of New Energy Systems, Ingolstadt, GERMANY**

Presenter's biography:

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Session reference: 5CO.5.2
Subtopic: 5.4 Market Implementation, Investments & Financing
Topic: 5. BIOENERGY INTEGRATION

Data and Model Based Analysis and Optimization of Heat Pump Integrated Biomass Heating Networks

Short introductive summary:

The main task of the research is the analysis and optimization of the heat pump integrated biomass district heating networks based on real operation data and dynamic modelling. Over the past few years, studies have shown that due to the increase in biomass energy prices, the reduction in fossil fuel costs and the development of alternative technologies, it has become even more important to increase the efficiency of biomass heating networks in order to improve their competitiveness. The most effective measures to increase efficiency are the installation of flue gas condensing units in biomass heating plants and the innovative integration of heat pumps. Within the framework of the BioCond project, an in-depth analysis using modelling and data from actual plants showed that the integration of flue gas condensation and heat pumps resulted in a 22% increase in efficiency, but meanwhile a higher primary energy demand due to the heat pump electricity demand.

Presenter: **Yusheng CHEN, Regenerative Energy Systems TUM Campus Straubing for Biotechnology and Sustainability, Straubing, GERMANY**

Presenter's biography:

since 06/2020 Research assistant, Professorship regenarative Energy systems, TU Munich
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Session reference: 5CO.5.3
Subtopic: 5.4 Market Implementation, Investments & Financing
Topic: 5. BIOENERGY INTEGRATION

Concentrated Solar and Biomass Hybrid Power Plants: Impact of Thermal Energy Storage into Biomass Annual and Seasonal Utilization

Short introductive summary:

In this study, a technical analysis of the CSP-TES-Biomass hybridization is developed, exploring the synergy between the participating generation sources. The effect of the inclusion of the backup system on parameters such as the capacity factor and the electrical efficiency of CSP Stand-alone plants is addressed. Besides, the impact of the inclusion of different thermal storage capacities on the solar fraction, the annual use of biomass, and the distribution of its demand both monthly and seasonally are evaluated. CSP-Biomass hybridization provides improved dispatchability with 100% renewable support to CSP plants while reducing the uncertainty from biomass supply. Hybridized systems would allow better use of the resources involved, especially when these are in limited quantities. This means that the installation of CSP-Biomass hybridized plants can be extended to regions further north in Europe.

Presenter: **Raúl GUTIÉRREZ, AICIA, Sevilla, SPAIN**

Presenter's biography:

Raul Gutierrez is a Ph.D. candidate at the Chemical and Environmental Engineering Department at the University of Seville. His research is based on power, fuels, and chemicals production through the hybridization of concentrated solar power technologies and thermochemical conversion of biomass.

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Session reference: 5CO.5.4
Subtopic: 5.4 Market Implementation, Investments & Financing
Topic: 5. BIOENERGY INTEGRATION

Primary Interactions of Biomass Components during Fast Pyrolysis

Short introductive summary:

This study investigated the primary reactions occurring when the main component of biomass are mixed and blended together. A comparison was also made with the native biomass (Birchwood).

Presenter: **David O. USINO, University of Borås, Resource Recovery and Building Technology Dpt., Boras, SWEDEN**

Presenter's biography:

Doctoral student at the university of Boras

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Session reference:	3CO.6.1
Subtopic:	3.2 Pyrolysis
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Catalytic Fast Pyrolysis of Defatted Microalgae Using Different Metal-Doped HZSM-5 Catalysts

Short introductive summary:

This study evaluates the effects of loading metal species, i.e. Zn, Cu, Ni, Co and Ce to HZSM-5 zeolites on the pyrolysis product distribution of defatted microalgae by applying micro-pyrolysis (Py-GC/MS).Deoxygenation and denitrogenation indices and aromatic selectivity were defined to evaluate catalyst performance based on the difference in relative yields in O-containing, N-containing compounds or aromatic hydrocarbons with and without catalysts. Catalyst characterization including crystallinity, pore sizes and acid sites were measured by XPS, N2 adsorption-desorption and NH3-TPD.

Presenter: **Qi NIU, Ghent University, gent, BELGIUM**

Presenter's biography:

I am a PhD student in Ghent University. My research topic is about microalgae pyrolysis

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Session reference: 3CO.6.2

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Enhanced Pyrolysis of Lignin for the Recovery of Bio-Aromatics

Short introductive summary:

This work described fast pyrolysis of lignin, which was greatly improved by using simple addtives. This is particularly interesting to obtain bio-based aromatic compounds.

Presenter: **Stef GHYSELS, Ghent University, Green Chemistry and Technology, Thermochemical Conversion of Biomass Research Group, Gent, BELGIUM**

Presenter's biography:

Stef Ghysels graduated as bioscience engineer, specialized in chemistry and bioprocess technology at Ghent University.
Afterwards, Stef Ghysels started as PhD and teaching assistant at the department of Green Chemistry and Technology, at the research group of Thermochemical Conversion of Biomass.

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Session reference:	3CO.6.3
Subtopic:	3.2 Pyrolysis
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Kinetic Study of Acid Pretreated Biomass Using Coats-Redfern Method

Short introductive summary:

Thermal kinetics of raw and sulfuric acid pretreated biomass was investigated. This work supplements knowledge on the effect of acid pretreatment on biomass kinetics and provides useful information to optimize the reaction conditions.

Presenter: **Nannan WU, UGent, Ghent, BELGIUM**

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Session reference: 3CO.6.4

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Impact of Biochar on the Anaerobic Digestion of Waste Activated Sludge

Short introductive summary:

Dr Marco Chiappero, 27 years old, is currently a PhD student in Environmental and Civil Engineering at Politecnico di Torino, Italy. He received his Master in 2018 in Environmental Engineering at Politecnico di Torino. In 2018, for his Master thesis, he spent a five-month stay in the Department of Civil Engineering at McGill University in Montreal, Canada, focusing on pre-treatments to optimize the anaerobic digestion of wastewater sludge. At present, his PhD research activity concerns the optimization of methane production from different bio-wastes by the addition of biochar.

Presenter: **Marco CHIAPPERO, Politecnico di Torino, DIATI Dpt., Turin, ITALY**

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Session reference: 2CV.3.2

Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Combinatorial Effects of Temperature, PH and Retention Time on Anaerobic Digestion of Switchgrass

Short introductive summary:

To better design AD systems for conversion of lignocellulosic feedstocks an understanding of how the system behaves at different operating conditions is vital. This study provides steady state process data that may be used to evaluate AD of lignocellulosic feedstocks across operating conditions combining mesophilic and thermophilic temperatures, acidic, neutral and basic pH, and 3, 5 and 10 day retention times. Preliminary data indicates neutral and thermophilic condition may provide the highest percent conversion. However, other combination may yield products that are better suited for integration with other processes, such as basic conditions having biogas better suited for systems requiring high methane purity with minimal need for carbon dioxide removal.

Presenter: **Katharine HIRL, University Park, State College, USA**

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Session reference: 2CV.3.3
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Anaerobic Codigestion of Tomato Pomace (Peels Plus Seeds) with Buffalo Sludge Improves Methane Production

Short introductive summary:

The buffalo farming and the cultivation of tomatoes for processing are typical Italian productions. Both produce consistent quantities of residues which disposal represents a concern in terms of environmental and economic impact. While the codigestion of agro-food wastes with cattle slurry has been analyzed, the use of buffalo slurry for the same purposes was less studied. Objective of the work was to identify the optimal inoculum/substrate ratios (ISR) of buffalo sludge (BS) and tomato pomace (TP) for producing biogas through anaerobic digestion. TP extracted from a commercial variety of tomatoes were used in a batch experiment in an Automatic Methane Potential Test System (AMPTS, Bioprocess Control, Sweden). The highest percentage of methane reached in biogas was: 75.1, 76.4, 70.8, 32.9 and 69.1 for ISR 3.6, 2, 1, 0.5 and BS respectively. The higher cumulated production was obtained with ISR 1 (11,2 NL CH4 /L). The results highlighted the potential of the TP/BS codigestion and the synergy that can be obtained by balancing the process with an optimal substrate inoculum ratio (ISR). The VS concentration of TP appears the key factor when codigested with BS.

Presenter: **Enrico SANTANGELO, CREA, Research Centre for Engineering and Agro-Food Processing, Monterotondo, ITALY**

Presenter's biography:

Dr. Enrico Santangelo has a Degree in Agricultural Science, and the PhD in Plant Genetic. He is researcher at CREA-IT where he has been involved in research activities concerning the mechanization of energy crops. Currently, he is working on the recovery and exploitation of agriculture residues.

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Session reference: 2CV.3.4
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Assessment of Synergistic Effects during Co-Digestion of Typical Agro-Industrial Wastes Using Biochemical Methane Potential (BMP) Assays

Short introductive summary:

The large amounts of waste produced during the agro-industrial activities, may cause tremendous environmental impacts if they are managed improperly. Anaerobic digestion (AD) of agro-industrial wastes is considered as the most promising biological process, for the effective treatment of high organic content waste streams. AD presents both environmental and economic benefits, as it provides pollution control and energy production, in a circular economy context. This study aimed at assessing the anaerobic digestability and methane production potential of typical agro-industrial wastes, namely olive-mill wastewater (OMW), cheese whey (CW) and liquid cow manure (LCM), as well as the effect of co-digestion of these waste streams.

Presenter: **Michael KORNAROS, University of Patras, Chemical Engineering Dpt., Patras, GREECE**

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Session reference: 2CV.3.5

Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

A New Waste Free Technology for Recovery of Ligno-Cellulose as Biogas as Energy Source and as Feedstock for Chemical Products

Short introductive summary:

Biogas production from organic waste is one of the most promising ways to recycle carbon dioxide to produce energy and chemical products being produced from oil and natural gas. The wasted enormous amounts of ligno-cellulosic waste from agriculture are very attractive as raw materials for biogas production by anaerobic digestion. Further biogas can be upgraded and used as an alternative fuel to natural gas or to be converted to syntheses gas by dry reforming to get chemical products. The present paper shows some results from pilot scale study on biogas production from hay.
Various methods for pre-treatment of cellulose were tested.
A consecutively connected set of four bioreactors operating at mesophilic temperature mode was constructed. The used substrate was ground hay mixed with cow dung as inoculum. The experimental data showed high biogas yield with methane concentration reaching 80% vol. The biogas could be subjected to catalytic dry reforming to produce synthesis gas.
The cascade of bioreactors can operate autonomously in parallel under different conditions.
Optionally the biogas was upgraded by carbon dioxide absorption to produce chemical products.

Presenter: **Venko BESCHKOV, Institute of Chemical Engineering, Bulgarian Academy of Sciences, Lab Chemical and Biochemical Reactors, Sofia, BULGARIA**

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Session reference: 2CV.3.8
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Improving Sustainability and Circularity of Palm Oil by Anaerobic Digestion of Empty Fruit Bunch, Mesocarp Fibre, and Palm Oil Mill Effluent, Enabling Self-Sufficient Energy Production from Biogas

Short introductive summary:
The production of palm oil can improve the sustainability and circularity by anaerobic digestion of EFB, MF, and POME. Anaerobic digestion experiments with untreated and steam treated EFB and MF were performed. It was experimentally proven that steam treatment of EFB and MF improves the anaerobic digestibility of these residues. Conceptual palm oil mill set-ups were analysed on techno-economic, environmental, and circularity aspects.
The biogas from the EFB, MF, and POME can provide enough energy to be self-sufficient in steam and electricity. If the steam boiler runs on biogas instead of biomass, no cyclone and electrostatic filter are required for emission control, which equalizes the CAPEX related to a larger biogas system. Preventing methane emission from open POME ponds drastically decreases GHG emission. Besides, extra revenues can be obtained from surplus electricity and the export of shell. Moreover, the nutrients and recalcitrant organic matter are preserved in the sludge and effluent, which can be returned to the soil of the plantation.

Presenter: **Juliën VOOGT, Wageningen Food & Biobased Research, Wageningen, THE NETHERLANDS**

Presenter's biography:
Scientist at Wageningen Food and Biobased Research

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Session reference: 2CV.3.9
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Start-Up of Trickle Bed Reactor Using Inoculation with Cow Manure for Ex-Situ Biomethanation

Short introductive summary:

Biogas is mainly a blend of CH4 and CO2 where CO2 occupies a significant part of the volume (from 20 up to 45%) representing no energetical use. In recent years, methods for CO2 reuse in biogas production have gained a high interest. One of these methods is microbial CH4 production through the hydrogenotrophic methanogenesis catalyzed by methanogenic archaea that use CO2 and H2 as substrate. In this work, the direct inoculation of the reactor with cow manure to enrich hydrogenotrophic methanogenesis was investigated. The studies were performed in a counter-current trickle bed reactor (TBR) filled with packing material (working volume 815mL). The data indicated a rapid development of hydrogenotrophic methanogens originating from the cow manure. This approach allowed for complete acclimatization within 9 days leading to a stable biomethane production with CH4 content 90%. In contrast to other studies, this approach does not require any special acclimatization procedure (or inoculum) and pH-maintaining systems.

Presenter: **Michal SPOSOB, NIBIO, Division of Environment and Natural Resources, ÅS, NORWAY**

Presenter's biography:

Research Scientist (2020-) - Norwegian Institute of Bioeconomy (NIBIO), Norway
Postdoctoral Researcher (2019-2020) - Chungbuk National University, South Korea
PhD Student (2014-2018) - University of South-Eastern Norway (USN), Norway

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Session reference: 2CV.3.11
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Analysis of the Potential Biogas Production from Pig Manure in Pig Farms Located in Colombia

Short introductive summary:

The production of pig manure in farms represents at least 5.7% of the total weight of these animals. These residues produce pollution, contamination of water, and generates conflicts with the communities that leave nearby. This work intends to evaluate the composition of pig manure from four different farms located in Colombia and study the biogas production at laboratory scale and compare this production with the real potential of fermenters located in each one of the pig farms. The compositional analysis was perfomed using NREL protocols, then the Biological Methane Potential (BMP) using the standard VDI4630 and the Theroetical Biological Methane Potential were determined. After that biogas production was evaluated in farms in Valle del Cauca, Atioquia, Tolima and Cundinamarca. Possible improvement opportunities were identified in farms where an economic benefit due to biogas productions is generated.

Presenter: **Daniel David DURÁN-ARANGUREN, Universidad de los Andes, Chemical Engineering Dpt., Bogotá, COLOMBIA**

Presenter's biography:

Chemical Engineer(2014)-Universidad de América,Bogotá, Colombia
MEng. Process and Product Design(2017) and MSc. Chemical Engineering(2018)-Universidad de los Andes, Bogotá, Colombia
Teaching Assisant(2017 - 2020)-Universidad de los Andes
PhD Student(2019 - Present)-Universidad de los Andes

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Session reference: 2CV.3.13
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Fine and Platform Chemicals from Wood by Combining Chemical and Biotechnological Processes

Short introductive summary:

This contribution is on the realization of an integrated biorefinery concept, which makes use of the pilot plant facilities available at the Fraunhofer CBP. In detail, wood chips were fractionated by the organosolv process and all products were converted into value-added fine and platform chemicals. The optimization and evaluation of each process allow a comprehensive assessment of the value chain from raw material processing and conversion to product separation.

Presenter: **Ireen GEBAUER, Fraunhofer Center for Chemical-Biotechnological Processes, Biomass Fractionation Dpt., Leuna, GERMANY**

Presenter's biography:

2007 - 2012 B.Sc. and M.Sc. in Chemistry, Leipzig University, Germany
2013 - 2017 PhD Chemistry, Leipzig University, Germany
2018 - 2019 Project Manager at Wood K-plus, Lenzing, Austria
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Session reference: 3CV.4.2
Subtopic: 3.6 Biorefineries
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Comparison of Rapid Calibration Models to Predict the Composition of Biomass Based on FT-NIR, FT-IR and Solid-state NMR

Short introductive summary:

My name is Kristoffer Mega Herdlevær. I am a PhD student at the Department of Chemistry, University of Bergen. I conduct research toward «Utilization of woody biomass and residues for production of energy products and high-value natural compounds.» This project addresses basic research challenges in the different steps of biomass treatment and use to provide a validated basis for developing a lignocellulosic woody biomass biorefinery that is suitable for the conditions specific to Western Norway.

Presenter: **Kristoffer HERDLEVÆR, University of Bergen, Chemistry Dpt., Bergen, NORWAY**

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Session reference: 3CV.4.4

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Lack of Data? a Decision-Making Approach to Process Synthesis of Biorefineries under Uncertainty

Short introductive summary:

Climate change is a widespread issue posed by greenhouse gas (GHG) emission produced from human activities. As emission mitigation protocols increases in number, one way to comply with these protocols is by implementing biorefineries. A biorefinery converts biomass into biofuel, power and chemicals through a combination of processes. Due to the heterogeneous composition of biomass, various processing pathways are available for biomass conversion. This makes designing an optimal biorefinery process a difficult task. In addition, the inherent uncertainties in biomass feedstock supply would further complicate the decision-making process. To address these challenges, this work developed an optimisation model to synthesise an optimal biorefinery process design under uncertain feedstock conditions by adapting the Hurwicz Criterion approach. The uncertainty in the feedstock supply is represented as scenarios in Hurwicsz Criterion approach. This approach allows the decision makers to input anticipated feedstock supply values into the criterion to choose the best alternative design.

Presenter: **Viknesh ANDIAPPAN, Heriott-Watt University Malaysia, School of Engineering and Physical Sciences, Putrajaya, MALAYSIA**

Presenter's biography:

Viknesh Andiappan is an Assistant Professor at Heriot-Watt University, Malaysia Campus. His area of specialisation centres on the development of systematic design approaches for biomass energy systems and supply chains. His research aims to integrate process design and operational considerations

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Session reference:	3CV.4.5
Subtopic:	3.6 Biorefineries
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

A Novel Gradient-Based Monitoring System for Dark Fermentation in Plug-Flow Reactors

Short introductive summary:

Dark fermentation has a great potential to provide short-chain carboxylic acids as substrate in many subsequent mono-cultivation bioprocesses. Plug-flow reactors with exclusive radial mixing of the substrate can evolve a segregation of the AD steps like hydrolysis, acidogenesis and methanogenesis. Nevertheless, on-line monitoring of the corresponding gradients for improved process control was not deeply investigated so far. In this work, sensors are mounted at dedicated spots along the PFR. This allows to monitor values of the pH, redox potential and conductivity. It is investigated whether gradient formation would offer benefits for an automated operation and increased robustness, while process disturbances and performance optima can be identified quickly.
Correlation analysis showed that the formation of gradients, with the pH, ORP and conductivity variations along the reactor, appears in parallel to the SCCAs accumulation in the liquid phase and an enhanced H2 production.
The application of different conditions to AD and DF in PFR permits to evaluate the relevance of the various parameters in the gradient formation.

Presenter: **Marion LONGIS, Technische Universität Berlin, Bioprocessing Dpt., Berlin, GERMANY**

Presenter's biography:

PhD Student at the Bioprocessing chair of Peter Neubauer at TU Berlin from February 2019, I am part of the FACCE-SURPLUS financed project PASS-BIO: Plug Flow reactor-based Acid fermentation for Small Scale BIO-refineies under supervision of project leader Dr. Stefan Junne.

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Session reference:	3CV.4.6
Subtopic:	3.6 Biorefineries
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Valorization of Lignocellulosic Waste from Greenhouse Horticulture Crops within a Biorefinery Concept

Short introductive summary:

The fruit and vegetable sector and, in particular, the horticultural intensive type systems dedicated to the production of greenhouse vegetables, represents one of the main industries generating organic waste. These crops produce considerable amounts of lignocellulosic residues after harvesting of horticultural products. This residue is currently used as a substrate in composting transformations; however, the present work aims at providing new alternatives for its conversion towards biofuel production and other relevant high added-value products.
The use of lignocellulosic biomass carbohydrates as a sugar source for the production of bio-based products requires a pretreatment process for effective biomass fractionation. In this work, the extrusion process has been selected as pretreatment technology for enhancing the accessibility of the lignocellulosic residue resulting after harvesting of greenhouse horticulture crops. Enzymatic hydrolysis yields up to 81% were obtained after the alkaline extrusion pretreatment.

Presenter: **Maria José NEGRO ALVAREZ, CIEMAT, Energy Dpt., Madrid, SPAIN**

Presenter's biography:

Senior Researcher at CIEMAT (Spain). The main research areas include biological processes for energy production from biomass resources, micro-organisms research for biofuel production, fermentative processes and biomass pre-treatment processes.

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Session reference: 3CV.4.7
Subtopic: 3.6 Biorefineries
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Integrated Biorefinery of Food Processing Byproducts: Subcritical Water Pre-Treatment of Apple Pomace Coupled with Hydrothermal Carbonization and Subsequent Anaerobic Digestion

Short introductive summary:

Food losses and food waste are critical issues. Indeed, almost one third of all food produced worldwide is lost or wasted. This not only raises concerns about the unethical behaviour of wasting food in a world where famine still exists but also about the sustainability of the overall food system. In this study, we propose an integrated process to take advantage of both the residual wet streams from food processing industries and their high water content considering apple pomace as the model substrate. The process consists in three combined steps: subcritical water pretreatment (SubH2O), hydrothermal carbonization (HTC) of the pretreated solid fraction and anaerobic digestion (AD) of the pretreated liquid fraction combined with the HTC solid product (i.e. hydrochar). According to the preliminary results, subcritical water deconstructs apple pomace matrix, solubilizing organic compounds that can be more conveniently exploited. Thus, SubH2O pretreatment can be an effective option to reduce the environmental footprint associated with food processing industries.

Presenter: **Jacopo PAINI, Libera università di Bolzano, Science and Technology Dpt., Bolzano (BZ)., ITALY**

Presenter's biography:

Enthusiastic about life with an upbeat spirit, I know how to have fun and tend to value all which is fresh and new in the world. On the other hand, I must admit that I can get bored easily. It’s all about big thrills and exciting antics that take me out of my comfort zone.

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Session reference: 3CV.4.9

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

The URBIOFIN Project: an Integrated Innovative Biorefinery for the Transformation of Municipal Solid Waste into New Bio-Based Products

Short introductive summary:

The European project URBIOFIN (Grant agreement ID: 745785) aims at demonstrating an integrated innovative biorefinery for the transformation of the organic fraction from municipal solid waste (OFMSW) into new bio-based products. The project will optimise at a demo scale the transformation of OFMSW into different chemical building blocks (e.g. bioethanol, volatile fatty acids (VFA), and biogas), biopolymers (e.g. polyhydroxyalkanoates (PHA)), and additives (e.g. bioethylene, biofertilisers) using novel physico-chemical and biological approaches grouped within three interconnected modules. Overall, the URBIOFIN project will valorize the OFMSW into new bioproducts with applications in different sectors, thus contributing to implementing the Bioeconomy Strategy of the European Union.

Presenter: **Antonio David MORENO GARCIA, CIEMAT, Department of Energy, Madrid, SPAIN**

Presenter's biography:

Antonio D. Moreno is Researcher at the Biofuels Unit at CIEMAT (Spain). He has expertise on the production of advanced biofuels and bio-based products from lignocellulosic materials, focusing mainly in fractionation technologies, biocatalysis and microbial fermentation.

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Session reference:	3CV.4.10
Subtopic:	3.6 Biorefineries
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Waste-Based Biorefinery Proposition as Alternative to the Sugarcane Vinasse Destination from Brazilian Sugar-Energy Sector

Short introductive summary:

Brazil occupies the position of second largest ethanol producer in the world, largely using hydrated ethanol in flexible-fuel vehicles and fuel mixtures with addition of anhydrous ethanol to gasoline. In the Brazilian harvest of 2019/2020, 642.6 million tonnes of sugarcane were processed to produce 34 million cubic meters of ethanol and 29.7 million tons of sugar. Sugarcane cultivation promotes the production of several residues from the field to industrial processing, being bagasse and vinasse the most expressive in quantitative terms. The present study encourages the implementation of sugarcane vinasse biorefineries, using fermentative routes, microalgae cultivation and complementary processes, expanding the ethanol productive chain sustainability.

Presenter: **Rafael PEREIRA, Universidade Federal do ABC, Santo André, BRAZIL**

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Session reference: 3CV.4.11

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Phosphoric Acid Catalysed Hydrolysis Impact on the Cellulose Content in the Wood Residue after Furfural Production

Short introductive summary:

These are the first scientific results of the ERDF project "Investigation of the impact of phosphorus-containing catalysts on the conversion of wood C-5 and C-6 polysaccharides into products with high potential for integrated biorefineries".The main goal of this research is to find out the optimal parameters for phosphoric acid catalysed hydrolysis that allow to produce of furfural from wood chips and save cellulose in the lignocellulosic residue for further conversion processes. These results will be used as a reference to evaluate other phosphorus-containing catalysts effect on furfural production and enzymatic hydrolysis.

Presenter: **Prans BRAZDAUSKS, Latvian State Institute of Wood Chemistry, Biorefinery Laboratory Dpt., Riga, LATVIA**

Presenter's biography:

P.Brazdausks works at the Latvian State Institute of Wood Chemistry. The research area embraces the development of a pretreatment technology for complex processing of lignocellulosic biomass to obtain valuable products-furfural, ethanol, etc.

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Session reference: 3CV.4.12
Subtopic: 3.6 Biorefineries
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Evaluation of Ni-based catalysts for hydrotreatment of bio-oil model compound mixtures in a continuous flow reactor: selectivity and resistance to sulfur poisoning

Short introductive summary:

The abstract presents the comparison of two nickel-based catalysts for hydrotreatment of fast pyrolysis bio-oil. The effect of chromium as a promoter over the selectivity as well as the impact of sulfur over the selectivity and conversion of the catalysts is adressed.

Presenter: **Caroline CARRIEL SCHMITT, Karlsruhe Institute of Technology, IKFT Dpt., Eggenstein-Leopoldshafen, GERMANY**

Presenter's biography:

PhD in Chemical Engineering (2020) with background on thermochemical conversion of biomass and catalytic hydrotreatment of fast pyrolysis bio-oil. Currently is the coordinator of the bilateral activities between Karlsruhe Institute of technology and Brazilian universities.

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Session reference: 3CV.4.13

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Total ambition in biofuels: a leading producer and marketer

Short introductive summary:

On May 5, 2020, Total announced its ambition to reach carbon neutrality for all of its operations, from production to the energy products used by its customers (Scope 1+2+3), by 2050 together with society. This ambition is backed by an integrated strategy across the gas, electricity and liquid fuels value chain and the development of carbon sinks. Oil should be used sparingly, for applications where it cannot be easily substituted. At the same time, biofuels and tomorrow's e-fuels will need to take on a larger role. The Group is changing its mix to reflect this trend. Oil products accounted for 66% of sales in 2015, 55% in 2019, and could decline to 35% in 2030. By 2050, this share could shrink to 20%, with a quarter of that from biofuels, helping Total reduce the carbon intensity of the products it sells by 60%.

For more than 20 years, Total has been a committed leader in biofuel research, production and distribution. The Group aims to become a major force in this market, with sales growth of more than 10% a year by 2030.

To make that ambition a reality, Total is seeking to develop synergies with existing assets, such as its La Mède refinery, which was converted into a biorefinery in 2019.

In September 2020, the Group announced a project to convert its Grandpuits refinery into a zero-crude complex including a biofuel plant which is expected to be commissioned in 2024. This plant will have a production capacity of 170 kt a year of sustainable jet biofuel, 120 kt a year of road biofuel and 50 kt a year of bionaphtha, for producing bioplastics. For the most part, it will be supplied with animal fats from Europe and used cooking oil, supplemented with other vegetable oils, excluding palm oil. The conversion of the refinery will represent a total investment of over €500 million.

Presenter: **François IOOS, TOTAL, FRANCE**

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

Co-authors:

F. IOOS, TOTAL, FRANCE

Session reference: ICO.2.1

Subtopic: 6.1 Advances in Large Scale Gasification

Topic: 6. INDUSTRY TRACK

Advanced Biofuels and More from Biorefinery - Cooperation is the Key to Success

Short introductive summary:

St1 is a private Nordic energy company operating in Finland Sweden and Norway. Our vision is "to be the leading producer and seller of CO2 -aware energy. In the spirit of our vision we have number of investments and operations to go forward in sustainable energy transition.

Presenter: **Patrick PITKÄNEN, St1 Oy, Renewable Energy, HELSINKI, FINLAND**

Presenter's biography:

Patrick joined to St1 in 2008 and has gained profound expertise within the biorefinery industry especially in waste to advanced ethanol fuel biorefining.
Patrick is director of St1 Renewable Energy (Thailand) Ltd. a R&D and business development center for cassava waste ethanol business.

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P. Pitkänen, St1 Oy, FINLAND

Session reference: ICO.2.3
Subtopic: 6.7 Advances in Bio-Fossil Fuels
Topic: 6. INDUSTRY TRACK

Bio-based Diesel: Yesterday, Today, and Tomorrow

Short introductive summary:

This presentation will review the properties and benefits of Biodiesel (FAME), Renewable Diesel (HVO), and blends of the two. It will also discuss environmental impacts that can be achieved uniquely with diesel engines using bio-based diesel fuels.

Presenter: **Dave SLADE, Renewable Energy Group, Inc., Biofuel Technology and Services, USA**

Presenter's biography:

As REG's Executive Director, Biofuel Technology & Services, Dave Slade works to improve product quality at REG's biorefineries, evaluate new feedstocks, develop co-product opportunities, and advance process technology. Dave has been with REG since 2007 and has a Ph.D. in Chemical Engineering.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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D. Slade, Renewable Energy Group, Inc., USA

Session reference: ICO.2.4

Subtopic: 6.7 Advances in Bio-Fossil Fuels

Topic: 6. INDUSTRY TRACK

An Alternative Pathway toward Urban Sewage Sludge Management: Turning a Problem to an Opportunity to Generate H2 Fuel for Transportation

Short introductive summary:

The timely decarbonization of the energy sector, in line with the recently announced by the European Commission Green Deal plan, has led the Greek government to abandon the lignite mining and power production activities by 2028. The regional and municipal authorities in the Western Macedonia Region (WMR) in Greece, an energy-focused industrial area, are coordinating their efforts to effectively bridge the gap between the current "grey" economy to a greener, sustainable and prosperous future by investing in diversified economic activities securing at the same time a smooth and just transition for local communities. In this framework, the current study presents an ambitious plan to turn urban waste into green H2. More specifically, the sewage sludge from all WMR municipalities will be anaerobically digested into biogas, which will then be converted into H2 for the fueling of 12 garbage trucks.

Presenter: **Nikolaos NTAVOS, Cluster of Bioeconomy & Environment of Western Macedonia - CluBE, Kozani, GREECE**

Presenter's biography:

Nikolaos Ntavos is the Co-founder and Manager of CluBE – Cluster of Bioeconomy and Environment of Western Macedonia, Greece and a Dipl. Energy Engineer of the University of Western Macedonia and a PhD candidate in the green hydrogen field.

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Session reference: CP.2.1

Subtopic: 1.5 Municipal and Industrial Wastes

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Hydrogen from Biomass Sources: Technological Review and Energy and Greenhouse Gases Emissions Assessment

Short introductive summary:

The paper reviews several pathways to produce hydrogen from biomass or biomass-derived sources, and provides an exhaustive review of the most promising technologies towards commercialization. Different production pathways are evaluated from a techno-economic point of view, focusing on an energy assessment to evaluate their potential market uptake.

Presenter: **Marco BUFFI, JRC Ispra, C2 Unit, Ispra (Varese, Italy), ITALY**

Presenter's biography:

Marco Buffi is Doctor of Industrial Engineering, specialized in bioenergy and biofuels. He is currently scientific project officier at Joint Research Center of EU Commission in Ispra (Italy). He has experience as project manager in academic research, H2020 projects and biofuel plant design.

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Session reference: CP.2.2
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

The Potential of Biomass-Based Hydrogen in West-Andalusia

Short introductive summary:

In this study, the potential for biomass-derived hydrogen is comprehensively analysed considering a realistic use of current biogenic residues in relevant sectors (e.g., industry: refineries and energy: electricity). However, not all residues can be used for the production of hydrogen and an analysis has to be made to find how much biomass is suited for hydrogen production and what amounts of hydrogen can be produced from biomass. The selected region (west-Andalusia, Spain) has been selected thanks to the presence of a great biomass wealth, relevant industrial presence (two oil refineries), and data availability. An analysis of the vision of different regional stakeholders on biomass-based hydrogen is made. The best-suited biomass for the production of hydrogen and the possible applications of hydrogen in west-Andalusia are identified. Lastly, the amount of hydrogen that can be produced is compared to the specific needs for renewable hydrogen in this region.

Presenter: **Deanne VAN DER SLIKKE, Universidad de Sevilla, Sevilla, SPAIN**

Presenter's biography:

I am a master student in Mechanical Engineering at the University of Technology Delft. I am following the track 'Energy, Flow and Process Technology' and recently finished an internship at the University of Seville. I conducted a research on the potential of biomass-based hydrogen in west-Andalusia.

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Session reference: 5CO.7.1

Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen

Topic: 5. BIOENERGY INTEGRATION

Biogas Conversion to Green Hydrogen by Catalytic Sorption Enhanced Steam Reforming (SESR): the Feasibility Study

Short introductive summary:

Biogas is a valuable source of renewable energy and also a secondary energy carrier produced from biodegradable organic materials via anaerobic digestion. It is mainly composed of CH4 (55-70 vol.%) and CO2 (27-44 vol.%). The present work proposes the use of biogas for green hydrogen production by the sorption enhanced steam reforming (SESR) process. It has recently emerged as a novel promising method to improve hydrogen production efficiency and combines, in a single unit, hydrogen production and carbon dioxide separation by a solid CO2 acceptor. The conversion of biogas to green hydrogen by SESR has been hardly explored. Therefore, the objective of the present work is to prove the feasibility of the SESR of biogas to produce high-purity high-yield green hydrogen. To this aim, a comprehensive assessment of the process was carried out to evaluate operating conditions for the SESR of biogas to optimize hydrogen production.

Presenter: **Roberto GARCIA, INCAR-CSIC, Oviedo, SPAIN**

Presenter's biography:

2008-2012 I joined as reasearcher at the University of Oviedo, involved in projects regarding biomass combustion. 2012-13 I was granted at Saint Gobain ARDC. Since 2014 I have been involved in different projects related to biomass thermal energy conversion at PrEM group in INCAR-CSIC.

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Session reference: 5CO.7.2
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

From Pulp to Fuel - a Preliminary Sustainability Assessment of Biodiesel Production Based on Residues from the Pulp Industry

Short introductive summary:

The EU funded ”Pulp&Fuel project” contributes to the development of advanced biofuels by using residue streams as feedstock materials (such as bark and black liquor from pulp and paper industries) and by testing and demonstrating novel productions methods (as the combination of dry and supercritical water gasification). In this work, a preliminary assessment of the environmental and social implications of the Pulp&Fuel production process is provided, using Environmental and Social Life Cycle Assessment. The study also verifies that the used feedstocks and production technologies provide biofuels that comply with the relevant sustainability criteria governing biofuels in the EU.

Presenter: **Sofia POULIKIDOU, IVL Swedish Environmental Research Institute, Life Cycle Management Dpt., Malmö, SWEDEN**

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Session reference: 5CO.7.3
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Hydrothermal Liquefaction and Gasification Process Assessments Applied to Different Kind of Resources

Short introductive summary:

Wet organic wastes (sewage sludge from municipal water treatment or food wastes) or algae are organic resources withn a very high water content and a quite interesting carbon, hydrogen and energy content in their dry matter. The high water content makes incineration or gasification inefficient. It is then preferred to convert them through hydrothermalprocesses, to produces either organic liquids or gas.

Presenter: **Guillaume BOISSONNET, Commissariat à l'Energie Atomique, Biomass Project Dpt., Grenoble, FRANCE**

Presenter's biography:

Involved in Biomass and energy systems assessment since 2000.

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Session reference: 5CO.7.4

Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen

Topic: 5. BIOENERGY INTEGRATION

Enhancing Social Life Cycle Assessment in Bioeconomy Projects: the Role of Stakeholder and Public Engagement

Short introductive summary:

The paper discusses how Social Life Cycle Assessment can be enhanced by stakeholder engagement analysis to help gauge the persepctives of diverse social actors (stakeholders and the public more widely) on issues that crucial for the development of the bioeconomy. It draws on empirical data from bioeconomic projects to highlight the importance of public engagement and social acceptance of biomass use for bioenergy and other products, novel processing technologies employed, their potential socio-economic impacts and the prospects for bioeconomy value chains.

Presenter: **Yara EVANS, Imperial College London, Centre for Environmental Policy, London, UNITED KINGDOM**

Presenter's biography:

I am Human Geographer with specialisms in urban development, conflicts over natural protected aereas, international migration, political ecology, and socioeconomic assessment of projects and development inititives on local communities and the social dimensions of the bioeconomy.

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Co-authors:

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Session reference: 4CO.8.3
Subtopic: 4.1 Sustainability, Socio-Economic Impacts and Public Acceptance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Combining Historical & Spatial Analysis to Understand the Social Acceptability of Wood-Burning Energy Technologies in the Great Lakes Region, USA

Short introductive summary:

Biofuels currently contribute 50% of the world's renewable energy, yet the development of each type of biofuel technology is complicated by a constellation of political, social, and economic factors. This research examines the socioecological implications of differently-scaled woody biomass energy technologies in the Michigan, USA including residential woodstoves, community-scale boilers, and biomass power plants. The project combines archival analysis, semi-structured oral history interviews, survey data, and spatial analyses to investigate the sociopolitical factors that have led to adoption of wood-burning technologies. What factors have led to different communities embrace or opposition of woody biofuel projects? How does the issue of scale affect social acceptability of biofuel projects? This research offers new ways of evaluating the social impacts of different types of woody biomass technologies, and suggests the importance of understanding how specific cultural nuances shape the sustainable development of bioenergy projects.

Presenter: **Sarah MITTLEFEHLDT, Northern Michigan University, Earth, Environmental & Geographical Sciences Dpt., Marquette, USA**

Presenter's biography:

Sarah Mittlefehldt is Associate Professor in the Department of Earth, Environmental & Geographical Sciences at Northern Michigan University. She earned her doctorate in the Department of Forestry at the University of Wisconsin-Madison and a Masters in Science Education from Harvard University.

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Session reference:	4CO.8.4
Subtopic:	4.1 Sustainability, Socio-Economic Impacts and Public Acceptance
Topic:	4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Modelling of Tar and Water Vapors Condensation in a Commercial Micro-Scale Gasification Power Plant

Short introductive summary:

In this work, a psychrometric model based on the recent literature (Harb et al., 2020) is proposed.
Starting from the gravimetric tar concentration analysis performed on a commercial gasifier, the model was able to estimate that in the first 1.5 hrs of operation, more than 5 g of class 4 and 5 of tars condensate in the pipeline.
Moreover, the model applied to a real temperature profile of the gasification facility suggested a minimum operating temperature of the gas line of 45 °C to avoid the water condensation. Instead, to significantly reduce the condensation of light tars, the minimum working temperature resulted in 70 °C.

Presenter: **Nicolò MORSELLI, Università degli Studi di Modena e Reggio Emilia, Engineering Dept. E. Ferrari, Carpi, ITALY**

Presenter's biography:

I am a mechanical engineer and I'm currently enrolled with a scholarship in the PhD in Industrial and Environmental Engineering.

I'm working in the wood biomass gasification field collaborating with the company All Power Labs, global leader of micro-scale biomass cogenerators.

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Session reference:	2CO.9.3
Subtopic:	2.4 Gasification for Power, CHP and Polygeneration
Topic:	2. BIOMASS CONVERSION FOR BIOENERGY

Valorisation of Residual Forest Biomass from the Pulp and Paper Industry through Gasification

Short introductive summary:

This work aims to valorise the forest residues from the pulp and paper industry through gasification.

Presenter: **Luís TARELHO, Universidade de Aveiro, Environment and Planning Dpt., Aveiro, PORTUGAL**

Presenter's biography:

Professor/Researcher in Environmental Engineering at Dep. of Environmental and Planning, and at the CESAM, University of Aveiro, Portugal. Research in the field of thermochemical conversion of solid fuels (coal, biomass, solid wastes, sewage sludge).

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Session reference: 2CO.9.4
Subtopic: 2.4 Gasification for Power, CHP and Polygeneration
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

A Study of the Physical Properties of Cellulose Derived Biofuel Component Blends and their Blends with Diesel

Short introductive summary:

The decarbonisation of transport using alternative low carbon fuels, such as biofuels, will be a key component in achieving the reduction of greenhouse gas emissions required for the UK to become a net zero society by 2050. Most biofuels currently used are first generation, however, the Revised Renewable Energy Directive (RED II) limits these to a maximum of 7% of the final energy consumption for any Member State of the European Union. Production of second-generation biofuels from cellulose and lignocellulose is an increasingly active area, with a range of conversion methods being developed, including the alcoholysis of cellulose to produce the corresponding alkyl levulinate and the dialkyl ether, from the dehydration of the alcohol. Biofuels based on blends of the alcohol, alkyl levulinate, and dialkyl ether have the potential to be a tailorable biofuel component blend depending upon the final application. Knowledge of the physical properties of these blends is fundamental. This study investigates the physical properties and blending characteristics of the biofuel components produced from alcoholysis of cellulose as three-component blends and when blended with diesel.

Presenter: **Scott WISEMAN, University of Leeds, School of Chemical and Process Engineering, Leeds, UNITED KINGDOM**

Presenter's biography:

PhD student at the University of Leeds as part of the Bioenergy CDT. My PhD project is investigating the effects that cellulose derived biofuel components have on the combustion and physical properties of diesel, and the effects on the emissions from a CI engine.

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Session reference: 3CV.5.2
Subtopic: 3.6 Biorefineries
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Invasive Plants as a Local Source of Lignocellulosic Biomass for Cellulose Fibers and Aromatic Platform Compounds

Short introductive summary:

Invasive plants annually represent several million tons of unexploited biomass, which is locally available but is largely discarded or burnt. In our study we demonstrate a circular resource valorization, extending the biomass value chain all the way to final paper products and lignin-based chemicals.

Presenter: **Brigita HOCEVAR, National Institute of Chemistry, Catalysis and Chemical Reaction Engineering Dpt., Ljubljana, SLOVENIA REPUBLIC**

Presenter's biography:

I am a postdoc researcher at the National Institute of Chemistry in Slovenia. My research topic is catalytic hydrodeoxygenation of compounds, a representative in the cellulose part of lignocellulosic biomass.

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Session reference:	3CV.5.3
Subtopic:	3.6 Biorefineries
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Process of Cultivation of Microalgae Chlorella in Wastewater to Obtain Biodiesel with Biorefinery Processing Peerspective

Short introductive summary:

In this project it is expected to obtain the optimal conditions of the microalgae culture processes by modifying the parameters of pH, temperature, lighting, nutrient concentration in order to increase the productivity of biomass in the crop and reduce operating costs in the extraction of the Biodiesel generation process. using domestic wastewater as a culture medium.
The results obtained serve to increase the efficiency of the microalgae culture process in photobioreactor (50 mL, 250 mL and 1000 mL) through the use of industrial wastewater containing nutrients and good control of the operating parameters.
Microalgae was obtained in domestic wastewater, after three weeks, in a volume of 1L: 0.16 g of dried clorella sp microalgae. With a 1600% growth.
The wastewater lowered its phosphorus concentration from 5.3 ppm to 3.8 ppm..

Keywords: biodiesel, chlorella, wastewater, biorefinery, photobioreactor.

Presenter: **Magali Camila VIVAS-CUELLAR, Universidad Nacional de Ingenieria, Lima Dpt., Pueblo Libre, PERU**

Presenter's biography:

Premio Ingeniera CIP 2018 (3er lugar) por Colegio de Ingenieros del Perú (CIP). Doctorado en Ciencias Energetica (2016-2020) en FIM - UNI. Investigadora del grupo de BIO-INGENIERIA (2002-a la fecha). MSc. Ing. Quimico.
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Session reference: 3CV.5.5
Subtopic: 3.6 Biorefineries
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Two-Step Fractionation of Olive Stones for the Full Recovery of Sugars and Lignin

Short introductive summary:

Olive oil production and its associated industry generates a large amount of by-products and residues, among which olive stones (OS, also known as olive pits) are one of the main solid wastes. Traditionally, olive stones are separated by decanting together with the pulp and the peel, forming a semi-solid pomace, the so-called “Alperujo” in Spanish. This mixture contains a small amount of oil that can be recovered in the pomace extraction industry. But, in recent years, OS are separated before the secondary oil extraction and conveyed to be used as fuel in domestic heating systems or industrial boilers.
OS is a lignocellulosic material composed mainly of cellulose, hemicellulose (with xylose as the main sugar), and lignin. Its composition makes it a material with great potential for valorization.
In this work, a two-stage fractionation strategy is proposed, a first dilute acid stage to solubilize the hemicellulosic fraction and a second organosolv stage to increase the delignification of the material and improve the yield in enzymatic hydrolysis.

Presenter: **Carmen PADILLA RASCÓN, Universidad de Jaén, Ingeniería Química, Ambiental y de los Materiales Dpt., Jaén, SPAIN**

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Session reference: 3CV.5.7
Subtopic: 3.6 Biorefineries
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Fungal Biodiversity as a Source of Enzymes for the Conversion of Biomass Into Bioproducts and Materials

Short introductive summary:

Plant renewable biomass is considered as a sustainable source of organic carbon on earth and the perfect equivalent to petroleum for the production of fuels, fine chemicals and materials with net zero carbon emission. In this context, lignocellulosic biomass, which is abundant, low cost and rich in sugars, is very well positioned to become the raw material of the future. The development of sustainable conversion processes, known as biorefineries, has inherent benefit related to energy security and the preservation of the environment. Within a circular economy prospective, valorization of plant biomass is expected to enable the transition from a fossil to a renewable carbon-based economy, thus limiting greenhouse gas emission and climate change. However, the natural resistance to microbial and enzymatic deconstruction, collectively known as ´ ´ biomass recalcitrance´ ´ , is one of th main bottlenecks for the development of sustainable biorefineries.

Presenter: **Jean-Guy BERRIN, INRAE, Polytech Dpt., MARSEILLE Cedex 09, FRANCE**

Presenter's biography:

Directeur de Recherches at INRAE since 2008, expert of fungal enzymes for lignocellulosic biomass conversion into bioproducts and materials.

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Session reference: 3CV.5.8

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Microbial Lipids from Wheat Straw for Biofuels, Food and Chemicals

Short introductive summary:

This study investigates the potential of different oleaginous yeast strains to convert different wheat straw hydrolysates to biolipids. We are testing lipid production from the total hydrolysate or lipid or ethanol production after furfural production from the hemicellulose fraction. We found a surprisingly high diversity among the strains in the formation of lipids with partially doubling in lipid yields and production rates when comparing different strains. Several strains were not or only to a limited degree able to assimilate xylose. For one strain we found co- assimilation of formed lipids together with xylose, whereas another strain of a closely related species accumulated lipids when assimilating xylose. Our results demonstrate that understanding the physiology of lipid accumulation is essential for establishing a biorefinery based on oleaginous yeasts.

Presenter: **Volkmar PASSOTH, Swedish University of Agricultural Sciences, Molecular Sciences Dpt., Uppsala, SWEDEN**

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Session reference: 3CV.5.9

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Biolipids from Crude Glycerol and Hemicellulose Hydrolysate: Valorisation of Low Value Side Streams

Short introductive summary:

Conversion of crude glycerol (CG) and hemicellulose hydrolysate (HCH) to microbial lipids by oleaginous yeasts was tested. Only 11 out of the tested 27 strains were able to grow on CG as sole carbon source. Cultivation in mixed substrate of GC and HCH had a stimulating effect on glycerol assimilation and lipid formation in Rhodotorula yeasts. This result was verified for two strains under controlled conditions. Gene expression analysis in R. toruloides CBS 14 verified specific regulation of metabolism under the tested conditions.
Our results revealed specific targets for optimising the conversion of two low-value residues to high value biolipids.

Presenter: **Volkmar PASSOTH, Swedish University of Agricultural Sciences, Molecular Sciences Dpt., Uppsala, SWEDEN**

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Session reference: 3CV.5.10

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Pressurized Carbon Dioxide as a Pretreatment for Lignocellulosic Biomass

Short introductive summary:

While abundant in nature, lignocellulosic biomass is a challenging substrate for bioconversion due to its recalcitrant nature. Pretreatment of lignocellulose can be performed using a variety of biological, chemical, and physical methods to enhance the feasibility of bioconversion for biofuel and bioenergy applications. Supercritical carbon dioxide is a potentially attractive pretreatment as it is non-toxic, readily available, poses no environmental risk, and requires relatively mild conditions to reach the critical point. In this study, pressurized carbon dioxide was evaluated as a pretreatment for several sources of lignocellulosic biomass in terms of free sugar liberation, impact on downstream enzyme hydrolysis, and biochemical methane potential.

Presenter: **Brandon GILROYED, University of Guelph Ridgetown Campus, School of Environmental Sciences, Ridgetown, CANADA**

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Session reference: 3CV.5.11

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Ultrasound Assisted Ozone Pre-Treatment and Fractionation of Residual Lignin from Biomass to Value Added Products

Short introductive summary:

ultrasound-assisted ozone pre-treatment of spelt husk, corn cob and fractionation into the 3 components for subsequent conversion to value added chemicals.

Presenter: **Hafsat IBRAHIM, Newcastle University, Chemical Engineering Dpt., Newcastle upon Tyne, UNITED KINGDOM**

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Session reference: 3CV.5.12

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Lignin-Based Biorefinery: Monomers, Polymers and Fuels from Hydrolysis, Organosolv and Kraft Lignin

Short introductive summary:

Lignin is the most abundant natural aromatic/phenolic polymer and is one of the main structural components of lignocellulosic biomass, the other two being hemicellulose and cellulose. It is widely available in the form of lignosulphonate, kraft and soda sulphur-free lignins, as by-product of the pulp and paper industry, as well as side-stream in various cellulose-based biorefinery schemes. In this presentation, we will discuss the state of the art and recent results of our group, on lignin valorization processes that are currently being developed and exhibit high exploitation potential, with emphasis on fast pyrolysis and hydrogenolysis of lignin which are capable to provide bio-oils that contain valuable phenolic and/or aromatic (BTX) compounds. Such bio-oils can be hydrodeoxygenated (HDO) towards hydrocarbon fuels or can serve as source of monomers for the production of phenolic or epoxy resins or BTX based polymers. In addition, the use of lignin or functionalized lignin as epoxy and PF resins additive will be also presented.

Presenter: **Konstantinos TRIANTAFYLLIDIS, Aristotle University of Thessaloniki, Chemistry Dpt., Thessaloniki, GREECE**

Presenter's biography:

Professor, Dept. Chemistry, Aristotle University of Thessaloniki. Undergraduate and PhD at Dept. Chemistry, University of Ioannina, Greece. Postgraduate training at SHELL-Laboratorium, Amsterdam. Post-doctoral at Michigan State University, USA. Scopus ID: 8406363900; http://ktrianta.webpages.auth.gr

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Session reference: 3CV.5.13

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Microbial Growth on Concrete-Like Materials Containing Indrustrial Wastes

Short introductive summary:

This abstract is part of JAMK coordinated national research and development project “Sustainable bioresidual concrete” in Finland during 2018-2020. This paper focuses on the research part in the project that focused on the microbial growth in the surfaces of concrete-like material test pieces. Heat-sterilized sample test pieces have been exposed to a mixture of microbial suspensions isolated from microbial samples from moisture damaged buildings, soil and dead plant materials. These pieces was cultivated and microbe growth were monitored about two months. Based on the preliminary test results, microbes grow in the surfaces of the concrete-like material pieces and it seems that microbe’s growth continues on the surface of the concrete-like materials piece even in poor and dry conditions.

Presenter: **Hannariina HONKANEN, JAMK University of Applied Sciences, School of Technology, Jyväskylä, FINLAND**

Presenter's biography:

Ms Hannariina Honkanen, Lic.Sc. (Tech.), principal lecturer and bioenergy specialist, has worked at JAMK University of Applied Science since 2009. She has been working for education and training, but also in national and international projects and energy and environment technology related assignments. She has been involved in building two master's programmes in JAMK, and has references in teaching e.g. in coordinating several continuing education programmes for academic unemployed people in Central Finland. Honkanen's special competence is in energy use of Nordic biomasses: solid bio fuel management and fuel characteristics, bioenergy production in Nordic climate and emission control. Before career in JAMK, during 2002-2008, Ms Honkanen worked in Lappeenranta University of Technology with education and several energy and environmental technology related EU projects.

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Session reference: 1CV.6.1
Subtopic: 1.5 Municipal and Industrial Wastes
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Primary Reactions and Gaseous Products by Fast Pyrolysis of Plastics

Short introductive summary:

Low-Density Polyethylene (LDPE), Polypropylene (PP), and Polystyrene (PS) have been used to investigate primary reactions and gaseous products using Py-GC/MS/FID. The fast pyrolysis of the three different plastic materials have been separately conducted at 600 °C for 5 s. Gaseous fraction was highest for PS and followed by PP and LDPE. The quantified gas products of PS, PP, and LDPE corresponded to 103±12 wt%, 31±3 wt%, and 14±1 wt%, of the initial mass, respectively. Furthermore, the gaseous composition of PP and LDPE exhibited aliphatic compounds in the range of C3-C22 while PS presented mono-, di-, and tri-aromatics. In addition, most of the hydrocarbons formed from PP and LDPE had fewer carbon atoms than 12, 73% and 78%, respectively. Regarding PS, about 95% of the gaseous products are monoaromatic. The major compounds from LDPE were butane, 1-pentene, and 1-hexene while from PP were 2,4-dimethyl-1-heptene, propene, and pentane. The main compound from PS is styrene. This work is necessary for understanding the chemical pathways through understanding of primary reactions of common plastic material.

Key words: Fast pyrolysis, Primary reactions, Polyethylene, Polyprop

Presenter: **Supriyanto SUPRIYANTO, University of Borås, Resource Recovery and Civil Engineering Dpt., Borås, SWEDEN**

Presenter's biography:

I am PhD Student in Resource Recovery, University of Borås, Sweden. I graduated Master Program in Chemical Engineering at Chalmers University of Technology and Bachelor Program in Chemical Engineering at Universitas Islam Indonesia

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Session reference: 1CV.6.4
Subtopic: 1.5 Municipal and Industrial Wastes
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Coffee Pellet Vs. Conventional Pellet: A Statistical Evaluation Based on Quality Parameters

Short introductive summary:

Recent combustion experiences on coffee pellets in Italy displayed very interesting energy yield and low residual by-product (ash), demonstrating a good potential of coffee grounds to be exploited as bio-fuel for energy purposes. This work aims at comparing through a statistical analysis specific characteristics of coffee pellets with those of other commercialized pellets to highlight differences in final quality parameters of the fuel.

Presenter: **Francesco GALLUCCI, CREA-IT, Monterotondo, ITALY**

Presenter's biography:

Researcher at the Council for agricultural research and economics - Research Centre for Engineering and Agro-Food Processing (CREA-IT). He works on the energy conversion of biomass (combustion, gasification and anaerobic digestion). Authors of more than 40 scientific publications.

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Session reference:	1CV.6.7
Subtopic:	1.5 Municipal and Industrial Wastes
Topic:	1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Bio-Energy from Municipal Waste. Industrial Case Study

Short introductive summary:

In accordance to the Green Deal and all tendencies to turn the energy production into a C free one, a possibility consists of the recovering of the bio-waste energy that is locally available and offers continuity as main energy source and turn it into a CO2 neutral energy source. In the frame of a national project (EPOC - Energy for a clean city, http://epoc.mec.upt.ro/index.php?pagina=media), a biogas pilot plant, based on municipal waste (MW) anaerobic degradation, was conceived and finally turned into a Romanian patent.
The main scope and objective of the paper focus on demonstrating: (i) the possibility of biogas production from the biodegradable fraction of local MW under mesophilic anaerobic conditions, (ii) the utilization of the biogas in a hot-water boiler by replacing the standard used natural gas, (iii) cost-effective evaluation of the general solution in terms of CO2 reduction and economics.
Special remarks will focus on the adaption of the burner to the use of biogas produced, instead of the former natural gas as basic fossil fuel.

Presenter: **Ioana IONEL, Politehnica University of Timisoara, Mechanical Engineering Dpt., Timisoara, ROMANIA**

Presenter's biography:

I graduated as mechanical engineer and further dedicated my activity to clean combustion etchnologies, starting with the PhD research, accomplished on a field concerning Ultrasound influence on Lignite combustion. By 1990 I became as Humboldt fellow in contact with the several German and European universities/research groups/ and had the privilege to learn about flue gas cleaning technologies. I habilitated with a study/book concerning the pollution generated by Romanian power plants. In Romania I realized a special lab for air quality monitoring. Also I am coordinating the research Center of my department, and recently we started to develop renewable energy sources research, especially in the field og biomass co-combustion and biogas generation, CO2 capturing included. I have 8 Patents recognized in Romania. I have more than 100 ISI papers published. Since I was nominated as PhD coordinator, I succeeded to support 26 PhD students to finalize with success their study. I also coordinated several national and E projects, especially aiming bio-energy applications, environmental protection (air quality, reduction of green house gases, waste utilisation), and clean energy sources (including coal as transition fuel, but associated with CO2 capture).

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Session reference: 1CV.6.9
Subtopic: 1.5 Municipal and Industrial Wastes
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Energetic Valorisation Solution of Biowaste from Municipal Solid Waste Including Food Waste, Green Waste and Sludge for a Circular Economy Strategy in Porto Santo Island

Short introductive summary:

The aim of this work is to identify multiple resources and develop an energetic valorization solution for biowaste from undifferentiated municipal solid waste, including food waste, green waste and sludge produced in Porto Santo Island.
For this purpose, an inventory of the local waste resources were done, a questionary was elaborated for the local producers such us restaurants and hotels, educational material were done for the sensibilization about the circular economy principle in the local community.
A pilot initiative was planned, coordinated and implemented for the pioneer biowaste differentiated separation by the local community participants.
The analysis of the samples contributed to a complete specification of the raw materials available in order to develop a valorization solution.
A process solution for the organic and energetic valorization was developed in accordance with the specific properties of the resources analyzed for biogas production, compost production and cogeneration with self-consumption of thermal energy and electricity.

Presenter: **Fabiola SOUSA PEREIRA, MIT Portugal/IST-UTL, IN+ Center for Innovation, Technology and Policy Research, Lisbon, PORTUGAL**

Presenter's biography:

Chemical Engineer from IST-UTL and MIT PORTUGAL Sustainable Energy Systems PhD Student.

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Session reference: 1CV.6.10

Subtopic: 1.5 Municipal and Industrial Wastes

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Roadmap for the Successful Penetration for the Non-Food Crops Near to Agricultural Practice

Short introductive summary:

This work will present the main findings of PANACEA project that will be completed at the end of February 2021.

Presenter: **Efthymia ALEXOPOULOU, CRES - Center for Renewable Energy Sources and Saving, Biomass Dpt., Pikermi Attikis, GREECE**

Presenter's biography:

She is an agriculture engineer grantuated from the Agricultural University in Athens (AUA) with PhD on the “Adaptability and biomass productivity of the non-food crop Kenaf in Greece”. She is responsible for Energy Crops Unit in Biomass Department of Center for Renewable Energy Sources.

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Session reference: 1CV.6.12

Subtopic: 1.6 Innovative Biomass Production for Energy Integrated into Traditional Agri-Forestry Systems

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Decentralized Exploitation of Biomass-Derived Waste and Residues by Pyrolysis and Subsequent Entrained Flow Gasification for Gas Engine Use

Short introductive summary:

The project PyroGas examines the decentralized exploitation of biomass-derived waste and residues by pyrolysis and subsequent entrained flow gasification for gas engine use. The PyroGas concept includes considerations for phosphorus recovery.

Presenter: **Andreas EWALD, TU München, Chair of Energy Systems, Munich, GERMANY**

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Session reference: 1CV.6.13
Subtopic: 1.5 Municipal and Industrial Wastes
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Sequential Cropping Responding to the Need to Develop New Sustainable Feedstock for Lipid Biofuels

Short introductive summary:

Sustainable biofuels are indispensable for climate mitigation. As the European Union is increasing climate ambition, the need for sustainable advanced biofuels increases. One major obstacle in the 2020’s will be scarcity of sustainable feedstock. Current planned investments in renewable diesel only will create feedstock scarcity. New novel agricultural methods and innovations are needed to provide truly sustainable feedstock for the growing need of biofuels. This paper describes the business case for climate positive fuels, a novel innovation that has multiple positive impacts on climate change mitigation. EU’s climate goals depend both on how to reduce transport emissions and how to involve the agricultural sector in climate mitigation. Sequential cropping provides solutions to both challenges.

Presenter: **Marko JANHUNEN, UPM - The Biofore Company, Director Public Affairs, LSB Leaders of Sustainable Biofuels Chair, Helsinki, FINLAND**

Presenter's biography:

He is Director, Public Affairs for UPM. He is managing UPM’s public affairs work especially with regard to European Union’s environmental, energy, transport and climate change related policies. Marko has been working on public policy issues related to sustainability, environmental and energy issues, public policy, issues management and corporate responsibility for almost 20 years with experience from all continents. Marko is one of the founding members and the current Chair of Leaders of Sustainable Biofuels (LSB), a coalition of 13 corporations from nine countries promoting the uptake ofadvanced biofuels. Marko holds a Master’s Degree in Political History issued by the University of Helsinki, a Masters in European Affairs from the College of Europe in Bruges, Belgium, and an Executive MBA from the Helsinki School of Economics. He speaks Finnish, English, Swedish, German and French.

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Session reference: ICO.3.1

Subtopic: 6.8 Advances in Non-Food Crops Cultivation

Topic: 6. INDUSTRY TRACK

The Birth and Future of Modern Bioenergy in India

Short introductive summary:

Modern Bioenergy is being recognized as an increasingly important low-carbon resource by policy-makers around the world to meet climate policy targets. In India also, there is a clear recognition of the significant role of bioenergy in electricity generation, industrial heating, commercial and domestic cooking & heating as well as in other applications. For India, surplus availability of biomass feedstock from agriculture and forestry/wasteland sector is estimated at 247 million tonnes (Mt) for 2020-21 and 265 million tonnes (Mt) for 2030-31 due to increased crop production. The associated carbon dioxide mitigation potential resulting from the substitution of coal is estimated at 205 Mt in 2030-31 if the entire biomass surplus is to be diverted for power generation or other applications using coal/fossil fuels.

Presenter: **Dishant KATARIYA, Katariya Agro Pvt Ltd, INDIA**

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Session reference: ICO.3.2

Subtopic: 6.8 Advances in Non-Food Crops Cultivation

Topic: 6. INDUSTRY TRACK

Sustainable Camelina Cultivation as a Catch Crop

Short introductive summary:

Climate change contributes to drought occurrence, soil erosion and desertification. As a result, farmer profitability has dramatically decreased, with increased downside risk. This is a global situation: in Europe over 4 million farms were lost during 2005-2015 -this is more than 1,000 farms lost every day-, while in Australia in the last 20 years profit decreased 22%, with the chance of very low profits more than doubling.

Catch crops are grown in unused arable land which would have otherwise been left fallow, between successive main crops. This way, replacing a fallow land period with a catch crop provides farmers with a new harvest and additional income. Additionally, catch crops also provide agronomic and environmental benefits, helping avoiding erosion, capturing nutrients, improving soil structure & benefiting biodiversity.

Presenter: **Yuri HERRERAS YAMBANIS, Camelina Company España, Fuente el Saz de Jarama, SPAIN**

Presenter's biography:

As founder of Camelina Company, I have worked over the past 10 years in developing camelina as a sustainable feedstock for aviation biofuels, focusing on developing camelina to fit rotations as a catch crop or double crop, not impacting this way the farmer's main crop production.

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Session reference: ICO.3.3

Subtopic: 6.8 Advances in Non-Food Crops Cultivation

Topic: 6. INDUSTRY TRACK

The Total Crop Valuation of Industrial Hemp

Short introductive summary:

Hemp is the most versatile crop in the world; but most are concentrating only one product the crop is giving us. HempFlax is going for the full potential. Harvesting stalk, seeds, leaves to be processed in a full range of products from cat litter up to premium nutraceuticals. Capitalizing on the full hemp crop utilization needs specific harvesting technology and processing technology should be in place in the nearby area. HempFlax discuses the road to full crop utilization.

Presenter: **Mark REINDERS, HempFlax Group, THE NETHERLANDS**

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Session reference: ICO.3.4

Subtopic: 6.8 Advances in Non-Food Crops Cultivation

Topic: 6. INDUSTRY TRACK

Study of Catalytic Performances and Kinetics of CO2 Hydrogenation Reaction over a K-Fe/Al2O3 Catalyst for Gaseous and Liquid Hydrocarbons Production

Short introductive summary:

The interest of this work is Power-to-Liquid, as it is a developing technology that can combine CO2 utilization with the renewable electricity storage. In particular, we are interested in the CO2 hydrogenation reaction towards synthetic hydrocarbons, that can have applications in both transports and chemical industry.
The aim is to experimentally study the reaction in order to investigate its catalytic performances and to model the reaction kinetics.

Presenter: **Carlotta PANZONE, CEA Grenoble, Grenoble, FRANCE**

Presenter's biography:

Carlotta Panzone was born in Turin, Italy. She studied Chemical Engineering in Politecnico di Torino and got her Master degree in 2017, after a 6-month period of study in Pierre and Marie Curie University in Paris within the Erasmus program. She then moved to Grenoble, France to pursue a PhD in Che

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Session reference: 5CO.10.1
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Process Performance Comparison of CO2 and Syngas Conversion to Biomethane over a Metal Hydride Catalyst

Short introductive summary:

Nowadays, biomethane production from biomass and its waste has been intensively investigated. There are various conversion technologies for biomethane production, which are expected to play a specific role in the future energy as a green biofuel for transportation or power generation at small scale. The gasification and methanation of the biomass pathway is not as advanced as anaerobic digestion, but the advancement of this technology in the last decade leads to the development of new cost-effective biomethane production technology. The aim of this work is to develop and test an innovative biomethane production concept based on plasmochemical gasification and conversion of synthetic gases to biomethane using a new metal hydride catalyst. The technology developed can be integrated into small combined heat and power plants, bio-waste generating plants or decentralized areas as an additional source of renewable energy or biofuel production. This paper presents results of the optimum operating conditions of biomethanation process using CO2 and artificial syngas conversion over a metal hydride catalyst.

Presenter: **Nerijus STRIUGAS, Lithuanian Energy Institute, Laboratory of Combustion Processes, Kaunas, LITHUANIA**

Presenter's biography:

Nerijus Striugas was born on August 01, 1979 in Siauliai, Lithuania. From 2003 to 2009 PhD studies in Power and Thermal Engineering at Lithuanian Energy Institute. Currently, Head of Laboratory of Combustion Processes at Lithuanian Energy Institute. Fields of interest - combustion and gasification processes and its application for industry.

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Session reference: 5CO.10.3
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Evaluation of the Impacts of Maintaining Sugarcane Straw on Water Availability in a Brazilian Hydrographic Basin

Short introductive summary:

Sugarcane has gained prominence in the world energy scenario as an important source of renewable energy and the use of straw resulting from mechanized harvesting may increase its participation in supplying energy demand. However, in addition to mitigating greenhouse gases, it is also important to assess the possible impacts that removing this straw from the field can have on natural resources, such as in the water availability of a basin.

Presenter: **Daniele HENZLER, LNBR/CNPEM - Brazilian Biorenewables National Laboratory, Sustainability Dpt., Campinas, BRAZIL**

Presenter's biography:

Graduated in Agricultural Engineering from the State University of Campinas (2017).
Master student in Planning of Energy Systems in the department of mechanical engineering of the State University of Campinas.
Analyst at the Brazilian Bioethanol Science and Technology Laboratory - CTBE / CNPEM.

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Session reference:	4CO.11.1
Subtopic:	4.2 Environmental Impacts
Topic:	4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Influence of Yield Gap and Straw Recovery Rates on Ecosystem Services Associated with Sugarcane Electricity

Short introductive summary:

The study performs a georeferenced environmental assessment of electricity production from sugarcane biomass, taking into consideration sugarcane yield gaps and sustainable straw recovery rates, to understand and quantify the Ecosystem Services associated with sugarcane electricity, such as bioenergy production, mitigation of GHG emissions, and water recycling. It is done through integration of Life Cycle Assessment (LCA) methodology, Geographic Information Systems (GIS), process simulation using the Virtual Sugarcane Biorefinery (VSB), and agroclimatic modeling.

Presenter: **Nariê RINKE DIAS DE SOUZA, LNBR/CNPEM, Sustainability Dpt., Campinas, BRAZIL**

Presenter's biography:

Sustainability Analyst at the Brazilian Biorenewables National Laboratory (LNBR / CNPEM). PhD student at University of Campinas.

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Session reference: 4CO.11.2

Subtopic: 4.2 Environmental Impacts

Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Environmental and Socio-Economic Impact Assessment of Giant Reed Production in Heavy Metals Contaminated Soils

Short introductive summary:

Production of energy crops in contaminated soils is a interesting option that associates the decontamination of soils , with the production of a biomass that may provide an additional income to farmers. Moreover, this biomass is a low indirect land-use change-risk feedstock for bioenergy or bioproducts, that helps to reduce the dependence on fossil fuels, contributing to the decarbonisation of the economy, in line with the objectives of the European Green Deal. Therefore, the main purpose of this work is to evaluate the environmental and socio-economic impact of the giant reed production in different heavy metals (Zn, Cr, Pb, Cd, Ni, Cu) contaminated soils during three year growing seasons. Overall results suggest that the production of giant reed in heavy metals contaminated soils have positive and less positive aspects over its production in non-contaminated soils. The productivity loss in contaminated soils diminishes the energy, and the greenhouse savings, but it contributed to improve the quality of soil and waters and the biological and landscape diversity.

Presenter: **Ana Luisa FERNANDO, Universidade Nova de Lisboa, Ciências e Tecnologia Biomassa Dpt., Caparica, PORTUGAL**

Presenter's biography:

Ana Luísa Fernando holds a PhD in Environmental Sciences. Associate Professor at Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa.Main scientific areas: energy crops, remediation of contaminated soils, valorization of agro residues.

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Session reference: 4CO.11.3
Subtopic: 4.2 Environmental Impacts
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

External Costs Associated to Dedicated Cynara Cardunculus Cultivation in Marginal Rainfed Lands for Local Bioenergy Production

Short introductive summary:

Marginal or unproductive land can be used for bioenergy production, under dryland regimes, without competing for productive land and food crops. The cultivation of Cynara cardunculus in these lands, for local heat and power production, would moderate rural loss inhabitants, soils erosion and fires' increase among others.

This study investigates the environmental impacts through life cycle assessment and calculation of external costs applying Externy methodology, providing a clearer picture of the promotion of bioenergy in rainfed regimes in drylands.

The substitution of conventional energies (fossil fuels and the national electricity mix) by perennial crops for bioenergy purposes will contribute to mitigate climate change. Besides, internalise the external costs will provide a view of possible profitability for farmers, topic of vital importance in rainfed drylands with lower yields, preserving, at the same time, marginal agricultural systems.

Presenter: **Carmen LAGO RODRÍGUEZ, CIEMAT, Energy Dpt., Madrid, SPAIN**

Presenter's biography:

Degree in Biological Sciences. Experience in environmental and economic research projects focus on renewable energies. Currently, she is working on sustainability of biomass pathways to produce heat, electricity and biofuels, using LCA methodologies.

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Session reference: 4CO.11.4
Subtopic: 4.2 Environmental Impacts
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Hydrogenation of TCR®-Oils - a Route to Renewable Chemicals and Fuels

Short introductive summary:

The Thermo-Catalytic Reforming (TCR®) enables the production of renewable fuel as well as the production of renewable chemicals from residual and waste biomass. TCR® is a process recently developed which is based on intermediate pyrolysis with integrated reforming. At temperatures up to 700 °C in the reforming zone, a hydrogen rich gas and a high-grade bio-oil are produced. The various advantages of using the TCR®-oil are the lower oxygen and water content compared to other bio-oils as well as the most important characteristic, its thermal stability, which makes it distillable and applicable for other thermal processes. The aim of this work is to generate renewable high quality hydrocarbons resulting by the hydrogenation of the crude TCR®-oil. Through hydrogenation, the hydrogen content was increased and the oxygen, sulfur, nitrogen content was significant lowered or respectively removed close to zero. In long term, the combination of TCR® and hydrogenation of the TCR®-oil is a promising approach to produce CO2 neutral fuels and chemicals to substitute fossil oil.

Presenter: **Jan GRUNWALD, Fraunhofer UMSICHT, Sulzbach-Rosenberg, GERMANY**

Presenter's biography:

I studied chemistry in Munich and I get the Master degree in February 2018. In July 2018 I start with my PhD at Frauhofer UMSICHT institute branch Sulzbach-Rosenberg in the group for energy technologies.

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Session reference: 3CO.12.1

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Impact of Biochar Type, Biochar-Kraft Lignin Ratio and Reactor Temperature on Microwave Pyrolysis of Kraft Lignin

Short introductive summary:

The current petrochemical consumption is damaging the ecosystem. Bio-oil represents an alternate source of key chemical compounds applied in several industries. In this project, the first phase i.e., microwave pyrolysis of Kraft lignin (KL) in presence of wood biochar is being carried out to obtain bio-oil with lower moisture and higher aromatic organic content. The innovation of this study is investigating the impact of using spruce and hemp biochar, at varied ratios and operating temperatures, on the yield and composition of the bio-oil. The final goal of this project is to synthesize a bio-oil that can be taken as a precursor material for conversion into a novel bio-based thermoplastic polymer. At this stage, the observation and primary quantitative results are available to be discussed. Spruce biochar demonstrated a higher average KL bio-oil yield at all power levels compared to hemp biochar. With increasing power level from 300 W to 600 W, the bio-oil yield increased while the biochar yield reduced. 50:50 ratio of KL and wood biochar feedstock exhibited the highest bio-oil yield. Further testing is being conducted to analyze the biochar and bio-oil composition.

Presenter: **Disha BISTO, University of New Brunswick, Fredericton, CANADA**

Presenter's biography:

A leader in sustainability and diversity with interest in interdisciplinary problem-solving and innovation. In 2019, I received a B.Sc. in Chemical Engineering from University of New Brunswick(UNB). I am currently a research-based Master's candidate in Mechanical Engineering at UNB.

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Session reference: 3CO.12.2
Subtopic: 3.2 Pyrolysis
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Preparation and Screening of Mo Carbide Catalysts for Continuous Fast Pyrolysis Bio-Oil Stabilization by Hydrotreatment

Short introductive summary:

Bio-oil, produced via fast pyrolysis (FPBO) has gained attention as replacement for traditional fossil feedstocks. FPBO as such is so far applicable for fuel oil applications. However, bio-oil upgrading has been studied as a route for the production of renewable transportation fuels and chemicals from FPBO. Hydrotreatment, especially hydrodeoxygenation (HDO), is a crucial step of bio-oil upgrading to chemically stable and low oxygen content fuel components.

BioFlex project aims to study and further develop the desired properties of FPBO hydrotreatment catalysts. The focus is in the first stabilising step aiming for the development for catalysts being active at low temperatures with good sulfur and coke tolerance. For the second (deoxygenation) step, more conventional sulfided catalysts will be applied. As part of the project, molybdenum carbide -based catalysts, that have shown promising results and noble metal catalyst like activity are studied as sulfur-tolerant and regenerable option for bio-oil stabilization in continuous operation. Deactivation and regeneration methods for MoC_2-based catalysts in bio-oil HDO are identified.

Presenter: **Juha LEHTONEN, VTT Technical Research Centre of Finland, Sustainable Energy and Chemical Technology Dpt., Espoo, FINLAND**

Presenter's biography:

Dr. Juha Lehtonen is research professor at VTT for area Sustainable energy and chemical technology. He has a long career in industrial research organizations as a specialist of chemical reaction engineering, catalysis and development of biofuels, oil refinery and specialty chemicals processes.

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Session reference: 3CO.12.3
Subtopic: 3.2 Pyrolysis
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Development of a CHP Boiler for Biomass Derived Fast Pyrosis Bio Oil (FPBO)

Short introductive summary:

In the current H2020 project, SmartCHP, a small-scale combined heat and power system fueled with FPBO is being developed. The objective is the development of a CHP system with an engine fueled with FPBO and a flue-gas boiler, that utilizes the thermal energy of the flue gas from the engine and of an integrated burner for FPBO.
In the H2020 project, Residue2Heat, small-scale residential boilers in the range of 20 - 60 kW were developed for FPBO at the OWI Science for Fuels gGmbH, Germany (OWI). The SmartCHP project continues this development for CHP system with an electrical output of 100 - 1000 kWel. In this paper the planned CHP system, the simulation-based development of the boiler-burner system and experimental results are presented.

Presenter: **Melanie GROTE, OWI Science for Fuels, Herzogenrath, GERMANY**

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Session reference: 3CO.12.4

Subtopic: 3.2 Pyrolysis

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Factors Influencing the Co-Digestion of Mango Husk (Seed Vessel)

Short introductive summary:

This work explores some variables that could influence the co-digestion of mango seed vessel or husk (MH) in the production of biomethane using the BMP test. First, the influence of the inoculum source was evaluated using rabbit manure and pig manure. After that the effect of adsorbent materials on the generation of methane enriched biogas was evaluated using activated carbon, silica gel, and pectin. Finally, the effect of the nitrogen source (Yeast extract and L-Arginine) and the carbon to nitrogen ratio (C/N) was studied. Results demonstrate that after 550 hours, swine manure with mango husk produced 173.75 mL CH_4 /g VS, while rabbit manure with mango husk produced 69.75 mL CH_4 /g VS. Additionally, it was demonstrated a higher methane production in the digesters with the addition of commercial chemical adsorbents, where pectin stands-out with a methane production of 483.50 ± 20.97 mL CH_4 / g SV, which is an amount six times greater than the inoculum alone. It was found that the C/N ratio has influence on the results of the BMP tests while the nitrogen source does not. The modified Gompertz model which were found to describe adequately the behavior observed.

Presenter: **Daniel David DURÁN-ARANGUREN, Universidad de los Andes, Chemical Engineering Dpt., Bogotá, COLOMBIA**

Presenter's biography:

Chemical Engineer(2014)-Universidad de América,Bogotá, Colombia
MEng. Process and Product Design(2017) and MSc. Chemical Engineering(2018)-Universidad de los Andes, Bogotá, Colombia
Teaching Assisant(2017 - 2020)-Universidad de los Andes
PhD Student(2019 - Present)-Universidad de los Andes

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Session reference: 2CV.7.2
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Optimization of Hydrothermal Pretreatment for Enhancing Empty Fruit Bunches Hydrolysis and Biogas Production

Short introductive summary:

Dr. Chonticha Mamimin graduated from Thaksin University in Thailand with a Ph.D.'s degree in January 2017 and post-doctoral in general microbiology at the University of Bergen, Norway. She initiated and developed a research project on the conversion of palm oil mill wastes to biofuels. She involved with the biohythane project supported by Agricultural Research Development Agency (Public Organization). In 2016, she received award for Thailand young inventors from The National Research Council of Thailand. She also received Taguchi Prize for Outstanding Ph.D. Thesis in 2017 from Thai Society for Biotechnology (TSB). Last year, she received Excellent Doctoral Thesis Award (Agricultural and Biological Sciences) from the National Research Council of Thailand (NRCT). Currently, she is work on pilot-scale study in biohythane production project with an industry partner. Over the past, I have worked in molecular biotechnology and environmental biotechnology with 19 international journal publications. As a current, she works as a post-doctoral fellow at Khon Kaen University, Thailand. She also continued working on anaerobic digestion, which utilization.

Presenter: **Chonticha MAMIMIN, Khon Kaen University, Faculty of Technology, Khon Kaen, THAILAND**

Presenter's biography:

I am a post-doctoral fellowship in the Faculty of Technology, Khon Kaen University, Thailand. Over the past, I have worked in molecular and environmental biotechnology. I have been working on methane production from wastewater and industrial biomass residues.

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Session reference:	2CV.7.3
Subtopic:	2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic:	2. BIOMASS CONVERSION FOR BIOENERGY

Digestate from Co-Fermentation of Maize Silage, Energy Beets and Cucumber Leaves and Stalks

Short introductive summary:

In Latvia, out of 48 biogas plants that use agricultural product residues and waste as raw materials, some do not use manure. Anaerobic fermentation of energy beets Gerty and greenhouse cucumber leaves and stalks and testing of digestate usefulness were performed within the framework of the ongoing project LAD-29. The raw materials obtained from project partner were anaerobically processed in sixteen bioreactors at 38°C in a batch mode during 32 days period. The obtained results showed good bioconversion of feedstock for digestate and energy production (specific methane 0.397 Lg-1dom). The result obtained in co-fermentation of biomasses was better than that obtained from each raw material separately. The digestate was mixed with wood ash and used as fertilizer for growing of several crops. Solid fraction of digestate was used for pelletization. If the dry matter of digestate was 25% - 30%, then it was possible to produce quite durable pellets for fertilization.

Presenter: **Imants PLUME, Latvia University of Agriculture, Institute of Agricultural Energetics, JELGAVA, LATVIA**

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Session reference: 2CV.7.7
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

An Automated Process to Compute Density of Unknown Liquid (Organic Slurry) Using Brine as a Prototype

Short introductive summary:

The research was used as prototype to determined the relationship between density of liquid and compression of the springs supporting the tank from beneath.
The tank was to be used as an anaerobic digested for production of biogas.
Production of methane gas, it potential depends on water dilution ratio, so is expected that any digested tank can be calibrated to give direct readings of densities of bio-degradable material from displacement of the suspension springs.

Presenter: **Olubukola ADEYEMI, Rivers state University, Physics, Port-Harcourt, NIGERIA**

Presenter's biography:

Adeyemi kudirat, Assistant Chief Education Officer with Lagos State Government,Nigeria. She is a member of Astronomical Society of Nigeria and World Energy and Meteorology Council.In February 2021,she was recognised as the Best Desk Officer on Environment by the first Lady of Lagos State,Nigeria

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Session reference: 2CV.7.8

Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Orange Peel Valorization to Biomethane: Preliminary Profitability Analysis

Short introductive summary:

A preliminary profitability analysis of the valorization of orange peel waste to biomethane was carried out. Different percentages of orange peel (from 25 to 100%) were evaluated considering real data from the production of this waste in Spain. According to the obtained results these plants are not profitable with the current natural gas prices. The value of the incentives needed to make the process profitable was also calculated.

Presenter: **Judith GONZÁLEZ ARIAS, Universidad de León, León, SPAIN**

Presenter's biography:

Energetic engineer, MSc. in Renewable Energy and PhD student at University of León. Currently working on thermal treatments such as pyrolysis and hydrothermal carbonization in order to obtain high quality fuels.

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Session reference: 2CV.7.10

Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Combined Storage and Pretreatment Process of Sunflower Catch CropuUnder Alkaline Conditions Prior to Anaerobic Digestion

Short introductive summary:

This work presents an innovative storage and pretreatment process of catch crops for anaerobic digestion. Instead of being stored in acidic conditions like in the usual ensiling process, the addition of CaO here allows to reach alkaline condition that allow mircobial inhibition and pretreatment effect on the biomass.
After 180 days of storage, the results show that the methane potential of the sunflower harvest grown by 21% while the easily accessible fraction of the biomass was increased.

Presenter: **Clement VAN VLIERBERGHE, INRAE/GRDF, Narbonne, FRANCE**

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Session reference: 2CV.7.12
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Towards Developing an Optimum Anaerobic Co-Digestion from Wastewater Sewage Sludge as Biogas Production Enhancement Technique: Physicochemical Characteristics & Microbial Community of Methanogens of the Feedstock

Short introductive summary:

This study was conducted on WWTWs (WWTW 1 and WWTW 2) in GP, SA under Johannesburg Water (JW). The physicochemical characteristics of the raw sewage sludge were analyzed according to Standard Methods for the Examination of Water and Wastewater. For the microbiological characteristics, the genomic DNA was extracted using the ZymoBIOMICS protocol, DNA sequencing was done in a PacBio Sequel system. For alignment, raw subreads were processed through the SMRTlink CCS algorithm to produce highly accurate reads. This highly accurate reads were then processed through Usearch database. Taxonomic information was determined based on the Ribosomal Database Project's 16s. To obtain the methane potential that can be achieved from the mono & co-digestion of the feed, BMP (Biochemical Methane Potential) was used

Presenter: **Khuthadzo MUDZANANI, University of the Witwatersrand, Chemical and Metallurgical Engineering Dpt., Johannesburg, SOUTH AFRICA**

Presenter's biography:

Khuthadzo Mudzanani is PhD student at CSIR, registered with Wits University, South Africa. Her previous studies includes pretreatment of biomass, polymers synthesis for wastewater remediation and biomethane production. She is currently working on beneficiation of municipal wastewater sludge.

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Session reference: 2CV.7.13
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Feasibility Assessment of Napier Pak Chong 1 as a Substrate for Biogas Production

Short introductive summary:

Napier grass is fast-growing, high-yield, easy harvesting and highly abundance in Thailand. Therefore, the biogas production potential was studied in this work to examine the feasibility of Napier grass in anaerobic fermentation. The Pennisetum purpureum x Pennisetum americanum (Napier Pak Chong 1) was used as the organic materials substrate for biogas production under an anaerobic fermentation. The batch fermentation was tested in a 1,000 ml glass bottle with a working volume of 400 ml. In this experiment, cow manure was used as the inoculum. The ratio of inoculum and organic materials substrate was 1:2. The glass bottle was operated in the temperature-controlled room at 35±2 °C for 60 days. The influent and effluent were analyzed for pH, COD, TS, and TVS. These parameters were used to analyze correlations of the biogas production rate and the working volume in the batch fermentation. The cumulative volume of biogas produced was used to measure the fermentation performance. The study found that Napier grass revealed accumulative biogas production of 496.2 ml/gVSadded with methane content of 55.1%.

Presenter: **Prakaidao POMDAENG, Feng Chia University, Master Program of Green Energy Science and Technology, Taichung, TAIWAN**

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Session reference: 2CV.7.15
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Work Productivity Evaluation of Different Harvesting Systems in Oak Coppice Stands

Short introductive summary:

The aim of the present work was to evaluate different harvesting systems in turkey oak coppice utilization, in order to compare the effectiveness of these various harvesting possibilities. In particular the evaluation focused on extraction with cable skidder, light gravity cable yarder and medium gravity cable yarder.

Presenter: **Francesco LATTERINI, CREA-IT, Monterotondo, ITALY**

Presenter's biography:

Researcher in Agricultural Mechanization.

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Session reference: 1CV.8.7

Subtopic: 1.1 Biomass Potentials and Biomass Production Models

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Felling Operation in Artificial Coniferous Stands: Work Productivity Analysis

Short introductive summary:
Three different forest yards in Central Italy were evaluated for what concerning work productivity. In particular two motor manual felling and one full mechanized felling operation were analyzed.

Presenter: **Walter STEFANONI, CREA-IT, Monterotondo (RM), ITALY**

Presenter's biography:
Research activities in the crops for energy production

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Session reference:	1CV.8.8
Subtopic:	1.1 Biomass Potentials and Biomass Production Models
Topic:	1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Effect of a Foliar Treatment on Camelina Sativa (L.) Crantz.

Short introductive summary:

Within the CAMEVAR project, we are assessing the impact of vernalization on development, flowering induction, and seed production in camelina (Camelina sativa (L.) Crantz).
To assess the impact of vernalization on camelina varieties used in the central area of Spain (Community of Madrid) we are using a 3.8 square meters refrigeration chamber (temperature down to -15ºC). The chamber has a battery of seven LED toplights (PHILLIPS 1.2 DR/W/FR_1_LB) with output levels that range between 520 to 620 μmol/s per module and an average efficacy of 2.9μmol/J, to simulate day/night cycles.
We will use multivariate analysis of variance to compare the measured parameters dependence to minimum night temperature and varieties and to determine significant differences in the behaviour, growth, development and fertility of each variety and within the controls.

Presenter: **David MOSTAZA-COLADO, IMIDRA, Agroenvironmental Research Dpt., Alcalá de Henares, SPAIN**

Presenter's biography:

PhD in hydrogeology and water resources management.
Currently working as a research at IMIDRA (Madrid Institute of Rural, Agricultural and Food Research and Development) in the CAMEVAR project. Or focus is to select a variety of Camelina sativa (L.) Crantz adapted to the central region of Spain.

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Session reference: 1CV.8.12
Subtopic: 1.1 Biomass Potentials and Biomass Production Models
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Biomass Recovery from Olive Rejuvenation Pruning in Several Varieties and Climatic Conditions

Short introductive summary:

Biomass from rejuvenation pruning in traditional olive orchards can represent an interesting source of energy.
Two Intensities/modalities of pruning were compared in several varieties and different conditions to implement model applicable for all olive orchards.
Obtained results are interesting for the intensification process of the olive and easily transferable to the stakeholders.

Presenter: **Enrico Maria LODOLINI, Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Centro di ricerca Olivicoltura, Frutticoltura e Agrumicoltura, Rome, ITALY**

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Session reference: 1CV.8.14
Subtopic: 1.1 Biomass Potentials and Biomass Production Models
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Hemp Cultivation Techniques Evaluation for Sowing Seed Production

Short introductive summary:

The production of hemp (Cannabis sativa L) seed for reproductive use in Italy is still unknow for reasons linked not only to agronomic aspects but also of limited availability at acceptable costs of specific technologies present in other areas. In recent years for this purpose, trials have been conducted in more region and the results can be considered very promising for central and south Italy. This experience showed preliminary test on two region, three varieties and three period of sowing

Presenter: **Alberto ASSIRELLI, CREA - Research Center for Engineering & Agro-Food Processing, Monterotondo - RM, ITALY**

Presenter's biography:

Dr. Alberto Assirelli has a PhD in Agricultural Engineering in 1997 and start working in the Department of Economics and Agricultural Engineering at the University of Bologna, continuing his works in other public and private research centers.
Researcher in the Agricultural Engineering Unit (CREA-ING) of the Agricultural Research and Experimental Council (CREA), in Monterotondo (Roma).
Author of more than 400 publications in the fields of agricultural mechanization with particular reference to the development and testing of new machinery for food, feed and energy crops.

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Session reference: 1CV.8.20
Subtopic: 1.1 Biomass Potentials and Biomass Production Models
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Estimating the Availability of Forest Biomass from Aggregated Forests in Tohoku Region of Japan

Short introductive summary:

This study estimated the supply potential and availability of unused materials of cedar, cypress, pine, and larch for woody biomass power generation in Aomori, Iwate, Miyagi, Akita, and Yamagata prefectures. As a result, supply potentials of used and unused materials were estimated at 11,388,960 m3/year and 2,277,792 m3/year. Then, those availabilities were estimated at1,630,207 m3/year and 326,041 m3/year. Therefore, the rate of availabilities to supply potentials was 14.3%. The demand was estimated at 951,740 m3/year from 100,000 m3/year with the generation capacity of 5 MW. The rate of unused material availability to the demand was 34.3%. The rates as a unit of subcompartments and aggregated forests with thinning subsidy were increased to 91.4% and 190.3%, respectively. Thus, the estimated availability with thinning subsidy met the demand sufficiently in this region.

Presenter: **Kazuhiro ARUGA, Utsunomiya University, Forest Science Dpt., Tochigi, JAPAN**

Presenter's biography:

I am a professor of Forest Engineering, Department of Forest Science, Utsunomiya University, Japan. My specialty is forest biomass harvesting and utilization. I am a coordinator of IUFRO (International Union of Forest Research Organizations), Working party 3.01.01: Road Networks and Transportation.

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Session reference: 1CV.8.21
Subtopic: 1.1 Biomass Potentials and Biomass Production Models
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Assessment of Fast-growing Tree Plantations Using the Analytic Hierarchy Process -AHP Methodology (Case Study Situation in Latvia)

Short introductive summary:

The BE-Rural project, funded by the EU’s Horizon2020 programme, supports the establishment of regional and local bio-based economies by involving relevant actors in the development of bioeconomy strategies and roadmaps in its Open Innovation Platforms (OIP) regions. Case study in Latvian OIP region investigates the bioenergy potential of fast-growing tree plantations in the overall framework of identifying and assessing their bioeconomy potential. The study offers five different fast-growing tree plantation scenarios to experts to select the best plantation type for mentioned above purpose. To analyse the hierarchies the Analytic Hierarchy Process applied. according to expert assessments, the best management scenario of fast tree plantations in Latvia includes intensively managed willow plantations (0.24), followed by hybrid aspen plantations managed as forest (0.21), hybrid aspen plantations managed as forest plantations (0.20), hybrid aspen in agroforestry systems (0.19) and widely managed willow plantations (0.16).

Presenter: **Dagnija LAZDINA, LSFRI Silava, Forest Regeneration and Establishment Dpt., Salaspils, LATVIA**

Presenter's biography:

Education:Latvian University of Agriculture, Forestry Faculty, Latvia 2005-2008 Doctoral Studies Doctor of Forestry Research - Latvia University of Agriculture Dr.silv. , Senior Researcher at Latvian State Forest Research Institute Silava

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Session reference: 1CV.8.22
Subtopic: 1.1 Biomass Potentials and Biomass Production Models
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

An Estimation of the Energy Potential of Rice Industry By-Products in Sri Lanka

Short introductive summary:

The research "An estimation of the energy potential of rice industry by-products in Sri Lanka" is focused on some significant key areas in Sri Lankan agro-waste management and energy generation sectors because Sri Lanka is seeking new energy generation sources and resources in their national level. As well as, due to the large volume of rice production, by-products of the rice industry are being generated rapidly. Therefore, this research will evolve to resolve these ravels in a sustainable way. Moreover, it summaries all the statistical data according to their geographical locations and emphasizes the economic possibilities and scientific potential of energy generation in each region using rice industrial by-products.

Presenter: **Asanka Nuvansiri Illankoon WIJEPALA ABEYSINGHE MUDIYANSELAGE, University of Brescia, Civil, Environmental, International Cooperation, and Mathematical Engineering Dpt., Milan, ITALY**

Presenter's biography:

I'm a Ph.D. student at the University of Brescia, Italy. My research theme based on the safety, sustainability, and valorization of waste in the agri-food sector in developing countries.

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Session reference: 1CV.8.24

Subtopic: 1.1 Biomass Potentials and Biomass Production Models

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Biobased Bitumen - LIgnin Applied in Asphalt by the CHAPLIN Collaboration

Short introductive summary:

Bitumen is an important part of asphalt. Recently,
however, the supply of bitumen has become an increasing problem; the availability and the quality
are decreasing. In addition, the use of bitumen in
the short and long term is not sustainable. It is fossil
based and emits greenhouse gases in the production of asphalt. With lignin asphalt, on the other
hand, we contribute to the transition to a circular
and biobased industry with lower CO2 emissions

Presenter: **Joop GROEN, CBBD / Biorizon / Viride, Halsteren, THE NETHERLANDS**

Presenter's biography:

Joop Groen studied Process Engineering, Business administration (MBA), Strategic Innovation (MIT) and he is also a certified coach for personal development. Joop started his career with the General Electric company in the Engineering Plastics division where he worked for 17 years.

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Session reference:	ICO.4.1
Subtopic:	6.1 Advances in Large Scale Gasification
Topic:	6. INDUSTRY TRACK

From Lignocellulose to Bio-chemicals via levulinic Acid Production: First Results from the GreenSolRes Project

Short introductive summary:

Back in 2004 the US Department of Energy reported the exploitation potential of levulinic acid (LVA) as a unique platform chemical for the production of chemicals and fuels. Several companies and R&D institutes worldwide started research and development actions to make the large potential come true and develop a process to produce LVA in a sustainable and commercial competitive manner. LVA produced from starch and corn stover has become available on the market but limitations in sustainability and cost led to developments exploiting lignocellulose as feedstock in the GreenSolRes project.

Presenter: **Klaus LENZ, Syncom F&E Beratung, Research & Development Consulting, Ganderkesee, GERMANY**

Presenter's biography:

Klaus Lenz, received a phD in physics from the Rheinische Friedrich Wilhelms University in Bonn, Germany in 1987. He is the managing director of the innovation consulting firm SYNCOM Forschungs- und Entwicklungsberatung GmbH.

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Session reference: ICO.4.2
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

New Sustainable Solutions for the Plastic and Chemical Industry

Short introductive summary:

In this work, Neste’s new sustainable solutions for the plastic and chemical industries are presented. The solutions aim the upstream, supporting the current petrochemical business and infrastructure by providing new drop-in bio-based feedstock that can be used in the current facilities for manufacturing monomers and chemical building blocks. Hereby, general aspects about using two outputs from the NEXBTL™ process, bio-based LPG (mainly propane) and bio-based naphtha as feedstock for the production of propylene are presented. Bio-based LPG is converted using propane dehydrogenation (PDH), while renewable isoalkanes are converted using a steam cracking process. In both cases, comparison against their fossil analogs are presented. Finally some of the public initiatives of Neste towards new technological solutions to incorporate new sustainable, scalable waste and residue feedstock for chemicals and materials are also presented.

Presenter: **Oscar VERNAEZ, Neste, Innovation, Products and Applications Dpt., Kullo, FINLAND**

Presenter's biography:

R&D Manager for Chemicals and Materials in Neste (Finland). Is a material Engineer with a PhD in Polymer Chemistry and a PhD in Engineering. He worked 12 years as Polymer specialist in PDVSA Venezuela and 3 years as Group manager in the bioplastic department of the Fraunhofer UMSICHT in Germany.

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Session reference: ICO.4.3
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Biohydrogen Production by Thermotoga Maritima from a Simplified Medium Composed Solely of Onion and Natural Seawater

Short introductive summary:

Biohydrogen (BioH2) fermentation by anaerobic hyperthermophilic and halophilic bacteria, Thermotoga maritima (TM), was conducted in 2 L continuously stirred tank reactor (CSTR) using a simple culture medium based on a mixture of onion waste (OW) as a substrate and seawater (SW). Different batch cultures were investigated with various onion waste volumes (0, 200, 400, 600 and 800 mL) supplemented with natural seawater for a total volume of 1200 mL. The highest production of biohydrogen was obtained for an optimum volume of 50 % (v/v) of OW (i.e. COD = 30.7 g/l) supplemented by FeCl2 (100 µM), NH4Cl (10mM) and NaCl (15 g/L) In these conditions, BioH2 productivity, maximum yield and total hydrogen production obtained were 22.6 mM/L, 3.2 (molH2/molhexose) and 272 mM respectively, after 25 hours of growth. Beyond 50 % (v/v) of OW, hydrogen production decreased in correlation with metabolism deviation towards lactate production. Thereafter, a controlled fed-batch culture with OW added in doses was studied to prevent the substrate-associated growth inhibition and increase the BioH2 production, by controlling the nutrient supply.

Presenter: **Lamia BEN GAIDA, Superior Institute of Applied Biological Sciences of Tunis, Environmental Engeneering Dpt., Tunis, TUNISIA**

Presenter's biography:

Lamia BEN GAIDA is an assistant professor in bioprocess engineering at the Higher Institute of Applied Biological Sciences of Tunis. She was member of JEAI BIOTEC H2 (2017-2020) and is actually responsible of workpackage dark fermentation in the LMI BIOTEC H2 in Tunisia

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Session reference: 5CO.13.1
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Biohydrogen Production from Waste: Experimental Investigation and Deployment Prospect for Transportation

Short introductive summary:

This work deals with the production of biohydrogen form gasification of refuse derived fuel and the subsequent syngas upgrading to a stream to produce bioH2 for fuel cells used in public transportation. Both a process model using AspenPlus and experimental investigation are presented.

Presenter: **Alex SEBASTIANI, University College London, Chemical Engineering Dpt., London, UNITED KINGDOM**

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Session reference: 5CO.13.2
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Impact of Thermo-Acid Pretreatments on Biohydrogen Production by Dark Fermentation: Abiotic and Biotic Factors

Short introductive summary:

Dark fermentation appears as one of the most sustainable solutions to produce green hydrogen from biomass. To increase the H2 yield and specifically select hydrogen producing bacteria, the application of pretreatment technologies is often required. However, studies on biomass pretreatment (with or without inoculum addition) scarcely investigated the pretreatment impact on final microbial communities, which may explain some variations in the total metabolite amount, the metabolic profiles or in H2 yields. This study aims to investigate, the impact of thermo-acid pretreatments on dark fermentation performances. Despite the increase in soluble sugar concentration for every condition, thermo-acid pretreatments were only effective in one case (with an inoculum) to increase hydrogen production due to a microbial shift. Moreover, thermo-acid pretreatments negatively impacted indigenous bacteria.

Presenter: **Kévin DAUPTAIN, INRAE, Narbonne, FRANCE**

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Session reference: 5CO.13.3
Subtopic: 5.3 Alternative Renewable Fuels and Hydrogen
Topic: 5. BIOENERGY INTEGRATION

Bioplastics or Conventional Plastics: Which is their Environmental Impact? - Life Cycle Analysis of a Chair

Short introductive summary:

Plastics are everywhere in our everyday life. Despite their wide use, plastics remain ubiquitous material basically because of the pollution their End of Life is associated with. The European Commission has launched the project 'Comparative Life Cycle Assessment of alternative feedstock for plastic production' highlighting the importance of the development of plastics made of sustainable feedstocks. The aim of this paper is to present the work done to assess the environmental impact of a plastic chair produced by alternative (bio-based and recycled) as well as fossil feedstocks. Six different scenarios for the production of a plastic chair have been developed and the environmental impact of each one of them has been quantified via an LCA analysis. The comparison of the different scenarios is mainly done with a focus on the sixteen default impact categories considered in the Product Environmental Footprint (PEF). Moreover, the stages of the life cycle that contribute more to each impact category have been identified.

Presenter: **Aikaterini KONTI, European Commission, JRC, Ispra, ITALY**

Presenter's biography:

Dr. Aikaterini Konti joined the JRC as a researcher in 2018. She is a holder of a BSc in Biology, a BSc in Economics and a MSc in Microbial Biotechnology from the NKUA and she has received her PhD in Environmental Biotechnology from the NTUA.

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Session reference: 4CO.14.1
Subtopic: 4.2 Environmental Impacts
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Life Cycle Assessment of a New Biomass-To-Liquid Process Comparing Different Process Configurations

Short introductive summary:

2nd generation biofuels are promising alternatives for their fossil counter parts when it comes to greenhouse gas reductions. Therefore, a novel biomass-to-liquid process concept is investigated for its greenhouse gas savings potential while also considering other environmental impacts. The results compare three process configurations, two biomass feedstocks and will elaborate the benefits of process simulation based life cylce assessment.

Presenter: **Julia WEYAND, DLR, Stuttgart, GERMANY**

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Session reference: 4CO.14.3
Subtopic: 4.2 Environmental Impacts
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Are Bio-Based Synthetic Fibers a Viable Solution for Moving Towards a Sustainable Textile Industry?

Short introductive summary:

Numerous studies have shown that the textile sector has a high fossil-fuel dependency. Currently, pol-yester (fossil-based) makes up about a half of the industry's fiber production and the volumes are expected to increase. The polyester fiber can be substituted by three bio-based fibers: bio-based PET fiber; polytrimethylene terephthalate (PTT) fiber and polylactic acid (PLA). The environmental effects of this feedstock substitution have not been studied abundantly.

In order to understand the environmental performance of these bio-based synthetic fibers a comparative, cradle-to-gate life cycle assessment of the conventional polyester fiber and these substitutes was performed.

It was found that all three bio-based fibers are produced from the first-generation feedstock (crops). Currently, only the partially bio-based PET and PTT polymers are commercialized. Bio-sourcing for polyester is found to offer a limited improvement in a small number of impacts, while causing substantial additional environmental burdens elsewhere.

Presenter: **Tijana IVANOVIC, EMPA, Technology and Society Lab, St Gallen, SWITZERLAND**

Presenter's biography:

Tijana Ivanovic works as a Researcher at Swiss Federal Laboratories for Material Science and Technology (EMPA). She focuses on bio-based innovation for textile fibers as well as in the use of medical plastics. She holds a M.Sc. in Environmental Engineering from EPFL, Switzerland.

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Session reference: 4CO.14.4
Subtopic: 4.2 Environmental Impacts
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Differential Scanning Calorimetry for Thermodynamics and Kinetics Assessment of Hydrothermal Carbonization

Short introductive summary:

High-pressure differential scanning calorimetry is an underestimated tool for the study of HTC, as it can be used to study both thermodynamics and kinetics of the process. A novel model is proposed to reach this goal. Its results are presented. First, the results in terms of thermodynamics are presented, with a substantial reproducibility improvement with respect to the literature. Second, the results in terms of kinetics of the HTC process are proposed. To the best of the authors’ knowledge, the use of DSC for the study of HTC kinetics is unexplored in the literature.

Presenter: **Matteo PECCHI, Free University of Bolzano, Science and Technology Dpt., Bolzano, ITALY**

Presenter's biography:

I am a PhD student in the Bioenergy and Biofuels Lab at the Free University of Bolzano.
My topics are thermochemical process for bioenergy and biofuels production (gasification, pyrolysis, hydrothermal carbonization) and anaerobic digestion.

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Session reference: 3CO.15.1
Subtopic: 3.3 Hydrothermal Processing
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Hydrothermal Liquefaction Data Analysis with Machine Learning Algorithms

Short introductive summary:

This paper explains how machine learning algorithms, and in particular the random forest algorithm, can help to analyse hydrothermal results data. The random forest algorithm is successful in modelling data and can show us variables influence the results in an unexpected way.

Presenter: **Geert HAARLEMMER, CEA-LITEN, DTBH, Grenoble, FRANCE**

Presenter's biography:

Chemical engineering degree from Eindhoven University of Technology and a PhD degree from the University of Manchester (UMIST). Professional experience includes 13 years in the petroleum industry and 12 years in biomass conversion projects and CEA.

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Session reference:	3CO.15.2
Subtopic:	3.3 Hydrothermal Processing
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

A Comprehensive Process Model for System Analyses of Transportation Fuel Production via Hydrothermal Liquefaction

Short introductive summary:

In this work, a comprehensive process model for system analyses of transportation fuel production is presented. The emphasis of this work is on the incorporation of an extensive reaction network in the hydrothermal liquefaction and hydrotreating process step as well as on modeling a whole process chain, which includes the treatment of resiual process streams. The model parameters are based on process conditions from continuous pilot plant reactors used in the EU-funded HyFlexFuel project. Model results are validated by results obtained in the HyFlexFuel project or by comparison to literature results.

Presenter: **Leonard MOSER, Bauhaus Luftfahrt, Taufkirchen, GERMANY**

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Session reference:	3CO.15.3
Subtopic:	3.3 Hydrothermal Processing
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Challenges and Strategies of Hydrothermal Liquefaction of Sewage Sludge

Short introductive summary:

This work summarized the challenges during hydrothermal processing of sewage sludge in terms of biocrude qualities, and proposed potential integrated approaches to improve energy valorization of sewage sludge.

Presenter: **Ursel HORNUNG, Karlsruhe Institute of Technology, Institute of Catalysis Research and Technology Dpt., Eggenstein Leopoldshafen, GERMANY**

Presenter's biography:

Dr. Hornung is group leader of the working group hydrothermal liquefaction within the Institute of catalysis research and technology of KIT. She works over 20 years as scientist on the topics of polymer degradation, determination of chemical kinetics for reactor design and recovery of biomass.

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Session reference: 3CO.15.4

Subtopic: 3.3 Hydrothermal Processing

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Effects of Combustion Operating Conditions on Ash Reactivity of a 50:50 Bark-Straw Mixture

Short introductive summary:

Ash behavior poses various limitations on the thermochemical conversion techniques (combustion and gasification). Their presence in the liquid phase can lead to sintering effect in a furnace/boiler (i.e. large sticky pieces in the bottom of the reactor that block it) and bed agglomeration in a fluidized bed. Hence, instead of expensive additives application, a suitable solution is to mix biomasses with different ash contents and composition to alter their chemical composition and physical properties. Then upon heating, a chemical reaction within the ash, and not only phase dilution, can take place to form new solid phases in the mixture at the expenses of reducing the percentage of the liquid phase.

In this work, a 50:50 mixture of bark and straw was used in various laboratory and pilot tests, and XRD along with SEM analysis were applied. The chemical reaction was first verified by the appearance of new crystal phases at the expenses of a significant decrease in the concentration of the amorph in the biomass mixtures. Second, the effects of operating conditions on this reactivty were thoroughly evaluated and ranked, in order to find an optimum condition and control this reactivity.

Presenter: **Emile ATALLAH, CEA, Grenoble, FRANCE**

Presenter's biography:

PhD student at Univeriste Grenoble Alpes and CEA Grenoble working on studying ash reactivity of biomass mixtures in combustion and gasification processes.

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Session reference: 2CV.9.1
Subtopic: 2.3 Biomass Combustion in Large Utilities
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Influence of Biomass Type on Corrosion during Fluidized Bed Combustion

Short introductive summary:

The main objective of this work is to analyse the corrosion behaviour of bare and coated coupons of ferritic steels and a high-alloy multipurpose austenitic stainless steel facing the increasingly extreme conditions that arise in the generation of energy using biomass as fuel. Three biomasses from different categories (wheat straw, eucalyptus and industrial wood waste) have been selected for evaluation at a 10kWth FBC pilot plant. From biomass fuels chemical analyses, atmosphere composition and real combustion conditions from different experimental combustion tests, as input data, the influence exerted by the biomass type employed over deposition and corrosion phenomena, has been studied by means of thermodynamic equilibrium calculations. Three different coatings (FeAl, NiAl, SiCrAl), were selected for corrosion evaluation. Metal interactions with ash components in the combustion atmosphere were determined for varied temperature ranges. Results reveal that fuel composition strongly affects the chemical attack towards different materials, thus coatings efficiency may vary with the biomass employed in the process.

Presenter: **Maria Luisa CONTRERAS, CIEMAT, Energy Dpt., MADRID, SPAIN**

Presenter's biography:

PhD in Applied Physical Chemistry, with 20 years of experience in Energy valorization of fuels and wastes. Her research is focused on emissions formation, including mercury and other trace metals in combustion processes, characterization of ashes and operational problems in fluidized bed combustion

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Session reference: 2CV.9.2
Subtopic: 2.3 Biomass Combustion in Large Utilities
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Experimental Study of Biomass Flue Gas Low Grade Heat Utilization Using Corrugated Plastic Tube and Corrugated Stainless-Steel Pipe

Short introductive summary:

Biomass incineration plants often use condensing economizers in order to raise the overall efficiency of the plat and also to capture waste heat from flue gas. However the captured waste heat depends on district heating system temperatures, allowing to cool the flue gas up to ~50°C, and that flue gas still generates some waste heat since it is still above the abmient temperature. Furthermore, cooler flue gas gives way to hazardous component condensation which would result in materials lifespan. In this study further cooling of the flue gas is considered using relatively cheap and reliable (with corrosin resistant) sources, comparing the heat recovery between the heat exchanger made up from widely available stainless steel to plastic tubes.

Presenter: **Zilvinas ULDINSKAS, Kaunas University of Technology, Kaunas, LITHUANIA**

Presenter's biography:

I am 27-year old energy engineer and PhD student from Kaunas, Lithuania. I am working in AXIS Tech company whose main outlet is biomass energy solutions, and studying in Kaunas University of Technology, currently working on biomass flue gas usage as waste heat source (low grade heat).

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

Co-authors:

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Session reference: 2CV.9.4

Subtopic: 2.3 Biomass Combustion in Large Utilities

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Biomass Co-Firing Technical Challenges - Combustion, Residues and Emissions

Short introductive summary:

Basic technological challenges related to biomass combustion and co-firing have been presented and discussed. The most significant differences concerning biomass combustion behaviour comparing to coal have been identified and discussed. The influence of biomass addition to the co-fired blend on the energy efficiency of the utility boiler has also been discussed. As the composition of biomass ash is strongly different from the one of coal, the influence of the individual compounds (alkalis) on the risk of boiler fouling and slagging has been evaluated, in terms of different biomass sorts. Ash composition, as well as the emission of gaseous pollutants for biomass combustion, have been identified along with the discussion of the additives which are used to change the ash fusion temperatures and thus reduce the risk of the defluidization of the bed material in CFB and BFB biomass co-firing boilers. The energy and emission issues concerning the combustion process of torrefied biomass will also be presented with the results of bench-scale testing as well as large scale utility boiler trial tests findings.

Presenter: **Jaroslaw ZUWALA, Institute for Chemical Processing of Coal, Zabrze, POLAND**

Presenter's biography:

Mr. Jaroslaw Zuwala holds the positions of R&D Deputy Director and Associate Professor in Institute of Chemical Processing of Coal in Zabrze. He is an experienced researcher&project manager in the field of clean coal technologies, energy storage and biomass and waste based renewable energy.

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J. Zuwala, Institute for Chemical Processing of Coal, Zabrze, POLAND

Session reference: 2CV.9.5

Subtopic: 2.3 Biomass Combustion in Large Utilities

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Modelling of Grate Fired Woody Biomass and Waste to Energy Plants - Status and Further Needs

Short introductive summary:
For four and a half years (2017-21), a large competence building project (GrateCFD) is running in Norway. The main objective of the project is development of Computational Fluid Dynamics (CFD) aided design tools and operational guidelines for optimum grate fired biomass- and waste-to-energy (BtE, WtE) plant operation through 1) Model development: improved fuel/fuel bed and gas release models, heat-exchanger deposition models, interaction with stochastic reduced order models, and reduced chemical kinetic models towards NOx prediction; and validation of these, 2) Simulations: transient and steady state CFD simulations of BtE and WtE plants; and validation, and 3) Concept improvements: BtE and WtE plant case studies selection, setup, simulations and analysis, giving design and operational guidelines.
In this work, the main findings of the project are presented. Moreover, further research needs are identified to arrive at effective and predictive modelling tools and approaches for grate firing of woody biomass and waste.

Presenter: **Oyvind SKREIBERG, SINTEF Energy Research, Thermal Energy Dpt., Trondheim, NORWAY**

Presenter's biography:
Dr. Øyvind Skreiberg is Chief Scientist within stationary bioenergy at SINTEF in Trondheim, Norway, having more than 25 years of broad bioenergy experience, contributed to more than 500 scientific publications, presentations and reports and representing Norway since 1998 in IEA Task 32.

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Session reference: 2CV.9.6
Subtopic: 2.3 Biomass Combustion in Large Utilities
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Towards Digital Biomass Spreader-Stoker Boilers: a Detailed, Particle-Based Model of Bed Combustion Coupled with CFD

Short introductive summary:

In this work, we describe a simulation model that couples the freeboard area and the bed of a large-scale spreader stoker wood boiler. To calculate the performance of this type of boilers, three sub-models have been coupled: a Lagrangian approach for the solid biomass particles introduced in the boiler, a model for the grate and a model for the freeboard.

Hence, this model gathers information regarding the conditions and position of the wood/fuel particles reaching the bed from the fuel injectors in the front wall of the boiler. Once in the bed, fuel particles are tracked and exposed to drying, devolatilization and reaction processes, exchanging species and energy with the freeboard area while being transported along the grate. The model keeps computational costs low while allowing for greater insight regarding the conditions within the bed and its interaction with the rest of the boiler.

The model has been applied to a 25 MWth spreader stoker boiler. The results show the strong coupling between the combustion pattern in the grate and the post-combustion processes in the freeboard. This indicates the relevance of including an accurate bed model for the simulation of biomass boilers

Presenter: **Eduardo GIMENO-ESCOBEDO, Nabladot S.L, Zaragoza, SPAIN**

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Session reference: 2CV.9.7
Subtopic: 2.3 Biomass Combustion in Large Utilities
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Heavy Gravity Cable Yarding in Italian Alps, Operation Planning and Logistic

Short introductive summary:

The present study was set up in Trentino-Alto Adige Region in Italy. The main aim was the analysis of a harvesting system consisting of motor manual felling with chainsaw, bunching and extraction by heavy gravity cable yarder and final processing with an excavator-based felling and processing head. This harvesting system allowed for the production of both timber and wood chips, these last from little branches and tops.

Presenter: **Francesco LATTERINI, CREA-IT, Monterotondo, ITALY**

Presenter's biography:

Researcher in Agricultural Mechanization.

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Session reference: 1CV.10.4
Subtopic: 1.1 Biomass Potentials and Biomass Production Models
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Work Productivity Analysis in Thinning Intervention of Chestnut Coppice in Central Italy

Short introductive summary:
This study was set up in Lazio Region in Italy. Work productivity in thinning intervention of a chestnut coppice was analyzed evaluating the working performance of an unusual harvesting system, the use of which was possible thanks to the low values of slope and roughness. Felling was motor manual with chainsaw, bunching was carried out by an excavator equipped with processing head and extraction through crawler tractor and wheeled truck.

Presenter: **Walter STEFANONI, CREA-IT, Monterotondo (RM), ITALY**

Presenter's biography:
Research activities in the crops for energy production

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Session reference: 1CV.10.5
Subtopic: 1.1 Biomass Potentials and Biomass Production Models
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Forest Operation in High Slope: Preliminary Considerations on the Possibility of Substituting Cable Yarder with Helicopter for Timber Extraction

Short introductive summary:

This study is a preliminary one, in which literature data are used to compare work productivity of cable yarders and helicopters in extraction operation performed in Italian Alps. 2 cable yarders and 3 different helicopters models were compared concerning working performance and extraction costs.

Presenter: **Walter STEFANONI, CREA-IT, Monterotondo (RM), ITALY**

Presenter's biography:

Research activities in the crops for energy production

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Session reference: 1CV.10.6
Subtopic: 1.1 Biomass Potentials and Biomass Production Models
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Biomass Classification by K-Means Clustering and Correlation Analysis Based on Compositional and Pyrolysis Data

Short introductive summary:

The demand for new sources of biofuel obtention has had a significant growth in the past few years. Thermochemical processes like pyrolysis have been evaluated as means to obtain energy and added value from organic industrial waste products which would otherwise be discarded. The yield from each of the 3 pyrolysis products is given by the type of biomass, its composition ad the temperature,time and heating rate of the pyrolysisi process. For this reason, this study aims to group data between different feedstock based on their composition and the yield of their pyrolysis. In order to accomplish this, three datasets of biomass compositional and pyrolysis data were collected. Afterwards, a k-means clustering analysis was applied to obtain groups and find which compositional characteristics favor the performance of pyrolysis. Possible biomasses were suggested depending on the needed pyrolysis product.

Presenter: **Valentina NUÑEZ-BARRERO, Universidad de Los Andes, Chemical Engineering Dpt., Bogota, COLOMBIA**

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Session reference: 1CV.10.17
Subtopic: 1.1 Biomass Potentials and Biomass Production Models
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Bioenergy in Mato Grosso State (Brazil) as a Vector for Integrating Agricultural Activities Towards Sustainable Development

Short introductive summary:

Mato Grosso is a leading state in Brazil's thriving agribusiness, both in crop and livestock production. However, it is also the second state in Amazon deforestation. Biomat Project was set up to identify the situation of bioenergy and opportunities for sustainably expanding its production and use in the state. An important finding was the possibility of integrating agricultural and different forms of bioenergy production to create a more sustainable system. For example, the combination of a corn-based biorefinery with livestock production and biogas from animal residues could reduce land use and the need for additional energy and synthetic fertilizers. Bioenergy is also a promising solution to mitigate environmental and economic impacts from diesel consumption and problematic electricity access in the state.

Presenter: **Suani COELHO, University of São Paulo, São Paulo, BRAZIL**

Presenter's biography:

Short bio.
Suani Teixeira Coelho is a Chemical Engineer, Master and PhD in Energy in the Graduate Program in Energy from the University of São Paulo, where she is currently lecturer, thesis advisor, PD supervisor and coordinator of the Research Group on Bioenergy (GBIO - former CENBIO).

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Session reference:	1CV.10.18
Subtopic:	1.1 Biomass Potentials and Biomass Production Models
Topic:	1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Assessment of Comminuted Biomass Behaviour during Arundo Donax Storage

Short introductive summary:

Dedicated energy crops can play a key role in providing substantial amounts of lignocellulosic feedstocks required for the second-generation biofuel production chain as well as heat and electricity production (JRC EC, 2011). Giant reed (Arundo donax L.) has already been recognized as a high yielding, stress tolerant crop suited to marginal lands and low-input cultivation, which could be encompassed in land-saving and environmentally sound bioenergy supply chains. For instance, giant reed has been proposed for bioethanol, biogas, and thermochemical conversion. Although considered for bioenergy throughout the world, this crop has received particular attention in the Mediterranean, where promising yields have been achieved in mid- and long-term field trials.

Presenter: **Simone BERGONZOLI, Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, CREA-IT, Treviglio (BG), ITALY**

Presenter's biography:

Agronomist, Phd in agricultural engineering I work since 2010 in crop harvesting, biomass feedstock and energy crops

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Session reference: 1CV.10.20
Subtopic: 1.1 Biomass Potentials and Biomass Production Models
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Heat & Power Production with Turboden Proven Technology

Short introductive summary:

This paper features the application of Turboden ORC technology for Combined Heat and Power (CHP) generation fuelled by wood biomass or other biomass residues.
In such installations, the ORC module is coupled to an automatically biomass combustion system with thermal oil heater and pollution control technology.

Presenter: **Simone PASSERA, Turboden, Sales Dpt., Brescia, ITALY**

Presenter's biography:

Simone Passera has been working for Turboden since 2012 having different position such as Application Engineer, Sales Engineer and Country Area manager. Currently he is Sales and Business Development Manager for Biomass application.

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Co-authors:

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Session reference: ICV.11.2

Subtopic: 6.1 Advances in Large Scale Gasification

Topic: 6. INDUSTRY TRACK

Biomass as the Key to a Sustainable Brick Production - Energy Supply, Generation of Process Heat and Recycling of Gasification Residues

Short introductive summary:

Using the example of a brick factory, the project analyzes how process heat (500 - 1000°C) and residues from gasifiers can be used for industrial brick production. The economic use of biomass in energy-intensive industries is thus demonstrated in an exemplary manner. In the project setup, different scenarios are investigated how heat and power from a wood gasifier (CHP) can be integrated in the brick process. Further goal of the project is the material utilization of coke from the gasifier, which can be used as pore forming agent material in the brick. This cascade system reduces disposal costs, improves the product properties of the brick, conserves fossil fuels, and at the same time increases the cost efficiency of the process. The project consortium exist of plant manufacturers (Burkhardt GmbH) and users (Ziegelwerk Ernst GmbH & Co. KG). Fraunhofer UMSICHT is project coordinator.

Presenter: **Julian WALBERER, Fraunhofer UMSICHT, 92237 Sulzbach-Rosenberg, GERMANY**

Presenter's biography:

03/2014 – 02/2015:Master environmental engineering
03/2015 – 01/2016:Master thesis at Fraunhofer UMSICHT "Performance investigation and optimization of alternative biofuels in an internal combustion engine based combined heat and power plant
02/2016:Researcher Scientist at Fraunhofer UMSICHT

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Session reference: ICV.11.3
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Efficiency Increase of a Small-Scale CHP Plant Fueled with Synthesis Gas Originating from Thermochemical Recuperation

Short introductive summary:

The project Heat Power Converter (HPC) aims to develop a retrofitting component for internal combustion engine based (ICE-based) combined heat and power (CHP) plants replacing the inlet and exhaust manifolds. The main idea of the project is the conversion of engine's exhaust gas thermal energy into chemically bound energy. This is possible through thermochemical recuperation (TCR) that is based on the steam reforming of hydrocarbons. Before entering the engine, the conventional CHP fuel is reformed and a hydrogen- and carbon monoxide-rich synthesis gas is generated. This synthesis gas constitutes the engine fuel and has a higher heating value than the conventional fuel. The increase of the lower heating value (LHV) through TCR among multiple exhaust gas heat recovery increases the overall CHP system efficiency and enables a more flexible operation regarding the power to heat ratio. HPC in cooperation with the CHP is to be developed into an industrial product ready for series production. This innovation leads to a significant reduction in carbon dioxide emissions by increasing the efficiency of CHP technology.

Presenter: **Sergej WARKENTIN, OWI Science for Fuels, Herzogenrath, GERMANY**

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Session reference: ICV.11.4
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Cooling Pig Manure by Surplus Heat from a Biogas Fueled CHP

Short introductive summary:

Often farm based biogas plants cannot utilise the heat production from the CHP production. On pig farms, however, the heat may be utilised for slurry cooling in animal houses which lowers ammonia and odour emissions from farm houses, but also reduces methane losses from manure before applied to the biogas plant. This can be done by applying an adsorption cooler, which is tested in a project co-funded by the Danish Environmental Protection Agency

Presenter: **Kurt HJORT-GREGERSEN, Danish Technological Institute, Environment Technology Dpt., Aarhus, DENMARK**

Presenter's biography:

Agricultural Economist, biogas technology

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Session reference:	ICV.11.5
Subtopic:	6.1 Advances in Large Scale Gasification
Topic:	6. INDUSTRY TRACK

Biowave: Microwave Pretreatment of Dairy FOG Waste for Enhanced Anaerobic Digestion

Short introductive summary:

Dairy FOG wastewater is difficult to treat, causes inhibitory effects in anaerobic digestion, and is diverted from the waste stream for disposal via land spreading. FOG compounds are energy-dense, representing up 50 % of the chemical oxygen demand of the total waste stream in 10 % of the volume. Accessing this energy reserve would lead to enhanced biogas production.

Here we present Biowave™ - microwave pretreatment technology. Microwave energy heats feedstocks efficiently and uniformly, enhancing chemical reactions and therefore aiding chemical breakdown of recalcitrant compounds, such as the long chain fatty acids found in FOG waste. By removing these compounds, the adverse effects of FOG waste on anaerobic digestion is eliminated and the energy locked up in this waste stream can be harnessed. The technology contributes to the circular economy by utilising FOG waste to produce renewable energy, and reducing the CO2 emissions and costs associated with transport and disposal.

Presenter: **Catherine MCINTYRE, Ashleigh Environmental, Dungarvan, IRELAND**

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Session reference: ICV.11.6
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Process for the Production of Sustainable Aviation Fuel from Residual Glycerol

Short introductive summary:

To meet with the required production of advanced biofuels, new processes are desired. A promising process is being developed within the scope of the European project GLAMOUR. Residual glycerol from FAME production plants, is used as feedstock and converted in sorption-assisted chemical looping recycling (SA-CLR), after which the gas is converted into primarily kerosene. The aim is to demonstrate the combined technologies at scale, to achieve an energy efficiency of 65% and a carbon efficiency of 45%. In this work, the progress and challenges on the production of jet fuel from steam reforming gas will be presented.

Presenter: **Evert BOYMANS, TNO, Biobased and Circular Technologies Dpt., Petten, THE NETHERLANDS**

Presenter's biography:

Evert Boymans, Ph.D. is a researcher and holds a PhD in the field of catalysis obtained at the Technical University of Eindhoven. Since 2017 he has been part of the gasification cluster within the biomass and energy efficiency group of ECN part of TNO.

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Session reference: ICV.11.9

Subtopic: 6.1 Advances in Large Scale Gasification

Topic: 6. INDUSTRY TRACK

Ramifications of Drop-In Biofuels for Amine, Sulphur Recovery and Sour Water Treatment Units in Crude Oil Refineries

Short introductive summary:

Authors of this paper are engineers of Sulphur Experts and Amine Experts companies, which are world leaders in providing analytical and process engineering support to amine, sulphur and sour water systems. This paper discusses the impact of bio-feedstock co-processing in hydrotreater and FCC units on amine, sulphur and sour water systems. To authors' knowledge there has not been done enough work in this area, and it is believed that this is the first publication focused on changes and challenges in these units resulted from bio-feedstock co-processing.

Presenter: **Philip LE GRANGE, Sulphur Experts, Katwijk, THE NETHERLANDS**

Presenter's biography:

Philip is a Chartered Chemical Engineer specializing in solvent systems and has performed troubleshooting, optimizing, commissioning and staff training on hundreds of amine solvent and sour water units across 73 production facilities in 31 countries.

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Session reference: ICV.11.11
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Biofuel Production Using a Staged Fischer-Tropsch Process Followed by Mild Hydrocracking

Short introductive summary:

The Horizon 2020 PULP&FUEL project (2018-2022, grant agreement No 818011) investigates the integration of biofuel production with a pulp mill. Dry gasification will provide the backbone for syngas production and super critical water gasification (SCWG) of weak black liquor aims to produce hydrogen to minimize the sacrificial conversion of CO to obtain the proper H_2/CO ratio for FT. Using a staged approach to a fixed-bed FT process, utilizing H_2 from SCWG, it is possible to achieve high overall carbon conversion while operating the first FT reactor with a Co-catalyst and with 1 H_2/CO 2, minimizing the initial sacrificial conversion of CO in the shift process. By operating the second reactor using an Fe-based catalyst, the overall product spectrum is moderated due to the inherent differences in selectivity. Mild hydrotreatment/hydrocracking converts the syncrude to transportation range biofuels.

Presenter: **Bjorn Christian ENGER, SINTEF, Trondheim, NORWAY**

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Session reference: ICV.11.12

Subtopic: 6.1 Advances in Large Scale Gasification

Topic: 6. INDUSTRY TRACK

Assessing Profitability of Bioenergy Production with Minimal Environmental Impact Biorefineries

Short introductive summary:

This paper shows that bioenergy production with biochemical-platform biorefineries designed to minimize the environmental impact and to maximize energy production can be as profitable as those biorefineries designed for maximum profit only.

Presenter: **Stephanie MARTÍNEZ VICTORIA, Centro de Investigacion y Estudios Avanzados, Unidad Guadalajara de Ingeniería Avanzada, Zapopan, Jalisco, MEXICO**

Presenter's biography:

Currently enrolled in a PhD of Science program at CINVESTAV-Guadalajara applied to the area of Automatic Control research.

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Session reference: ICV.11.16
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Toxicity and Circular Potential of Polyurethane Synthesized with Biomass by-Product and Waste-Derived Biopolyols

Short introductive summary:

The study describes some results acquired throughout research efforts in investigating the potential of crude glycerol-mediated solvothermal liquefaction of residual biomass for the production of high-quality biopolyols suitable for subsequent polyurethane (PU) product synthesis. The startup company ecorbio will undertake a feasibility study after the small-scale pilot production line is up and running. The present paper, meanwhile, focuses on the understudied recyclability, ecostability and ecotoxicity, and fire safety aspects of such synthesized biopolyol-based rigid PU foams and bioPU adhesives.

Presenter: **Lukas JASIUNAS, Ecorbio, Nicosia, CYPRUS**

Presenter's biography:

PhD in Chemical Engineering, studying solvothermal industry-friendly liquefaction of residual biomass for the production of sustainable biopolyols. Previous experience with renewable energy sources and harnessing methods, most recently with bio-oil production via Hydrothermal Liquefaction.

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Session reference: ICV.11.17
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Design of a Biogas Production Plant in Colombia Using Mango (Mangifera indica l.) Residues

Short introductive summary:
In this work, a biogas production plant in Colombia was disigned using experimental results form the codigestion of mango peels and pig manure. With the help of the experimental data and, by dint of governmental regulations and geographical locations, a realistic quantitative study was carried out which hypothesized the construction of a biogas plant. A national and international analysis of the installed capacity of biogas production plants was performed in order to set up a framework in which it became possible to calculate the geometric and physical characteristics of the tanks and reactors involved in a biogas production plant. The tanks and reactors were consequently designed and a feasibility analysis proved that the Tolima region was the best to carry out this project in Colombia.

Presenter: **Daniel David DURÁN-ARANGUREN, Universidad de los Andes, Chemical Engineering Dpt., Bogotá, COLOMBIA**

Presenter's biography:
Chemical Engineer(2014)-Universidad de América,Bogotá, Colombia
MEng. Process and Product Design(2017) and MSc. Chemical Engineering(2018)-Universidad de los Andes, Bogotá, Colombia
Teaching Assisant(2017 - 2020)-Universidad de los Andes
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Session reference: 2DO.1.1
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Sludge Reduction and Biogas Recovery in Anaerobic Co-Digestion Using Acidogenic Fermented Fish By-Products with Ligno-Cellulose Materials

Short introductive summary:

Fish-byproducts (FBs) were acid fermented using ligno-cellulose material (corncob) and tap water. Anaerobic co-digestion of fermented fish broth and sewage sludge is very useful for sludge reduction and bioenergy production when using discarded wastes as organic carbon sources. The processing cost of anaerobic co-digestion of FFB and sewage sludge is lower than that of composting or incineration. This strategy is economical in comparison with other methods because it can take advantage of the spare capacity of existing sewage treatment plants without investing in new facilities. Moreover, considering the income from energy recovery of methane gas, there is an advantage in that waste can be treated at a lower treatment cost than in the other treatment methods, and energy can be recovered.

Presenter: **H-J. CHOI, Catholic Kwandong University, Biosystems and Convergence Engineering Dpt., Gangneung, REPUBLIC OF KOREA**

Presenter's biography:

Prof. Dr. Hee-Jeong Choi received hers Ph D. at Technical University Berlin, Germany, on studies with biological wastewater treatment and bioenergy. After Ph D. she returned to Korea and started hers research department of Biosystems and Convergence Engineering in Catholic Kwandong University.

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Session reference: 2DO.1.2

Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

The Adaptation of Operating Biogas Plants to the Enhanced Use of Agricultural Residues

Short introductive summary:

The emphasis of the presented research project is on anaerobic treatment facing the difficulties of the lignocellulosic substrate characteristics. The project objective is to develop innovative approaches to create optimum conditions for the enhanced utilisation of lignocellulosic agricultural residues in operating biogas plants. Based on the case study on 15 selected biogas plants, anaerobic digestion effects and technical influences are examined to discuss future-oriented plant conceptual designs considering process related as well as socio-economic aspects.

Presenter: **Norbert GRÖSCH, Institute of New Energy Systems, Industrial Energy Systems Dpt., Ingolstadt, GERMANY**

Presenter's biography:

03/2018 - Institute of new Energy Systems - Research assistant
02/2017 - 02/2018: IBE Innovative BioEnergy - Project engineering/ consultant for biogas process
10/2011 - 02/2017: HTW Berlin (UAS) - Graduation: Master of Science
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Session reference: 2DO.1.4
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Perspectives for Bioenergy with Carbon Capture and Storage Implementation in Brazil

Short introductive summary:

Addressing climate change requires rapid greenhouse gas (GHG) emissions reductions, which can be achieved by shifting the energy system from fossil fuels to low-carbon, renewable sources. Furthermore, stabilising global temperatures demands net-zero emissions of long-lived GHGs. To achieve a carbon-neutral world, negative emissions technologies (NETs) will be necessary to compensate for residual emissions from hard to decarbonise sectors. Large scale deployment of NETs tends to be included in cost-effective decarbonisation scenarios generated by integrated assessment models, especially for more stringent targets and pathways with longer delays in reducing emissions. Notably, they rely mostly on bioenergy with carbon capture and storage (BECCS), seen as the most promising alternative to deliver carbon removal at the necessary levels.

Presenter: **Karen MASCARENHAS, RCGI - Research Centre for Gas Innovation, Human Resources & Leadership, São Paulo, BRAZIL**

Presenter's biography:

Director Human Resources at Research Centre for Gas Innovation, researcher in Public Perception, Leadership,Social Licence to Operate energy transition with emerging technologies as BECCS, Prof Adm Post-graduation at FGV, MSc Social Psychology and PhD candidate USP,research period Imperial College.

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Session reference: 4DO.2.1
Subtopic: 4.3 Climate Impacts and GHG Performance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

New Method Attributional Land Use and Land Use Change (aLULUC) Applied to Biofuels. What Can it Do Better than iLUC and dLUC?

Short introductive summary:

Drained peatland and deforestation, summarised as Land Use and Land Use Change (LULUC), have long been recognised to cause crucial climate impacts of global agricultural production. Commonly, these impacts are attributed to individual products in LCA via dLUC (direct Land Use Change) and iLUC (indirect Land Use Change) concepts. However, limited market demand for dLUC-free products cannot limit deforestation and ranges of input parameters and results of various iLUC calculations are so large that it is apparently too easy in political processes to raise doubts regarding their validity regardless of their scientific merits. To address these challenges, we chose an ex-post, land market-based approach: According to the attributional land use/land use change (aLULUC) approach, all emissions from LULUC in a reference period and area are evenly allocated to all uses of arable or grassland in this period and area. This results in emission factors that allocate actual and measurable emissions to all producers in each agricultural area. We present details of the methodology, highlight differences to dLUC and iLUC and show its advantages in practical applications.

Presenter: **Heiko KELLER, IFEU - Institute for Energy and Environmental Research Heidelberg, Heidelberg, GERMANY**

Presenter's biography:

Since 2011 Research associate at ifeu, Heidelberg, current position: senior project manager
2015-2019 Lecturer at Karlsruhe Institute of Technology (KIT), course on life cycle assessment
2006-2010 PhD in biophysics (University of Technology Dresden, Max Planck Institute of Molecular Cell Biology)

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Session reference: 4DO.2.2
Subtopic: 4.3 Climate Impacts and GHG Performance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

FarmCO2sink: Storage of C and GHG Emissions Reduction in Beech and Miscanthus-based Durable Products

Short introductive summary:

We quantified the climate impacts of agroforestry production systems from the cultivation/management phase and up to the use of agricultural products with traditional (direct combustion) or alternative uses destinations such as furniture (beech wood) and green building (miscanthus biomass).

Presenter: **Alessandro AGOSTINI, ENEA Research Centre, TERIN Dpt., Rome, ITALY**

Presenter's biography:

Alessandro Agostini is an environmental scientist, researcher at ENEA. His main activity is the environmental impact assessment of bioenergy, with a life cycle approach, with a focus on GHG emissions from solid and gaseous biofuels.

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Session reference: 4DO.2.3
Subtopic: 4.3 Climate Impacts and GHG Performance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Salix Variety Determines Soil Carbon Sequestration and Climate Impacts - Analysis Using Soil Carbon Modelling and LCA

Short introductive summary:

SRC Salix (or Willow) plantations have the potential to provide fast-growing biomass feedstock with significant soil and climate mitigation benefits - but varieties are quite different in their physiological traits, growth patterns and soil ecology. Soil carbon modelling was combined with life cycle assessment (LCA) to evaluate and compare soil carbon sequestration and climate impacts of bioenergy production from six commercial Salix varieties over a 50-year period in central Sweden. All six Salix varieties sequestered carbon dioxide as soil organic carbon and had climate mitigation potential. The results showed that it is Salix variety that determines the magnitude of SOC sequestration, biomass yield, growth pattern, response to fertilisation and, ultimately, climate impact. Hence the right variety selection is important to achieve the optimal balance between energy output and climate benefit.

Presenter: **Saurav KALITA, Swedish University of Agricultural Sciences, Energy and Technology Dpt., Uppsala, SWEDEN**

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Session reference: 4DO.2.4
Subtopic: 4.3 Climate Impacts and GHG Performance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Co-Processing Catalytic Fast Pyrolysis Oil in an FCC Reactor

Short introductive summary:

Co-processing Catalytic Fast Pyrolysis (CFP) oil with Vacuum Gas Oil (VGO) in a Fluid Catalytic Cracking (FCC) unit could allow the incorporation of biocarbon into common transportation fuels at a low cost and large scale. Potential drawbacks when co-processing bio-oils are higher reactivity (over-cracking), higher coke and aromatics formation, lower liquid yields, poor biocarbon incorporation into desired fuel products, remaining oxygen in liquid products, impacts of oxygenates and alkali on reactor materials, and bio-oil feeding problems. For this reason, studies of co-processing CFP oil are conducted at the laboratory-scale in a Davison Circulating Riser (DCR), a petroleum-industry standard for evaluating FCC operations. A techno-economic analysis indicates that the minimum fuel selling price (MSFP) range for fuel-range products derived from FCC co-processing of CFP oil is estimated at $3 to $4 per gasoline-gallon equivalent (GGE) at a yield of 51 GGE per ton of biomass.

Presenter: **Reinhard SEISER, NREL, Golden, USA**

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Session reference: 3DO.3.1
Subtopic: 3.4 Oil-Based and Renewable Hydrocarbon Biofuels
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

FLEXJET H2020 Project to Produce Sustainable Biogenic Jet Fuel

Short introductive summary:

flexJET H2020 project will build a pre-commercial demonstration plant for the production of advanced sustainable aviation biofuel (SAF) from waste vegetable oil and organic solid waste biomass, successfully demonstrating the “Sustainable Aviation through Biofuel Refining” (SABR) process for the refining biodiesel from organic waste oils combined with Thermo-Catalytic Reforming (TCR®) combined with hydrogen separation through pressure swing adsorption (PSA)) to produce SAF, a fully equivalent jet fuel blend (compliant with ASTM D7566 Standards). This project will deliver respective environmental and social sustainability mapping of SAF production and it will validate its comprehensive exploitation.

Presenter: **Artur MAJEWSKI, University of Birmingham, School of Chemical Engineering, Birmingham, UNITED KINGDOM**

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Session reference: 3DO.3.2

Subtopic: 3.4 Oil-Based and Renewable Hydrocarbon Biofuels

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Promotional Affect of CeO_2 and La_2O_3 on the Performance of Ni/ZrO_2 Catalyst in the Selective Catalytic Deoxygenation of Palm Oil to Renewable Diesel

Short introductive summary:

Major concerns with limited fossil fuel resources and with global warming caused by high CO_2 emissions have prompted a worldwide search for alternative and sustainable energy sources for the transportation sector [1,2]. Triglycerides-based biomass is a renewable alternative to fossil sources for the production of liquid fuels and chemicals. Biodiesel (FAME), synthesized from the transesterification of vegetable oils with alcohols, is being developed as a substitute of traditional petroleum-derived liquid fuels [3-5]. However, biodiesel has a number of disadvantages including low oxidative stability, high viscosity, poor cold weather performance, production of large amounts of crude glycerol as the main by-product and is incompatible for large-scale use in conjunction with fossil fuels [6]. As a result, second generation biofuel, also known as renewable diesel or green diesel, prepared from Selective Catalytic Deoxygenation (SDO) has been gradually developed. This is realized by three different reactions, decarboxylation (deCO_2), decarbonylation (deCO) and / or hydro-deoxygenation (HDO).

Presenter: **Nikolaos CHARISIOU, Laboratory of Alternative Fuels and Environmental Catalysis, University of Western Macedonia, Chemical Engineering Dpt., Kozani, GREECE**

Presenter's biography:

Dr. Nikolaos Charisiou is researcher in the Department of Chemical Engineering of the University of Western Macedonia. His research work has been published in 46 research publications in Peer Reviewed Journals, which has been acknowledged with more than 1126 citations and an h-index of 18 (Scopus).

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Session reference:	3DO.3.3
Subtopic:	3.4 Oil-Based and Renewable Hydrocarbon Biofuels
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Feedstock and Catalyst Impact on Bio-Oil Production and FCC Co-Processing to Fuels

Short introductive summary:

The work to be presented comprises catalytic fast pyrolysis (CFP) oil production using a coupled pyrolyzer/Davison Circulating Riser (DCR) pilot plant to produce fast pyrolysis vapors that are then upgraded in the riser with modified Johnson Matthey zeolite catalysts. The impact of feedstock (pine and Miscanthus) and catalyst (modified HZSM-5 zeolites) on CFP oil composition will be discussed. These lower oxygenate oils are used for co-processing with petroleum feedstocks to produce biogenic carbon containing hydrocarbon fuels.

Presenter: **Kimberly MAGRINI-BAIR, NREL, National Bioenergy Center, Golden, CO, USA**

Presenter's biography:

Dr. Magrini is a Principal Research Scientist and Group Manager in the National Bioenergy Center of the National Renewable Energy Laboratory. She currently manages NREL's Catalysis and Thermochemical Sciences Group, which focuses on the development of catalytic approaches to biofuels production.

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Subtopic:	3.4 Oil-Based and Renewable Hydrocarbon Biofuels
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Identification of Suitable Locations for HTL Plants in Europe under Consideration of Biomass Potentials and Economy

Short introductive summary:

Hydrothermal liquefaction (HTL) is gaining increased interest in research and early commercial HTL plants are under development. One advantage of HTL is its flexibility regarding the use of different biogenic feedstock types, raising the question which biomasses are most suitable for commercial HTL production. Waste streams such as sewage sludge are particularly attractive in terms of feedstock cost. However, the availability of waste streams as a feedstock for transportation fuel production is limited.

The contribution evaluates the geographical variability of HTL fuel production cost in Europe. Sewage sludge, cereal straw and miscanthus are considered as exemplary feedstocks from the waste, residue and cultivated biomass category. Fuel production costs and plant revenues at selected locations are computed from a techno-economic assessment (TEA) model.

Presenter: **Christina PENKE, Bauhaus Luftfahrt, Alternative Fuels Dpt., Taufkirchen, GERMANY**

Presenter's biography:

Christina Penke received her master degree in Process Engineering in 2016 from the TU Bergakademie Freiberg. She has been a researcher at Bauhaus Luftfahrt since 2017, focusing on the thermochemical conversion of biomass into fuel.

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Session reference:	3DV.1.1
Subtopic:	3.3 Hydrothermal Processing
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Hydrothermal Liquefaction of Oak Wood: in Situ Hydrodeoxygenation of Bio-Crude by Transition Metals.

Short introductive summary:

Hydrothermal liquefaction is a promising technology for the production of liquid bio-fuels. However the low quality of the bio-crude produced in HTL limits the diffusion of this technology at industrial scale. In fact, expensive up-grading processes are needed to make the oil a good substitute of fossil oil. The aim of this work is to produce a partially up-graded bio-crude having higher quality and so being more stable to be stored and transported with the use of zero valent metals in the HTL reactor. ZVM are used as hydrogen donor and as hydrodeoxigenation catalysts.

Presenter: **Lingyu TAI, Sapienza University, Chemical Engineering Dpt., Roma, ITALY**

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Session reference: 3DV.1.3

Subtopic: 3.3 Hydrothermal Processing

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Innovative Hydrothermal Carbonization (HTC) Process for a Nordic Pulp and Paper Mill

Short introductive summary:

The common way of handling sludge from pulp and paper mill’s waste water treatment plant (WWTP) is combusting it at the site. Combustion is rather a way to dispose the sludge than take advantage of its energy content. This paper assesses the potential to convert the wet low-value feedstock, specifically WWTP’s secondary sludge, to a more valuable bioenergy product called hydrochar through hydrothermal carbonization (HTC) using C-Green’s innovative OxyPower HTC technology. We assess the integration to a Nordic sulphate pulp mill with different assumptions and compare the results to current situation of combusting sludge in the recovery boiler. The approach contains assessment of effects of integration to pulp mill’s mass and energy balance (e.g. power consumption), study of the markets, economic assessment and assessment of effects on greenhouse gas emissions.

Presenter: **Elina MÄKI, VTT Technical Research Centre of Finland, Espoo, FINLAND**

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Session reference:	3DV.1.4
Subtopic:	3.3 Hydrothermal Processing
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Modelling the Distribution of Inorganics in HTL Products

Short introductive summary:

During the HTL process, inorganic compounds originating from the feedstock may cause operational issues due to corrosion and clogging of the HTL reactor, in addition to excessive wear. Attention must be paid to the inorganics in the bio-crude in consecutive catalytic processes as well. It is thus desirable to predict the inorganic composition of the HTL products based on the reactants and operating conditions, to avoid operational challenges and excessive maintenance costs. In this work, the combined use of two thermodynamic equilibrium models were applied to model the speciation and phase distribution of the inorganic compounds in HTL products.
Several approaches to use both models in combination were made. All these approaches were validated against both the quality of the modelling results (convergence and accuracy) and the similarity between the modelled products and the product distribution from the experimental data.

Presenter: **Judit SANDQUIST, SINTEF Energy Research, Thermal Energy Dpt., Trondheim, NORWAY**

Presenter's biography:

I am working on thermochemical processing technologies such as hydrothermal liquefaction, pyrolysis and gasification. Earlier, as a student researcher and master student, I got insight into cellulosic bioethanol technology.

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Session reference: 3DV.1.5
Subtopic: 3.3 Hydrothermal Processing
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Co-Hydrothermal Carbonization of Waste Biomass and its Assessment to Face the Air Pollution Related to Residential Biomass Combustion

Short introductive summary:

Hydrothermal carbonization (HTC) of rapeseed meal-pine sawdust blends has been performed in order to obtain a fuel showing a high energy density. Three main parameteres were assessed in the HTC process such as temperature, mixing ratio and biomass/water ratio. The responses to be evaluated were mass yield, higher heating value and energy yield. From this study, an optimal hydrochar was reached and it was pelletized so that the emissions from a heating pellet stove can be measured. Gaseous emissions (CO, CO2 and NOx) and particulate emissions were tested to determine whether the optimal hydrochar can meet the emission standards so a potential application on industry can be discussed here.

Presenter: **Herman Alfredo MURILLO ROMERO, Universidad de Santiago de Chile, Chemical Engineering Dpt., Estación Central, Santiago de Chile, CHILE**

Presenter's biography:

PhD candidate at University of Santiago de Chile in Process Engineering. My research interest centres on biomass conversion technologies, e.g. hydrothermal carbonization of solid waste to obtain upgraded fuels to be tested in heating stoves, so that emissions can be reduced.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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Session reference: 3DV.1.6

Subtopic: 3.3 Hydrothermal Processing

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Hydrothermal Carbonization of Rapeseed Meal for Biofuel Production: Effect of the Reaction Temperature on Fuel Quality and Emissions

Short introductive summary:

Hydrothermal carbonization of rapeseed meal was performed in order to reach a pellet showing improved quality compared to the raw biomass pellets. Some properties such as higher heating value, ash content, moisture uptake and compressive strength were evaluated. The idea is to prove if the hydrothermal carbonization process allows to get a fuel that produces lower emissions, especially particulate emissions.

Presenter: **Herman Alfredo MURILLO ROMERO, Universidad de Santiago de Chile, Chemical Engineering Dpt., Estación Central, Santiago de Chile, CHILE**

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Session reference:	3DV.1.7
Subtopic:	3.3 Hydrothermal Processing
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Microalgae Hydrothermal Liquefaction Process Optimization and Comprehension to Produce High Quality Biofuel

Short introductive summary:

The microalgae hydrothermal liquefaction (HTL) process is a promising solution to produce biofuel. The aim of the RAFBIOALG project is to study a full biofuel production chain using this technology. This project engages five research centers, CEA Cadarache for the microalgae cultivation and the HTL aqueous phase reuse, CEA Grenoble for the HTL process and the combustion properties of the product will be evaluated by CORIA. Finally, the full process chain will be evaluated for sustainability by the LBE to guide choices during the process optimization. The global objective is to build a mechanistic and kinetic study based on these observations. This model will be useful to analyse and predict conversion of other Chlorella microalgae through HTL for biofuel production as well as helping in the design of a future industrial process at a larger scale.

Presenter: **Lucie MATRICON, LITEN CEA, Grenoble, FRANCE**

Presenter's biography:

My name is Lucie Matricon and I am a chemical engineer from "Ecole nationale supérieure de chimie de Montpellier". I am currently doing a PhD on the hydrothermal liquefaction of microalgae, the goal is to understand the link between the biomass and the products (bio-oil, aqueous phase...).

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Session reference: 3DV.1.8

Subtopic: 3.3 Hydrothermal Processing

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Co-Liquefaction of Sugar Kelp with Alkali Lignin in Subcritical Temperatures

Short introductive summary:

I’m Madhawa Jayathilake, a Ph.D. research fellow at the University of Agder Norway. I’m studying hydrothermal processing of lignin and coliquefaction of lignin with different other feedstocks. Moreover, I’m more into Mathematical and CFD modeling of the liquefaction process.

Presenter: **Madhawa JAYATHILAKE, University of Agder, Engineering Sciences Dpt., Grimstad, NORWAY**

Presenter's biography:

I'm a Ph.D. student at Universitetet I Agder. Currently working on hydrothermal liquefaction of lignin, MAthematical and CFD modeling of the liquefaction process.

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Session reference: 3DV.1.10

Subtopic: 3.3 Hydrothermal Processing

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Production and Characterization of Raw and Torrefied Pellets of Phyllostachys Aurea Biomass for Energy Use

Short introductive summary:

The main purpose of this study is to assess the potential use of raw and torrefied culms of Phyllostachys aurea to produce fuel pellets with ISO 17225-6 and ISO 17225-8 quality requirements.

Presenter: **Edgar A. SILVEIRA, University of Brasilia, Mechanical Engineering Dpt., Brasília, BRAZIL**

Presenter's biography:

Professor at the Department of Mechanical Engineering, University of Brasilia. PhD in Mechanical Sciences from the University of Brasilia (Brazil) and in Fiber and Wood Sciences from the University of Lorraine (France)

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Session reference: 2DV.2.1
Subtopic: 2.1 Production and Supply of Solid Fuels and Intermediates
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Contamination of Wood Chips with Mineral Soil - Fuel Quality and Combustion Behaviour

Short introductive summary:
Contamination of woody biomass with mineral soils might have a substantial impact on fuel quality and combustion behaviour. Due to careless forest operation or muddy conditions during fuel production, e. g. during logging, transportation or storage, high shares of mineral soil of up to 10 w-% could be polluting the fuel. This may lead to unwanted effects during combustion such as high gaseous and total particulate matter (TPM) emissions, corrosion or slag formation. The aim of this study was thus to evaluate the combustion behaviour of contaminated wood chips including the identification and evaluation of potential damages to biomass boilers and the impact on air quality. Contamination of fuels with mineral soils led to elevated TPM emissions and elevated slag formation and should be avoided for failure-free and low-emission combustion. Results further indicate that the negative effects regarding TPM emissions and slagging also depended on the specific soil type.

Presenter: **Claudia SCHÖN, Technology and Support Centre, Solid Biofuels Dpt., Straubing, GERMANY**

Presenter's biography:
Claudia Schön studied environmental engineering at the TU Bergakademie Freiberg. She works at the department of Solid Biofuels at the Technology and Support Centre with main focus on emission measurement and emisson reduction from biomass combustion using different fuel assortments.

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Session reference: 2DV.2.3
Subtopic: 2.1 Production and Supply of Solid Fuels and Intermediates
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Know your Fuel: How Improved, Online Biofuel Characterization Can Improve Process Efficiency - the BIOFMET Project.

Short introductive summary:

Solid and liquid biofuels play an important role in the energy, transportation, and heating sectors. Unlike their fossil counterparts, biofuels are highly inhomogeneous. Composition and calorific value may vary significantly from one batch to the next of what is nominally the same fuel. This is an important obstacle in optimizing biofuel usage – e.g. for boiler operators to adapt combustion processes to varying degrees of moisture in wood chips, or for biodiesel manufacturers to notice impurities early in the production process – to name just two examples. Fast and exact characterization of liquid and solid biofuels is therefore key to improving efficiency. Unfortunately, such methods are not widely available. Research institutions across Europe are joined in the BIOFMET project to develop new and advanced measurement standards and reference materials for calibration of online instruments. As data becomes available in real-time, process control can be optimized, and state-of-the art data science techniques applied to biofuels.

Presenter: **Lars SCHWARZER, Danish Technological Institute, Energy and Climate Dpt., Aarhus, DENMARK**

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Session reference: 2DV.2.4
Subtopic: 2.1 Production and Supply of Solid Fuels and Intermediates
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Waste Biomass as Additive in High Quality Pellets for Energy Production

Short introductive summary:

This work evaluates the co-pelletization of pine sawdust (PIN) with residual biomasses from different origins such as almond shells (AS), coffee husks (CH), coffee dregs (CD), the solid by-product from eucalyptus woodchips fast pyrolysis (PEc), and two kinds of refused derived fuels (RDF1 and RDF2). Results showed that blends of pine sawdust with up to 15 wt.% of PEc and with up to 30 wt.% of the other residual biomasses studied provide high quality pellets, comparable to those obtained from pine sawdust. Furthermore, the production and associated costs of the pellets from the blends showed competitive with those of pellets from raw pine sawdust.

Presenter: **Roberto GARCIA, INCAR-CSIC, Oviedo, SPAIN**

Presenter's biography:

2008-2012 I joined as reasearcher at the University of Oviedo, involved in projects regarding biomass combustion. 2012-13 I was granted at Saint Gobain ARDC. Since 2014 I have been involved in different projects related to biomass thermal energy conversion at PrEM group in INCAR-CSIC.

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Session reference: 2DV.2.5

Subtopic: 2.1 Production and Supply of Solid Fuels and Intermediates

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Production and Supply of Solid Fuels and Intermediates

Short introductive summary:

Switchgrass (Panicum virgatum L.), as an energy crop, is defined by low investment in agricultural technology, high resistance to disease and pests, as well as potentially high yields. Switchgrass biomass can be converted into different forms of energy or biofuels, and one of the ways of conversion is energy production through thermochemical conversion processes. The aim of this study was to determine the energetic properties (calorific values, proximate and ultimate analysis) of switchgrass biomass in relation to four different wood ash application rate (control; 1,5 t ash/ha; 3 t ash/ha; 4,5 t ash/ha).The experimental field has been established at the end of April 2016, by split-plot design in three repetitions. Biomass harvest of switchgrass (Panicum virgatum L) will be conducted at spring season 2021, when the expected moisture content will be suitable for direct combustion process. Analyses of harvested biomass will be conducted at University of Zagreb Faculty of Agriculture in Laboratory for biomass and energy efficiency in agriculture.

Presenter: **Ana MATIN, University of Zagreb Faculty of Agriculture, Agricultural Technology, Storing and Transport Dpt., Zagreb, CROATIA**

Presenter's biography:

Ana Matin, Ph.D. is Assistant Professor at the University of Zagreb Faculty of Agriculture. She obtained her Ph.D. at the same Faculty in 2012. Matin works at the Faculty of Agriculture since 2004, and during that period was project manager.

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Session reference: 2DV.2.6
Subtopic: 2.1 Production and Supply of Solid Fuels and Intermediates
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Arundo Donax L. as Solid Biofuel - Biomass and Biochar Valorization

Short introductive summary:

The aim of this paper is to investigate the energy properties of the Arundo Donax L. energy crop and the possibility of its conversion to solid fuel (biochar) by pyrolysis. Investigations included structural, ultimate and proximate analysis, and the content of macro elements, as well as the share of biochar after the pyrolysis process, its energy properties, and the content of micro and macro elements. Based on the research conducted on direct combustion and pyrolysis of Arundo donax L. biomass, it can be concluded that this energy crop has great potential as raw materials for direct combustion. In addition, this culture is also characterized by significant potential in the process of pyrolysis, ie the production of bio-oil as an energy source and biochar as an added value product. Comparing the results obtained with biomass composition and biochar composition as a pyrolysis product, Arundo donax L. biomass is a quality raw material for the production of solid biofuels.

Presenter: **Mateja GRUBOR, University of Zagreb Faculty of Agriculture, Zagreb, CROATIA**

Presenter's biography:

Title of qualification awarded:
Master of Science in Engineering of Agricultural engineering

Work experience:
1. Date (from – until): 2015 - now
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 Position: Expert associate
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Session reference: 2DV.2.7
Subtopic: 2.1 Production and Supply of Solid Fuels and Intermediates
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Analysis of Fuel Properties and Flammability of Novel Miscanthus Genotypes, Grown in Croatia, during the First Three Vegetation Seasons

Short introductive summary:

In order to determine the possibility of its utilization, the objective of this research was to determine the biomass quality of 13 novel Miscanthus hybrids, grown in Republic of Croatia, within the BBI DEMO project GRACE, during the first three vegetation seasons. The aim was to evaluate their energy potential if used as raw material for direct combustion. Furthermore, the microscale combustion calorimetry (MCC) was applied to give a detailed insight into the combustion process of raw material for the same purpose.

Presenter: **Vanja JURISIC, University of Zagreb Faculty of Agriculture, Agricultural Technology, Storing and Transport Dpt., Zagreb, CROATIA**

Presenter's biography:

Vanja Jurisic, PhD is currently working as an Assistant Professor. Her area of expertise is related to RES in agriculture, in particular the pretreatment of lignocellulose biomass, as well as production of biofuels and bioproducts from different agricultural crops (energy crops, ag residues etc.).

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Session reference:	2DV.2.8
Subtopic:	2.1 Production and Supply of Solid Fuels and Intermediates
Topic:	2. BIOMASS CONVERSION FOR BIOENERGY

The Effect of Moisture on Specific Energy Requirement for Knife Milled Beech Chips

Short introductive summary:

Biomass size reduction technology belongs among the crucial steps of biomass to "X" conversion technologies. This size reduction step is a costly operation that consumes about 33% of the total electrical demand. Thus reducing the energy requirement and the right solution for grinding or milling of biomass would improve the whole process economics. The contribution aims to define a model predicting energy demand for knife milled beech chips of different moistures on machine variables.

The experiments were conducted for beech chips of moisture being 0.5, 7.5, 16.0 and 30.9 % wt. dry mass, single blade rotor with the constant peripheral speed of revolution being 10.2 m s-1 (1500 min-1) and 20.4 m s-1 (3000 min-1). The preliminary results evinced that particle size distribution and specific energy requirement are significantly affected by biomass moisture, see Fig. 1. It was found that beech chips of moisture 0.5 - 16.0 % wt. dry mass evinces brittle behaviour. Thus, the Rittinger comminution law was an applicable model to predict the energy requirement of size reduction with Rittinger constant in dependence on biomass moisture.

Presenter: **Lukas KRATKY, Czech Technical University in Prague, Process Engineering Dpt., Prague, CZECH REPUBLIC**

Presenter's biography:

Lukas Kratky is the associate professor at Department of Process Engineering of FME CTU in Prague. His professional skills scope to biorefinery designing and optimization, pretreatment of lignocellulosic biomass, technologies, machines and equipment to convert waste CO2 to chemicals.

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Session reference: 2DV.2.14
Subtopic: 2.1 Production and Supply of Solid Fuels and Intermediates
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Laboratory Fast Methods to Determine the Moisture Content of Solid Biofuels

Short introductive summary:

In this study, fast methods for moisture determination (using a microwave oven –MW-, an infrared stove –IR-, a near-infrared spectrophotometer –NIR-, and a thermogravimetric analyzer –TGA-) were evaluated and compared with the reference method described in ISO 18134-2. In addition, air and nitrogen were compared during thermo-gravimetric analysis to determine how the selected atmosphere could affect biomass oxidation. Four different fuels were tested: wood pellets, wood chips, olive stones, and almond shells. The method performance characteristics, including the measurement of the various uncertainty contributions (preparation, repeatability and reproducibility) were evaluated.

NIR and MW appeared to be the most accurate methods. IR consistently offered lower moisture results than the other methods tested. The relative combined uncertainty is higher than 2% for all samples and methods, including the reference method, and it could reach up to 6 % in some cases. The reproducibility is the major contribution to the uncertainty in most cases, however the contribution derived from sample preparation in TGA methods should be taken into account.

Presenter: **Miguel FERNÁNDEZ LLORENTE, CIEMAT, Energy department- CEDER, SORIA, SPAIN**

Presenter's biography:

Miguel Fernández Llorente (Master D. in Chemistry and Ph D. in Chemical Engineering) is responsible of Biomass Characterisation Laboratory placed in Soria (CIEMAT) from 1995. He has participated in more than 40 R&D projects and he has written several papers in conferences and international journals.

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Session reference: 2DV.2.15

Subtopic: 2.1 Production and Supply of Solid Fuels and Intermediates

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

An Innovative Cutting System for the Production of Calibrated Wood Chips from Pruning

Short introductive summary:

The commercial shredders used for prunings collection provide heterogeneous low-quality product. For these reasons, a new prototype for the collection of pruning residues with an innovative cutting system has been conceived and developed, improvementing of the calibration and the homogeneity of the processed product.

Presenter: **Enrico SANTANGELO, CREA, Research Centre for Engineering and Agro-Food Processing, Monterotondo, ITALY**

Presenter's biography:

Dr. Enrico Santangelo has a Degree in Agricultural Science, and the PhD in Plant Genetic. He is researcher at CREA-IT where he has been involved in research activities concerning the mechanization of energy crops. Currently, he is working on the recovery and exploitation of agriculture residues.

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Session reference:	2DV.2.16
Subtopic:	2.1 Production and Supply of Solid Fuels and Intermediates
Topic:	2. BIOMASS CONVERSION FOR BIOENERGY

Transforming Residual Biomass into Quality Food and Feed, a Comprehensive Approach

Short introductive summary:

Residual biomass is a key feedstock for energy, chemicals and materials bioeconomy platforms. However, the potential to recover quality edible ingredients from residual biomass has not been evaluated to our knowledge. This work is part of a larger study assessing how, and to which extent, residual biomass can sustainably be used for producing ingredients for the food and feed markets. We propose a comprehensive review of existing and emerging waste-to-nutrition conversion pathways. Besides drawing the big picture, we highlight the recurrent patterns and propose a qualitative comparison frameworks. An expected result to come is the quantitative production potential of eight waste-to-nutrition pathways in the case of France.

Presenter: **Ugo JAVOUREZ, Insa Toulouse, Haute Garonne, Toulouse, FRANCE**

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Session reference: DP.1.1

Subtopic: 3.7 Bio-Based Chemicals and Materials

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Introducing the Bioenergy Sustainability Indicator Model: A Framework for Assessing the Environmental, Economic & Social Sustainability Performances of Bioenergy

Short introductive summary:

As the scale of bioenergy increases and ever more complex bioenergy schemes and feedstock supply chains are planned and established, there is a key repeating question – is it sustainable? Bioenergy is a complex mix of technologies and activities and assessing its sustainability within different contexts can be equally complex – in reality sustainability is a balance of tradeoffs. The UK's Supergen Bioenergy Hub (SBH) have developed a new Bioenergy Sustainability Indicator Model (BSIM) to provide a flexible research tool to assess and compare the sustainability performances of bioenergy systems, feedstock, technologies and supply chains. The BSIM includes 104 sustainability issues that are structured within a framework of 33 sustainability indicators, 14 sustainability themes and 4 overarching sustainability categories – People, Development, Natural Systems and Climate Change. This presentation will introduce the BSIM and will provide sustainability assessment results for a number of the SBH's specific bioenergy case studies.

Presenter: **Andrew WELFLE, University of Manchester, Tyndall Centre for Climate Change Resarch, Manchester, UNITED KINGDOM**

Presenter's biography:

Andrew Welfle is a Research Fellow within the Tyndall Centre for Climate Change Research at the University of Manchester UK. Andrew's research interests are biomass resource modelling, sustainability, the global trade of biomass trade for energy end uses, the GHG performance of bioenergy.

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Session reference: DP.1.2
Subtopic: 4.1 Sustainability, Socio-Economic Impacts and Public Acceptance
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

A Kind of MAGIC? Life Cycle Assessment of Bioenergy and Bio-based Products from Marginal Land

Short introductive summary:

Land availability is a major factor which limits the production of bioenergy and bio-based products. Competition for arable land is likely to intensify worldwide over the coming decades. Against this background, the use of marginal lands could potentially alleviate this conflict. As part of a comprehensive integrated life cycle sustainability assessment within the EU-funded MAGIC project, we have analysed the environmental impacts associated with 9 selected value chains by means of screening life cycle assessment (LCA). Selected LCA results will be presented showing that i) there are no significant differences between bioenergy and bio-based products from standard agricultural land and from marginal land, ii) the results for biomass use from marginal land show an exceptionally wide range and iii) the long-neglected environmental impacts on biodiversity, water and the scarce resource phosphate need to be addressed, especially when investigating marginal land. We conclude that i) LCA is a very useful tool to identify optimisation potentials along the value chain and ii) only the use of unused, low carbon stock and low biodiversity marginal land avoids iLUC and minimises impacts.

Presenter: **Nils RETTENMAIER, IFEU - Institute for Energy and Environmental Research Heidelberg, Food and Biobased Systems Dpt., Heidelberg, GERMANY**

Presenter's biography:

Nils Rettenmaier is a senior scientist and project leader at the IFEU-Institute for Energy and Environmental Research Heidelberg. Based at the Department of Food and Biobased Systems, his main working fields are LCAs and biomass resource assessments.

Biographies and Short introductive summaries are supplied directly by presenters and are published here unedited

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Session reference: DP.1.3
Subtopic: 4.2 Environmental Impacts
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Correlating Methane Yield Increase after Ammonia Pretreatment to Biomass Compositional Characteristics

Short introductive summary:
The use of lignocellulosic biomasses for boosting the biogas production has gained a lot of attention in the recent years. Undoubtedly, they represent a huge potential for improving well established anaerobic digestion processes, however their rigid structure impeding fast hydrolysis makes a pretreatment step necessary. Given the different characteristics of the composition of biomasses, the identification of a global pretreatment method is a difficult task. In this study, a promissing ammonia pretreatment has been applied to seven different biomasses, including agricultural straws, manures and grass, in order to search for a correlation of their main compositional characteristics to the increase of the methane yield as a result of the pretreatment. The aim of the study was to determine whether the composition of lignocellulosic biomasses can predict the suitability of the pretreatment.

Presenter: **Anna LYMPERATOU, Technical University of Denmark, Chemical and Biochemical Engineering Dpt., Kgs.Lyngby, DENMARK**

Presenter's biography:
Anna Lymperatou holds a PhD in "Aqueous Ammonia Soaking as a pretreatment of lignocellulosic biomasses for improving manure-based anaerobic digestion" from the Dept. of Chemical and Biochemical Engineering of DTU. Her research interests are anaerobic digestion, nutrient recycling and biorefineries.

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Session reference: 2DO.4.1
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Improving Continuous Anaerobic Digestion of Cassava Pulp by Potassium Hydroxide Pretreatment

Short introductive summary:

Cassava pulp (CP), contains mainly of starch (68%) and lignocellulose (28%), has a high potential as feedstock biogas production. This study aimed to investigate the long term effect of KOH pretreatment during continuous anaerobic digestion for methane production from CP. Pretreatment with KOH was found to increase COD solubilization and reduce lignocellulose composition in CP. Biomethane potential (BMP) assay of pretreated CP with 0.5% KOH produced 321 ml CH4/gVS, accounting for 25% improvement of methane yield than that of untreated CP. Applying KOH pretreatment with continuous anaerobic digestion was successful operated. Methane yield of pretreated CP was 338 ± 27 ml/gVS. However, it is not significantly different from that of untreated CP, which might be because of using biologically-enhanced conditions by optimal C/N ratio adjustment, bioaugmentation, and trace elements supplementation that hindered the effect of pretreatment. The results showed benefits of using KOH pretreatment on reducing the level of suspended solids in the digester (55% lower than the untreated), which benefits the stability of the long-term digestion at higher organic loading rates.

Presenter: **Passanun LOMWONGSOPON, Mahidol University, Faculty of Science, Biotechnology Dpt., Bangkok, THAILAND**

Presenter's biography:

My name is Passanun Lomwongsopon. I am, currently, a master student in Biotechnology (Industrial biotechnology and bioprocess engineering) at Faculty of Science, Mahidol University, Thailand.

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Session reference: 2DO.4.2

Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Enhaced Biogas Production and Process Performance of a Plug Flow Reactor Digesting Swine Manure and Corn Stover Pellets

Short introductive summary:

I am actively involved in a research program on the biological conversion of agricultural residues into bioenergy/chemical products at the University of Guelph Ridgetown Campus. Conducts research on treatment trains to minimize and treat wastes including those originating from animal, agriculture and food processing, the conversion of high energy waste to biogas that serves as a renewable energy source, and novel bioreactor designs. He leads the development of modelling and evaluating techniques for anaerobic digestion systems including empirically screening feedstock to estimate energy potential, conducting biogas potential assays, conducting bench-scale treatability testing, evaluating novel farm-scale technologies, and developing decision support guidance.

Presenter: **Veluchamy CHITRAICHAMY, University of Guelph, School of Environmental Science, Ridgetown, CANADA**

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Session reference: 2DO.4.3
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Algae-Based Bio-Methane Fuel Purification and Carbon Sequestration

Short introductive summary:

We present a proof-of-concept study for a new integrated biomethane production system, which combines an innovative algae-based biogas purification process with hydrothermal carbonisation of digestate to achieve net negative carbon emissions. Our results demonstrate the scientific feasibility of this system and provide a whole-system carbon balance to verify the carbon credentials of the process.

Presenter: **Jonathan WAGNER, Loughborough University, Chemical Engineering Dpt., Loughborough, UNITED KINGDOM**

Presenter's biography:

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Session reference: 2DO.4.4

Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Natural Resources Use Efficiency: Water and Land Use Footprint of Biofuels

Short introductive summary:

LCA studies of biofuels have been published since the late 1980s. The studies cover LCAs of 1st and 2nd generation biofuels from annual and perennial crops and biomass residues produced via several conversion technologies. Moreover, the studies cover biofuels for transportation such as bioethanol and biodiesel, biogas and biomethane applications and bioenergy such as green electricity and heat. So far, all LCA studies addressed several environmental impacts such as greenhouse effect, energy resource depletion, stratospheric ozone depletion, acidification, eutrophication, photosmog, toxicity and others. Compared to conventional (i.e. mostly fossil) energy carriers, most results indicated more or less big savings in terms of primary energy and greenhouse gas emissions, while at the same time leading to negative implications regarding impact categories such as acidification and stratospheric ozone depletion.

Presenter: **Nils RETTENMAIER, IFEU - Institute for Energy and Environmental Research Heidelberg, Food and Biobased Systems Dpt., Heidelberg, GERMANY**

Presenter's biography:

Nils Rettenmaier is a senior scientist and project leader at the IFEU-Institute for Energy and Environmental Research Heidelberg. Based at the Department of Food and Biobased Systems, his main working fields are LCAs and biomass resource assessments.

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Session reference: 4DO.5.1
Subtopic: 4.5 Resource Efficient Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Development and Implementation of Resource-Labeling

Short introductive summary:

The growing, intensive and unsustainable use of resources at local, regional and global level causes direct and indirect environmental problems such as climate change, soil and water degradation, land consumption, water shortage or biodiversity loss. Measures to reduce resource consumption are measures to reduce greenhouse gas emissions and thus contribute indirectly to climate protection. In the long term, the current use of resources endangers the basis of life for all people.
Therefore, instruments have to be developed that achieve an absolute reduction of resource consumption in a timely manner. The introduction of the resource label Resource Score is a corresponding instrument with a far-reaching control function. In the style of the European energy consumption label, the Resource Score shows the lifecycle-wide utilization of essential resources.

Presenter: **Alexa LUTZENBERGER, ALRENE, Siek, GERMANY**

Presenter's biography:

Alexa Lutzenberger is working in projects for Renewable Energy, Sustainable Agriculture and Resources. Actual, she is member of the resource commission of the german federal environmental agency and some boards of Advisors. She is head of Alrene.

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Session reference: 4DO.5.2
Subtopic: 4.5 Resource Efficient Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

When Quantity Matters: Assessment of the Environmental, Economic, and Energy System Performance of Long-Term Residual Biomass Use in China

Short introductive summary:

This study assesses long-term use of residual biomass in China considering lifecycle greenhouse gas emissions, air pollution, and eutrophication. While keeping a focus on dynamic energy system aspects, competing non-energy uses of residual biomass are also assessed.

Presenter: **Sara SHAPIRO-BENGTSEN, Technical University of Denmark, Technology, Management and Economics Dpt., Kgs. Lyngby, DENMARK**

Presenter's biography:

Sara Shapiro-Bengtsen is pursuing a PhD at the Technical University of Denmark in Energy System Analysis on Sustainable Utilization of Residual Biomass in China. Current focus in on including a lifecycle perspective of environmental impacts in Energy System Analysis.

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Session reference: 4DO.5.3
Subtopic: 4.5 Resource Efficient Bioeconomy
Topic: 4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

Towards a Resource-Efficient Circular Economy: Environmental Benefits of Textile Recycling

Short introductive summary:

Driven by the growing world population and increasing prosperity worldwide, the production of textiles has increased steadily over the last decades. Up to now, textiles are mainly produced from virgin fibres, primarily cotton and synthetic fibres. Especially the large demand for natural fibres is associated with enormous resources of land, high consumption of water, an increased use of environmentally harmful fertilisers and pesticides as well as rising emissions of air pollutants and greenhouse gases. Life cycle assessments have shown that the environmental impact of textiles can be significantly reduced by using recyclable materials, establishing textile recycling technologies and increasing the number of utilisation cycles.

Presenter: **Guido REINHARDT, IFEU-Institut Heidelberg, Biomass & Food Dpt., Heidelberg, GERMANY**

Presenter's biography:

Dr. Guido Reinhardt is a member of the scientific board of IFEU-Institute for Energy and Environmental Research Heidelberg and a scientific director of the department "Sustainability of renewable energies and bio-based systems" with more than 25 years of professional experience in this topic.

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Session reference:	4DO.5.4
Subtopic:	4.5 Resource Efficient Bioeconomy
Topic:	4. SUSTAINABLE BIOECONOMY: IMPACTS AND POLICIES

BioTfueL Project: How to Continuously Measure the Anhydrous Weight Loss (AWL) of Torrefied Biomass in the Torrefaction Demonstration Plant

Short introductive summary:

Dr. Mathieu Morin is a R&D engineer at IFP Energies nouvelles. His work mainly focuses on the design and scale-up of processes involving catalytic cracking and solid thermal treatment and conversion. M. Morin obtained a Master Degree in Chemical Enginnering at the University of Toulouse in 2014. He reveived his PhD in 2017 on biomass gasification in dual fluidized bed.

Presenter: **Mathieu MORIN, IFP Energies Nouvelles, Chemical Engineering and Technology Dpt., Solaize, FRANCE**

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Session reference: 3DO.6.1

Subtopic: 3.1 Production of Thermally Treated Solid Fuels

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Hydrothermal Conversion of Wet Organic Residues to Intermediate Bioenergy Carriers - The F-CUBED Project

Short introductive summary:

F-CUBED is a H2020 project that kicked-off in May 2020 and responds to the H2020 programme for secure, clean and efficient energy. The project aims to convert wet, organic residues produced by different types of industries, namely paper sludge, fruit & vegetable waste and wet olive pomace, into high-quality intermediate solid bioenergy carriers. This is realised via TORWASH® hydrothermal treatment and dewatering.

Presenter: **Pavlina NANOU, TNO, Energy Transition Dpt., Petten, THE NETHERLANDS**

Presenter's biography:

Pavlina Nanou has 15 years of research experience on biomass conversion technologies. Since 2013 she works as a researcher and project manager on dry and wet torrefaction technologies at TNO Energy Transition. She is coordinating the scaling-up of the TORWASH technology.

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Session reference:	3DO.6.2
Subtopic:	3.1 Production of Thermally Treated Solid Fuels
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Assessment of Self-Heating in a Biochar Storage

Short introductive summary:

Self-heating and ignition are serious concerns when handling biomass and biochar during processing, transport, and storage. Several incidents on unintended ignition of biochar have been reported previously. This work aims to give a comprehensive study of self-heating in a biochar storage for industrial scale.

Presenter: **Aekjuthon PHOUNGLAMCHEIK, Luleå University of Technology, Engineering Sciences and Mathematics Dpt., Lulea, SWEDEN**

Presenter's biography:

I am PhD student at the Division of Energy Engineering at Luleå University of Technology. My research focusses on biochar production for metallurgical processes, which is conducted under the supervision of Assoc. Prof.Kentaro Umeki.

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Session reference: 3DO.6.3
Subtopic: 3.1 Production of Thermally Treated Solid Fuels
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Production of Clean Agro Pellet Commodities from Agro-Residues

Short introductive summary:

Large quantities of biomass will be needed to feed the biobased economy. Use of Crops and wood may cause land use change related green house gas emissions. Agro-residues could be an interesting alternative, but several issues are hindering efficient application: high potassium content and low bulk density are the most important issues.
This research aims at the development of a process to produce an intermediate commodity from agro-residues. These commodities should be stable, dense, nutrient depleted and applicable in both thermochemical and other biobased applications.
Through a combination of extraction (to remove potassium), steam treatment and pelleting a Clean Agro Pellet Commodity was produced. This commodity showed improved ash melting behavior, density, handling and stability. This way, a huge potential of nowadays unused biomass can be made available for the bioeconomy.

Presenter: **Koen MEESTERS, Wageningen University, FBR Dpt., Wageningen, THE NETHERLANDS**

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Session reference: 3DO.6.4

Subtopic: 3.1 Production of Thermally Treated Solid Fuels

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Production of Biofuels from Vinyl Laurates Using a Commercial Enzyme

Short introductive summary:

In this work the reaction from vinyl laurate to methyl laurate and lauric acid has been investigated. The reaction took place in the presence of acetone working as solvent as well as reactant. Commercial immobilized enzyme of Candida Antartica lipase B, Novozyme 435, was employed as catalyst. A design of experiments with two factors as well as a response surface methodology was performed

Presenter: **Jorge Mario MARCHETTI, Norwegian University of Life Science, Faculty of Science and Technology, Aas, NORWAY**

Presenter's biography:

I am a professor and the leader of the Reaction Engineering and Catalysis group at NMBU (Norway). My work focuses on the valorization of waste biomass. My work is also related to the development and application of catalysts, kinetics and processing modeling as well as techno-economic assessments.

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Session reference: 3DV.3.1

Subtopic: 3.4 Oil-Based and Renewable Hydrocarbon Biofuels

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Optimization for the Production of Fatty Acid Butyl Ester Using Glycerol Enriched Non-Calcined Calcium Oxide

Short introductive summary:

The production of biodiesel from Jatropha oil when using butanol and glycerol enriched non-calcined calcium oxide as heterogenous catalyst was carried out. It was studied the influences of reaction temperature and butanol: oil molar ratio on Jatropha oil conversion (X JOB) and the yield of fatty acid butyl esters (Y FABEs).

Presenter: **Jorge Mario MARCHETTI, Norwegian University of Life Science, Faculty of Science and Technology, Aas, NORWAY**

Presenter's biography:

I am a professor and the leader of the Reaction Engineering and Catalysis group at NMBU (Norway). My work focuses on the valorization of waste biomass. My work is also related to the development and application of catalysts, kinetics and processing modeling as well as techno-economic assessments.

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Subtopic: 3.4 Oil-Based and Renewable Hydrocarbon Biofuels

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Potential Impacts of the EUs Fossil-fuel car ban (2025-2030) on Future of Liquid Biofuels Research - an Analysis of Different Scenarios

Short introductive summary:

The purpose of this study is to provide a comprehensive assessment of the future research direction of liquid biofuels in light of the European Union (EU) and the United Kingdom’s (UK) climate action targets and specifically on the impact of the ban on the sale of new fossil-fuel operated cars on the research sector. To achieve this, the study carries out a comprehensive assessment of the technologies current-status and then simulates various outcomes based on their potential applicability and future development. Therefore providing a potential roadmap to guide researchers, policymakers, and industry stakeholders to further develop the industry.

Presenter: **Ehiaze EHIMEN, Institute of Technology Sligo, Research, Sligo, IRELAND**

Presenter's biography:

Ehiaze is the R&I Coordinator for the INTERREG Renewable Engine and EU NPA SYMBIOMA Research Projects. He has extensively published peer reviewed academic publications on algae biomass conversion, energy generation & storage, energy systems modelling, renewability assessments and bioenergy systems.

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Session reference: 3DV.3.3

Subtopic: 3.4 Oil-Based and Renewable Hydrocarbon Biofuels

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Optimising Composition of Renewable Aromatics from Lignin before Catalytic Upgrading and Fuel Blending

Short introductive summary:

Lignocellulosic plant material is not used for animal feed or human food and is an attractive biomass resource for future generations of renewable motor fuels. The lignin fraction is particularly promising, as it is the only natural resource available for direct recovery of aromatic hydrocarbons, a required component of motor fuels.
The lignin-to-liquid (LtL) process depolymerizes the lignin polymer in addition to partial removal of oxygen, providing a more suitable chemical structure for catalytic upgrading into aromatic hydrocarbons, than pure native lignin. This optimization process was targeted, by determining the need for feedstock pre-treatment, LtL-conversion reaction conditions and the need for product fractionation to target optimal functionality qualifying for catalytic upgrading.

Presenter: **Camilla LØHRE, University of Bergen, Chemistry Dpt., Bergen, NORWAY**

Presenter's biography:

Main research approach involves laboratory experimentation and organic analysis with an emphasis on thermochemical conversion of lignocellulosic biomass, organosolv fractionation, steam explosion pretreatment, NMR spectroscopy, GC-MS, TOC and EA.

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Session reference: 3DV.3.4

Subtopic: 3.4 Oil-Based and Renewable Hydrocarbon Biofuels

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Renewable Diesel Production through Selective Catalytic Deoxygenation of Palm Oil over Highly Selective Ni Supported on Al2O3, La2O3-Al2O3 and CaO-MgO-SiO2-Al2O3 Catalysts

Short introductive summary:

Nowadays, as the energy demand rapidly increases and environment issues become critical to human well being, the development of clean and sustainable energy is of paramount importance [1,2]. Vegetable oils and animal fats are attractive renewable energy resources and biodiesel is an industry that grows rapidly [3]. However, biodiesel usually suffers from disfavored fuel properties, such as limited compatibility with gas engine, low chemical stability and low caloric value due to the involved oxygen atoms and the unsaturated C-C bonds [4]. In order to overcome the drawbacks of biodiesel, selective catalytic deoxygenation (SDO), i.e., the essential removal of oxygen atoms and saturation of unsaturated C-C bonds of vegetable oils to green hydrocarbons (renewable diesel or green diesel) have been intensively researched during the last decades. This can be realized by three different reactions, decarboxylation (deCO2), decarbonylation (deCO) and / or hydro-deoxygenation (HDO)

Presenter: **Nikolaos CHARISIOU, Laboratory of Alternative Fuels and Environmental Catalysis, University of Western Macedonia, Chemical Engineering Dpt., Kozani, GREECE**

Presenter's biography:

Dr. Nikolaos Charisiou is researcher in the Department of Chemical Engineering of the University of Western Macedonia. His research work has been published in 46 research publications in Peer Reviewed Journals, which has been acknowledged with more than 1126 citations and an h-index of 18 (Scopus).

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Session reference: 3DV.3.6
Subtopic: 3.4 Oil-Based and Renewable Hydrocarbon Biofuels
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Microwave-Assisted FeCl3-Catalysed Pydrolysis of Giant Reed and Cardoon Cellulose Followed by Fermentation to Single Cell Oil by Lipomyces Starkeyi

Short introductive summary:

The present study investigated the sustainable microwave-assisted FeCl3-catalysed hydrolysis of giant reed and cardoon cellulose to give glucose. The acid pretreatment was implemented for giant reed, while steam-explosion pretreatment was adopted for cardoon. Giant reed is a promising energy crops able to grow on marginal lands, while cardoon stalks are the crop residue in the production of vegetable oil. The homogeneous catalyst FeCl3 presents important advantages compared with traditional strong homogeneous inorganic acids, such as less corrosion of reactor, low cost, simple recovery by precipitation, good efficacy at mild reaction conditions, energy saving, and high selectivity. Under different reactions conditions for the two feedstocks, each glucose-rich hydrolysate was obtained, which was employed as fermentation medium for the production of SCO by the yeast Lipomyces starkeyi DSM 70296.

Presenter: **Nicola DI FIDIO, University of Pisa, Chemistry and Industrial Chemistry Dpt., Pisa, ITALY**

Presenter's biography:

Ph.D. student in Chemistry and Material Science at the University of Pisa (supervisor: Prof. Anna Maria Raspolli Galletti) in collaboration with Sant'Anna School of Advanced Studies and Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA).

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Session reference: 3DV.3.7

Subtopic: 3.4 Oil-Based and Renewable Hydrocarbon Biofuels

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Biodiesel Synthesis from Mango (Mangifera Indica) Seed Oil Extracted with Supercritical Carbon Dioxide

Short introductive summary:

The use of mango seed oil for the generation of Biodiesel was studied in this work. The optimal supercritical extraction conditions obtained were 40 ° C, 300 Bar, 4 ml/min of CO2 flow and 1 ml/min of cosolvent flow (Isopropanol and ethanol). In this work it was found that the average supercritical CO2 extraction yield of Keitt mango seed was 17.56% and 6.29% with isopropanol and ethanol as cosolvents, respectively. Triplicate catalyzed transesterification reactions were performed with NaOH as a catalyst with a catalyst-oil ratio of 0.1: 1, Methanol: oil ratio of 1: 7, 60 ° C reaction temperature and reaction time of 90 min, finding reaction yields of 87.94% and 68.74% for the oil extracted with cosolvent Isopropanol and ethanol respectively. Tests and analyses were carried out to determine the physical properties of the product in comparison to regular-use diesel. The density of 857.5 kg / m3, cloud point index of 27.6 °C, pour point of 17.8 ° C, saponification value of 116.41 mg KOH/g, iodine value of 45.68 mg I /g and cetane number of 36.07. The results obtained demonstrate the viability of the use of this residue for biofuel production.

Presenter: **Luisdomingo GUZMAN, Universidad de los Andes, Chemical Engineering Dpt., Cartagena, COLOMBIA**

Presenter's biography:

Bilingual chemical Engineering student of La Universidad de los Andes.Focused on the area of Biomass research, specifically in the use of fruit residues for the creation of value-added by-products such as Biofuels.

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Session reference: 3DV.3.8

Subtopic: 3.4 Oil-Based and Renewable Hydrocarbon Biofuels

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Production of FAME from Rapeseed Soapstock

Short introductive summary:

We present an innovative three stage process for advanced biodiesel production from soapstock (SS). SS is a byproduct of vegetable oil manufacturing with no rational use. The advanced biodiesel synthesis scheme from SS developed in this work includes 3 following stages: synthesis of quality AO, esterification of the AO with methanol in presence of acid catalyst and transesterification of the obtained mixture with methanol in the presence of a basic catalyst. Advanced biodiesel synthesis from low quality rapeseed oil soapstock includes simple chemical methods, inexpensive reagents and mild conditions. Obtained product shows high FAME content (94.8%) and medium overall yield (43%). Thus, the currently realized production of advanced biodiesel from used cooking oil can certainly be expanded by using the SS (by-product of vegetable oil production). As the world production of vegetable oil is constantly growing and now exceeds 200 million ton per year, SS can become an important raw material for expanding the production of advanced biodiesel.

Presenter: **Valdis KAMPARS, Riga Technical University, Applied Chemistry Dpt., Riga, LATVIA**

Presenter's biography:

Born: October 5, 1944
Interests: Biomass conversion
Education: Dr.habil.chem. (1991)
Doctor of Science in former USSR (1983);
Experience:
Riga Technical University, Director of Institute of Applied Chemistry (2005-);
Professor (1989-).

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Session reference: 3DV.3.10
Subtopic: 3.4 Oil-Based and Renewable Hydrocarbon Biofuels
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Mechanistic and kinetic studies on hydrogen transfer deoxygenation of oleic acid over a bimetallic Pd60Cu40 catalyst

Short introductive summary:

This paper aims to offer an in-depth mechanistic insight into the surface reaction mechanism of the tandem hydrogen transfer-deoxygenation of oleic acid with tetralin as a hydrogen donor source. The kinetic modelling study builds on our previous work in which we screened a series of PdxCu(1-x) bimetallic catalysts supported on activated carbon and assessed the effect of Pd dilution and PdCu synergetic behaviour in a batch reactor. It was demonstrated that the Pd60Cu40/C catalyst exhibited excellent catalytic performance in converting oleic acid into diesel paraffinic hydrocarbons. The bimetallic material proved to be superior to monometallic Pd/C. However, the surface reaction mechanism and individual role of the active site (Pd & Cu) in the catalytic deoxygenation of oleic acid were yet to be clarified. Thus, in this work, we focused on (i) studying the effect of reaction temperatures and weight hourly space velocity (WHSV) on the reactants conversion and diesel hydrocarbon selectivity, (ii) developing a mechanistic insight into the surface reactions and (iii) determining the rate-limiting step of the overall reaction.

Presenter: **Kin Wai CHEAH, University of Hull, Chemical Engineering Dpt., Hull, UNITED KINGDOM**

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Session reference: 3DV.3.11

Subtopic: 3.4 Oil-Based and Renewable Hydrocarbon Biofuels

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Characterization of HTL Micro-algal bio-oil and Catalytic Upgrading over NiWS/Al2O3

Short introductive summary:

The algae, Chlorella sorokiniana grew at CEA Cadarache, was converted to a bio-oil using a continuous reactor at 300 °C, under 10 MPa for 15 min at CEA Grenoble. Then, the bio-oil was upgraded using a batch reactor at three different temperatures (350 °C, 375 °C, and 400 °C), and four reaction times (0h, 2.5h, 5h, and 8h) in heptane under 10 MPa (H2), over NiW/Al2O3 sulfided catalyst. The produced HTL and HDT oils were characterized by CHONS, XRF, ICP-OES, KF, GPC, 13C-NMR, and GCxGC-MS. The upgrading experiments permitted to reduce the amount of contaminant and improved the quality of bio-oil. The HHV increased from 36 KJ/mol in the HTL bio-oil to 47 KJ/mol in the upgraded oil at 400 °C, and the average molar mass reduced from 333 to 203 g/mol. The degree of deoxygenation and denitrogenation were, respectively, 90% and 26% at 350 °C, and 95% and 83% at 400 °C.Therefore, catalytic hydrotreatment is confirmed as a relevant technology for the upgrading of HTL micro-algal bio-oil but catalyst performances need to be increased or may be associated with a second treatment stage to reduce less-reactive N-components.

Presenter: **Bruno DA COSTA MAGALHAES, IRCELYON, Villeurbanne, FRANCE**

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Session reference: 3DV.3.14

Subtopic: 3.4 Oil-Based and Renewable Hydrocarbon Biofuels

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Challenges and Opportunities of Hydrothermal Carbonisation in the UK; Case Study in Chirnside

Short introductive summary:

I graduated from The University of Edinburgh with a First Class Masters Degree in Chemical Engineering in 2019, for the next year I worked within innovation funding in the UK. I simultaneously worked to finish my undergraduate paper for publishing which was successful on 10th August 2020 in the Royal Chemistry Societies Journal RSC Advances. I found most enjoyment working on this and want to spend my career exploring biofuels as sustainable energy production alternatives. On December 1st, I am returning to The University of Edinburgh to begin studying my self-proposed PhD research topic; modelling and evaluating the energetic and economic feasibility of a waste-to-energy-to-agriculture process, integrating hydrothermal carbonisation using PSEs advanced modelling software gPROMS.

Presenter: **Eloise BEVAN, University of Edinburgh, School of Engineering, Chester, UNITED KINGDOM**

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Session reference: 3DV.4.1

Subtopic: 3.3 Hydrothermal Processing

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

A Mini-Pilot HTL Reactor for Production of Fuel Intermediates from Biomass Wastes

Short introductive summary:

Hydrothermal liquefaction (HTL) is a thermochemical process that takes advantage of the water in the feedstock, at process conditions where the heat of evaporation for water is avoided and hence pre-drying is not necessary.
A continuous lab-scale HTL mini-pilot system Was installed at the end of 2019. The mini-pilot has a capacity of maximum 2 L/h slurry feed and is able to operate at state-of-the-art conditions, i.e. up to 500 °C and 350 bar. The reactor is built with a research focus, for studying operational issues, such as fate of inorganics, corrosion and the effect of depressurization on those. The system has the possibility to include stress loaded corrosion samples for material and weld testing under real HTL environment. To facilitate this objective, a relatively large compartment was needed to insert the samples, therefore, a CSTR reactor was selected. The mini-pilot is equipped with dual piston pumps and a two-stage depressurization system to study the depressurization effect on the product composition and distribution. Details about the reactor system as well as the first results will be discussed.

Presenter: **Judit SANDQUIST, SINTEF Energy Research, Thermal Energy Dpt., Trondheim, NORWAY**

Presenter's biography:

I am working on thermochemical processing technologies such as hydrothermal liquefaction, pyrolysis and gasification. Earlier, as a student researcher and master student, I got insight into cellulosic bioethanol technology.

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Session reference:	3DV.4.2
Subtopic:	3.3 Hydrothermal Processing
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

In-Situ Upgrading of Hydrothermal Liquefaction Products from Lignin Paper Pulp Waste Using Co-Solvents

Short introductive summary:

The study aimed to upgrade HTL products from lignin waste through co-solvent liquefaction using ethanol and THF as solvents. The results showed that THF performed better in degrading the lignin to phenolic and aromatic components that were present in the bio-oil phase. The bio-oil yield decreased and the hydrochar yield increased with an increase in co-solvent concentration. It was concluded from the results that much can be gained from using a co-solvent to produce HTL products that can be utilised in a biorefinery for increased carbon efficiency and profitability.

Presenter: **Sanette MARX, North-West University, Centre of Excellence in Carbon-based Fuels, Potchefstroom, SOUTH AFRICA**

Presenter's biography:

Prof Sanette Marx (PrEng) is holder of the SARChI Research Chair in Biofuels at the North-West University, South Africa. Her research area is biochemical and thermochemical conversion of biomass to biofuels, biochemicals and bio-plastics.

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Session reference:	3DV.4.4
Subtopic:	3.3 Hydrothermal Processing
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Development of Novel Mo2N-based Catalysts for the Hydrotreatment of Hydrothermal Liquefaction Biocrude from Sewage Sludge

Short introductive summary:

The aim of this study is the development of alternative efficient catalysts for the upgrading of Hydrothermal Liquefaction biocrude from sewage sludge.

Presenter: **Michalis VASSOU, CERTH, CPERI, Thessaloniki, GREECE**

Presenter's biography:

Michalis Vassou is a PhD student at the Chemical Process and Energy Resources Institute (CPERI), CERTH, Greece. His work focuses mainly on the production of liquid fuels through thermocatalytic hydrotreating.

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Session reference: 3DV.4.5

Subtopic: 3.3 Hydrothermal Processing

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Valorizing Driftwood Transported By Rivers from Waste to An Anode in Sodium-Ion Batteries

Short introductive summary:

Rivers transport a large volume of wood in many parts around the world. Driftwood plays a beneficial role in geomorphology and ecology of the river, impacting the dynamics of particulate organic matter storage, aquatic life and bedload transport in rivers. On the other hand, driftwood can have a negative impact by increasing the destructive power of floods. For example, in dams, driftwood can cause damages to the hydropower stations; as a result, driftwood is often collected and removed for safety reasons. Collected driftwood is often combusted or landfilled. The potential of driftwood for hydrochar production has never been studied before. The research aimed to evaluate the feasibility of hydrochar production from driftwood. The different genera of driftwood collected from Genissiat dam were identified for further processing by HTC. Moreover, the study examined the behaviour of different driftwood genre for hydrochar production and characterized the physico-chemical properties of produced hydrochar.

Presenter: **Abdullah QATARNEH, IHE Delft, Delft, THE NETHERLANDS**

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Session reference: 3DV.4.7

Subtopic: 3.3 Hydrothermal Processing

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Black Liquor Salt Behaviour during Supercritical Water Gasification in Continuous Reactor

Short introductive summary:

The H2020 Pulp&Fuel [1] project intends to make a significant contribution to biofuel development by taking advantage of the synergy between dry gasification and supercritical water gasification. The project has chosen to demonstrate its applicability to pulp industry that have both dry and wet wastes available. These wastes are today either recycled in low value fuel for combustion or are disposed at great cost. The mechanical and chemical processes provide large amounts of bark and wood co-products as dry waste. It also produces sludge as wet waste and an excess of black liquor in chemical pulp mills.
Black liquor supercritical water gasification is studied in two kinds of reactors into the CEA platform: batch and continuous reactor. Continous experiments allow to process larger quantities of feedstock, to operate the "injection / hydrothermal conversion / product separation / analysis" unit at the same time, and to validate operational conditions and performance. This abstract focuses on continuous experiments and salt management.

Presenter: **Marine PEYROT, CEA Grenoble, LITEN/DTBH/TLB Dpt., Grenoble, FRANCE**

Presenter's biography:

Marine Peyrot works in the L2CH laboratory for 10 years in the LITEN CEA in Grenoble; she has her expertise in biomass and waste pyrolysis and gasification and more particularly in reactor modeling, and also hydrothermal processes (liquefaction, and supercritical water gasification).

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Session reference: 3DV.4.8
Subtopic: 3.3 Hydrothermal Processing
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Ethanothermal and Hydrothermal Extraction of Tar from Char Produced in Commercial Gasifiers and Comparison with Conventional Tar Extraction Methods

Short introductive summary:

The management of tar has been at the center of attention for all gasification plants. Tar compounds that are contained in the char fraction may convert the char into a hazardous waste by increasing its ecotoxicity and, as a result, increase the overall cost of char disposal. This present study aims to apply conventional and novel methods for extracting the tar compounds from char. Currently, there is not a standardized methodology for extracting and measuring the tar compounds that are trapped in the porous of chars. Thus, the conventional methods of shaking and ultrasonic extraction have been selected and applied for 15 minutes and 30 minutes. These two methods are being compared with a novel hydrothermal/ ethanothermal extraction method that is proposed, which is performed in a hydrothermal autoclave reactor.

Presenter: **Stergios VAKALIS, University of the Aegean, Environment Dpt., Mytilene, GREECE**

Presenter's biography:

Stergios is an Assistant Professor at the Department of Environment of the University of the Aegean in the field of "Energy Management and Low Carbon Technologies". In the Laboratory of Energy Management, he works on waste gasification, energy modeling, the assessment of fuel characteristics.

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Session reference: 3DV.4.11
Subtopic: 3.3 Hydrothermal Processing
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Biomobility - Reimagining Transportation Fuel Landscape

Short introductive summary:
Bio-mobility refers to utilizing captive renewable biological resources such as feedstock to produce low carbon transportation fuel that can be used across all modes of mobility namely, land, air & water.
Transportation based on Biofuels has positive socio-economical & environmental impact. Bio-Mobility platform envisages utilization of Agri residues and organic waste for the production of both gaseous and liquid bio fuels using biochemical and thermochemical processes. Biomobility platform comprises of 1st generation Bioethanol, 2nd Generation cellulosic biofuels, bio diesel, renewable natural gas, Bio-methanol, Bio-hydrogen, Sustainable Aviation Fuel (SAF) & Marine biofuel.
As a renewable source of energy, Biofuels are environment friendly and carbon efficient and contributes to sustainable de-carbonisation through circular bioeconomy.
Collection of agriculture waste creates employment in rural areas & serves as alternate revenue stream for farmer thus boosting rural economy.

Presenter: **Shishir JOSHIPURA, Praj Industries Limited, INDIA**

Presenter's biography:
Mr. Shishir Joshipura is CEO and MD of Praj Industries Ltd., a Pune based Industrial Biotech major since 2018. Prior to this he was CEO of SKF India.
Currently he is Co-Chairman of CII National Task Force on Bioenergy 2020-21 and works closely with Govt agencies and stakeholders for the causes of industry. He is also member of Governing Board of The Council of EU Chambers of Commerce in India.
Mr. Joshipura was named as one of the 'most valuable CEOs' of India by Business world magazine in the year 2013 and listed amongst 'India's Top 100 CEOs in 2013' by Business Today magazine.

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Session reference: IDO.2.1
Subtopic: 6.15 Bioeconomy Advances in India
Topic: 6. INDUSTRY TRACK

Overcoming the Supply Chain Barrier to Scalable Deployment of Biofuels in India

Short introductive summary:

Effective ways to decarbonise Planet Earth are essential for mitigating the pace, extent and impact of climate change. Towards this end, it is imperative to maximise utilisation of renewable resources. The energy required for transportation, and the greenhouse gas (GHG) emissions thereof, are of special concern. E-mobility is gaining importance for short-distance transportation whereas long-haul modes, whether on land, sea or air still need significant alternate options. Natural gas, albeit significantly less adverse in terms of lifecycle GHG impact than coal or petroleum, is nonetheless a fossil fuel. All major fuels in use today require the presence of organic carbon in the structure, for which biomass - broadly construed to mean carbonaceous matter derived from currently or recently living organisms - is the only renewable source category.

Presenter: **Anjan RAY, CSIR - Indian Institute of Petroleum, Analytical Sciences Dpt., Dehradun, INDIA**

Presenter's biography:

Anjan Ray holds a Doctorate in Chemistry from the University of Pennsylvania. He has 25 years of cross-functional industry experience and currently heads CSIR-Indian Institute of Petroleum, with professional interests spanning energy policy, renewable energy, oil and gas, lubricants & surfactants.

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Session reference: IDO.2.3
Subtopic: 6.15 Bioeconomy Advances in India
Topic: 6. INDUSTRY TRACK

The Effect of Augmentation of Biochar and Hydrochar in Anaerobic Digestion

Short introductive summary:

Amendment of anaerobic digestion by biochar and hydrochar augmentation. Different thermochemical processing conditions resulted in chars with variable and attractive chemical and physicochemical properties. The addition of these chars in anaerobic digestion resulted in different kinetic dynamics. The addition of certain biochars doubled the methane production rate in comparison to the control. This effect was attributed to the surface functionality of the biochars, responsible for enhancing the syntrophic metabolism.

Presenter: **Jessica QUINTANA NAJERA, University of Leeds, School of Chemical and Process Engineering, Leeds, UNITED KINGDOM**

Presenter's biography:

Third year PhD Researcher with a BSc in Biochemical Engineering at the Autonomous University of Sinaloa and MSc in Biotechnology at the Center of Research and Advanced Studies of the National Polytechnic Institute (CINVESTAV-IPN).

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Session reference: 2DO.7.1
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Do Industrial and Municipal Waste Based Hydrochars Have Potential to Accelerate and Stabilize Anaerobic Digestion?

Short introductive summary:

Several studies reported improvements in the performance of anaerobic digestion (AD) when biochars were added, however, very few reported the use of hydrochars as additives in AD and the mechanisms by which this material may enhance AD are still unclear. This study contributes to understand the potential of hydrochars produced from industrial and municipal waste to accelerate and stabilize AD and the mechanisms involved. The results found show that anaerobic digestate, sewage sludge and fiber sludge hydrochars may have potential to enhance anaerobic digestion by promoting accelerated transfer of
reducing equivalents via direct interspecies electron transfer (DIET) and increasing the buffering capacity of AD systems.

Presenter: **Ailén Maria Florencia SOTO, IHE Delft, Institute for Water Education, Environmental Engineering and Water Technology Dpt., Delft, THE NETHERLANDS**

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Session reference: 2DO.7.2
Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Developing an On-Line Analyzer to Monitor Trace Constituents in Biomethane for Pipeline Injection - Update

Short introductive summary:

The growing demand to inject renewable gas into the US gas grid prompted GTI and ten gas utilities to develop a single on-line analyzer monitoring trace biomethane (BM) constituents not currently available in the market. These new constituents have deterred many gas utility customers from accepting renewable gas. Addressing this technology gap and cost barrier in on-line monitoring is critical for gas utilities to build confidence in the renewable gas economy.

The proposed presentation would include (1) the selected technology for product development (2) product development approach, (3) proven/planned detection ranges of each component, and (4) figures showing the stability of each component across time in an inerted cylinder (preferred gas sampling method of most utilities for lab analysis).

Presenter: **Kevin LEODINH, Gas Technology Institute, Environmental Chemical Research Services, Des Plaines, USA**

Presenter's biography:

Chemist in the Environmental Chemical Research Services team at GTI - a non-for-profit energy research institution. Current projects are focused in fuel gas/air analysis, on-line fuel gas sensors, biomethane monitoring, and the incorporation of RNG into the North American gas grid.

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Session reference:	2DO.7.3
Subtopic:	2.6 Anaerobic Digestion for Biogas and Biomethane Production
Topic:	2. BIOMASS CONVERSION FOR BIOENERGY

Update on ASTM D8230-19 - a Standardized Testing Method for Siloxanes in Biomethane. Interlaboratory Study Progress and Material Compatibility Studies

Short introductive summary:

ASTM D8230 was published in 2019 as a universal, industry-wide sampling and analysis procedure for measuring siloxanes in biomethane that can obtain a detection limit of 0.01 mg/M3 of silicon or less. Presented will be a summary of additional work conducted over the past 2 years in relation to ASTM D8230-19. This includes a current status of the Independent Laboratory Study (ILS) required to be completed within five years of initial publication, an evaluation of gas-phase siloxane standard mixtures from known manufacturers across the globe, and material compatibility studies with siloxanes. Materials for regulator bodies, as well as internal lubricants, were evaluated for use with gas-phase standards. Materials for tubing were evaluated for use in both standard transfer and sample transfer.

Presenter: **Russell BORA, Gas Technology Institute, Des Plaines, IL, USA**

Presenter's biography:

Mr. Bora is an R&D Manager within GTI's ISO 17025/A2LA accredited Environmental and Chemical Research Services Laboratory with more than 25 years of GC experience analyzing an array of energy-related materials. He also serves as Vice-Chair for ASTM D03 Committee on Gaseous Fuels.

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Co-authors:

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Session reference: 2DO.7.4

Subtopic: 2.6 Anaerobic Digestion for Biogas and Biomethane Production

Topic: 2. BIOMASS CONVERSION FOR BIOENERGY

Evaluation of Microalgae Capacity to Utilize CO2-Rich Effluents, Following the Blue Biorefinery Concept

Short introductive summary:

The objective of the present study is to investigate the behavior of several microalgal strains in the presence of “larger-than-normal” amounts of CO2 (10% v/v). The cultivation of strains is performed in lab-scale experiments, using different nutritional media that simulate the native habitat of each strain. The efficacy of the cultures is evaluated by monitoring the biomass growth rate and concentration, as well as their content in selected biochemicals, in correlation with their tolerance to excess CO2. The results show that the strains of Stichococcus sp. and Chlorella sp. exhibit unhindered growth under the presence of increased CO2 concentrations. In parallel, these species are able to adequately accumulate proteins and lipids, thus they can be promoted as the most promising species. In the next step, the selected strains will be used in scaled-up photo-bioreactors that will be coupled with the CO2-rich effluents and exhaust gases of the Greek Public Power Company.

Presenter: **Giannis PENLOGLOU, CERTH, CPERI, Thessaloniki, GREECE**

Presenter's biography:

Dr. Giannis Penloglou, Chemical Engineer, is a PhD Associate Researcher at CPERI/CERTH and a collaborative course instructor of the Chemical Engineering Department at Aristotle University of Thessaloniki (AUTH). He has participated in 11 National and European research projects.

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Session reference: 1DO.8.1
Subtopic: 1.4 Algae and Aquatic Biomass Production Systems
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

The Future of On-Line Monitoring for Microalgae Production

Short introductive summary:

Microalgae have demonstrated potential to meet the population’s need for a sustainable food, feed and chemicals. However, its industrial production relies in less measured parameters than the ones needed to be controlled, increasing the difficulty of monitoring and controlling the process. The goal of this work was to develop an on-line monitoring technology for the microalgae industry. For that we used fluorescence spectroscopy coupled with chemometric modelling to create prediction models for several biochemical parameters of interest. To prove its potential, four marine microalgae, with different morphological characteristics and biochemical composition, were studied: Dunaliella salina, Nannochloropsis oceanica, Tisochrysis lutea and Phaeodactylum tricornutum. This work shows that: Five parameters were successfully monitored in a wide concentration range: cell concentration and viability, pigments, fatty acids, and nitrogen; The same model can be used to monitor a parameter in different production processes, for a specific microalga; The same model can be used to monitor the same parameter in different microalgae.

Presenter: **Narcis FERRER LEDO, Wageningen University and Research, BioProcess Engineering Dpt., Wageningen, THE NETHERLANDS**

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Session reference: 1DO.8.2
Subtopic: 1.4 Algae and Aquatic Biomass Production Systems
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Primary Wastewater Treatment Using Scenedesmus Sp. and an Innovative Membrane Bioreactor: Productivity, Nutrient Removal and Composition of the Microalgae-Bacteria Consortium

Short introductive summary:

Microalgae are gaining increased importance in the context of European bioeconomy, especially in terms of bioremediation because of their dual role: they can recover nutrients from wastewater while producing valuable biomass. In the current study, primary urban wastewater was processed using the microalgae Scenedesmus sp. in an outdoor pilot-scale raceway reactor connected to an ultrafiltration membrane that allowed to separate cellular retention time from hydraulic retention time. The goal was to increase the amount of wastewater processed per square meter while maximising biomass productivity and nutrient removal.

Presenter: **Ainoa MORILLAS, Universidad de Almería, Ingeniería Química Dpt., Almería, SPAIN**

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Session reference: 1DO.8.4
Subtopic: 1.4 Algae and Aquatic Biomass Production Systems
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Hydrothermal Carbonisation of Sewage Sludge Using Recirculated Process Water

Short introductive summary:

In this work, hydrothermal carbonisation was used to convert sewage sludge into hydrochar and process water. The influence of the recycling of process water on HTC products was investigated. The resulting products were examined primarily with regard to their composition and quantity

Presenter: **Szymon HERDZIK, Regenerative Energy Systems, TUM Campus Straubing for Biotechnology and Sustainability, Straubing, GERMANY**

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Session reference:	3DO.9.1
Subtopic:	3.3 Hydrothermal Processing
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Performance of Various Sulphur Traps in Desulfurization of Organosulfur Compounds Formed under Supercritical Treatment of Biomass

Short introductive summary:

Catalytic supercritical water gasification (cSCWG) of wet biomass is a promising way to produce bio-methane with high energy efficiency. The gasification catalyst used needs to be protected from poisoning by sulphur using a sulphur-trap upstream the catalyst bed. This works presents advances in the identification of organosulphur compounds formed under hydrothermal treatment of biomass and presents conclusive results on the identification of performant S-trap for organic desulfurization under such conditions.

Presenter: **David BAUDOUIN, PSI - Paul Scherrer Institut, Bioenergy and Catalysis Dpt., Villigen PSI, SWITZERLAND**

Presenter's biography:

David Baudouin is a scientist in the laboratory for Bioenergy and Catalysis at PSI, Switzerland. His research focuses on the development of new sulphur absorbents materials, catalysts for hydrothermal gasification (HTG) and the optimization of HTG process and hydrothermal salt separation.

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Session reference: 3DO.9.2

Subtopic: 3.3 Hydrothermal Processing

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Catalyst Grading and Knowledge of Thermal Stability: Two-Front Approach for Smooth Continuous Hydroprocessing of Hydrothermal Liquefaction Biocrudes

Short introductive summary:

Hydrothermal liquefaction (HTL) of sewage sludge and Spirulina algae opens up an unparalleled opportunity by converting wet/dry organic content with no lipid restriction into a high quality biocrude. In the meanwhile, the HTL biocrude reveals a most exciting scientific challenge to produce sustainable drop in biofuels for long haul transportation. Serious efforts from last two decades brought out some promising results, but so far successful long term continuous hydroprocessing remains an exciting scientific challenge.
In order to overcome the short coming from the present literature a novel method was defined and successfully used to understand much better the thermal stability of both HTL biocrudes and the control of exothermicity during continuous hydrotreatment. A two front approach was used during the continuous hydroprocessing, where the knowledge of biocrude thermal stability and the catalyst grading in the reactor bed (three different catalysts from low to high activity) were utilized to stop coke formation and to control exothermicity.

Presenter: **Muhammad Salman HAIDER, Aalborg University, Energy Dpt., Aalborg, DENMARK**

Presenter's biography:

I received my M.Sc. (Hons.) in 'Advanced Materials and Processes´ at the University of Erlangen-Nürnberg with a specialization in Chemical Engineering and Nano-technology. I wrote my final thesis under the supervision of Prof. Dr. Peter Wasserscheid. I joined Aalborg University from May 2018.

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Session reference:	3DO.9.3
Subtopic:	3.3 Hydrothermal Processing
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Hydrothermal Carbonization of Lignocellulosic Biomass from Para-Pharmaceutical and Herbal Medicine Production

Short introductive summary:

This study aims at valorizing the industrial residues of the production cycle of para-pharmaceutical and herbal medicines. The case study refers to an Italian plant that currently disposes of lignocellulosic residues from the process at a relevant cost. The valorization of these residues through combustion, pyrolysis, gasification, and hydrothermal carbonization (HTC) processes were investigated by a combined analysis of their physicochemical and thermal properties and the results of thermodynamic equilibrium models. The energy cost of the HTC process was assessed through high pressure Differential Scanning Calorimetry (DSC) [1], its mass balance was obtained based on the results of HTC lab-scale tests. The results were implemented in an economical model. Three different scenarios were studied.

Presenter: **Alessandro CASCIOLI, Free University of Bozen-Bolzano, Faculty of Science and Technology, Bolzano, ITALY**

Presenter's biography:

Born in Terni (Umbria). Bachelor in Mechanical Engineering at University of Perugia. Erasmus + at FAU in Erlangen (Germany) during the bachelor. Master in Energy Engineering at Free University of Bolzano. PhD Student at Free University of Bolzano.

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Session reference: 3DO.9.4

Subtopic: 3.3 Hydrothermal Processing

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

The BeonNAT Project: Innovative Value Chains from Tree and Shrub Species Grown in Marginal Lands as a Source of Biomass for Bio-Based Industries

Short introductive summary:

The overarching objective of the BeonNAT project is to create added-value bio-based products through growing underused tree and shrub species in marginal land areas in Germany, Romania and Spain. BeonNAT project proposes to use marginal lands in Europe (4.3 M km2 and 0.4 M km2 of agricultural and forest marginal lands have been estimated in EU-28, respectively) to obtain forest biomass for the production of 8 products based on new bio-based value chains: essential oils, extracts, wood paper, particleboard, bioplastics, biochar, active carbon and absorbents. This way, BeonNAT will allow to produce biodegradable bio-based products and bioactive compounds that will play an important role to replace fossil-based products.

Presenter: **Luis Saúl ESTEBAN PASCUAL, CIEMAT-CEDER, Renewable Energy Dpt., LUBIA, SPAIN**

Presenter's biography:

Doctor in Forest Engineering by the Polytechnic University of Madrid. Senior Research Scientist in the Biomass Unit of CIEMAT. Since 1993 has devoted his main activity to R & D on various aspects of the production of biomass for energy: resources assessment, pre-treatment etc.

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Session reference: 1DV.5.1

Subtopic: 1.3 Biomass Crops and Energy Grasses

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Combustion Properties and Quality of the Perennial Wild Plants Common Tansy (Tanacetum vulgare L.), Common Knapweed (Centaurea jacea L.) and Mugwort (Artemisia vulgaris L.)

Short introductive summary:

Perennial lignocellulosic crops (PLCs) are key elements in the bioeconomy through providing advanced second generation biofuels. European perennial wild plant species (WPS) are highly promising, as they provide additional versatile habitats for open land animals and pollinators and an overall increase in biodiversity. These ecosystem functions could be improved shifting the harvest date from late summer to late winter, thus turning WPS into potential bioresources for thermochemical conversion. However, this field of research has so far hardly been considered. Therefore, this study aims at first insights to the combustion quality of the WPS common tansy (Tanacetum vulgare L.), common knapweed (Centaurea nigra L.) and mugwort (Artemisia vulgaris L.). Virginia mallow (Sida hermaphrodita L. Rusby) was included as a reference species. These results indicate that wild plant species may have combustion quality similar to Virginia mallow making them very promising sources for solid biofuels. However, it should be carefully considered which wild plant species are chosen and where they are grown to make optimal use of their overall ecosystem services.

Presenter: **Moritz VON COSSEL, University of Hohenheim 340b, Biobased Resources in the Bioeconomy (340b), Stuttgart, GERMANY**

Presenter's biography:

Postdoc at the Dept. of Biobased Products and Energy Crops, University of Hohenheim. Dr. sc. agr. (2018), M.Sc. agr. (2012), B.Sc. agr. (2010), Vegetable grower (2005). Agricultural diversification, Bioenergy, Climate change-adaptation and -mitigation, environmental sustainability.

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Session reference: 1DV.5.4
Subtopic: 1.3 Biomass Crops and Energy Grasses
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Quantification of Soil Contaminant Uptake and Establishing the Effect on the Combustion Capabilities of Two Bamboo Species Grown on Contaminated/Uncontaminated Soil.

Short introductive summary:

I am a Chemical and Metallurgical lecturer at the School of Chemical and Metallurgical Engineering at the University of the Witwatersrand in Johannesburg, South Africa. I am a member of the Clean Coal Technology Research group. I have conducted various analysis on three bamboo species that would first be suitable to our climatic conditions and most importantly not be invasive. The bamboo species have already been grown under contaminated soil and have survived a drought period in the Western Cape. Their chemical composition results were also promising.

The main objective of this paper was to establish the extent of contaminant uptake on the bamboo species grown on contaminated soil in order to help establish if they would be suitable for combustion end applications. It was also to perform combustion tests on the bamboo species and to compare them to the coal results. Two bamboo species, which had better results from previous analysis, were selected for the combustion, co-combustion with coal tests. The tests were performed on the different sections (top, middle and bottom) of the bamboo specie. The soil in which the bamboo species were grown in was also analyzed.

Presenter: **Zama MTHABELA, University of the Witwatersrand, Chemical and Metallurgy Dpt., Johannesburg, SOUTH AFRICA**

Presenter's biography:

Zama A. Mthabela is a Chemical and Metallurgical lecturer at the School of Chemical and Metallurgical Engineering at the University of the Witwatersrand in Johannesburg, South Africa. She is a member of the Clean Coal Technology Research group. She holds an MSc in Engineering.

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Session reference: 1DV.5.5

Subtopic: 1.3 Biomass Crops and Energy Grasses

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Short Rotation Energy Crops: Differences in Biomass Production of Twelve Taxa after Two Cutting Rotations

Short introductive summary:

The objective of the work is to compare the productions of twelve different taxa of short rotation woody crops to obtain biomass for energy purposes. The essay has obtained data from two consecutive harvests have been carried out, with a cutting rotation of tree years.
The research compares the biomass productions in dry weight per plant, as well as the biomass productions per area, since the planting densities for the different taxa are different. The work also compares differences between the productions of the first cut and the second cut of each taxon.
The species and clones used were: Paulownia tomentosa (princess tree), Populus x euramericana (Canadian poplar, tree clones: MC, I-214 and Luisa Avanzo), Ulmus minor (field elm, tree clones: Pareja, Curi-1 and Curi-2), Ulmus laevis (European white elm), Prunus x amygdalo-persica (adafuel), Tamarix gallica (tamarisk), Salix alba (white willow) and Platanus x hispanica (plane tree).

Presenter: **Inés BAUTISTA CARRASCOSA, IMIDRA, AgroEnvironmental Research Dpt., Alcalá de Henares, SPAIN**

Presenter's biography:

Forestry Engineer. Different forestry consulting companies and public administrations. Specialist in drafting and evaluation of environmental and forestry projects, and development of natural resource management plans. Currently, research in the development of new energy crops.

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Session reference: 1DV.5.6
Subtopic: 1.3 Biomass Crops and Energy Grasses
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Plant Growth Promoting Rhizobacteria (Pgpr) Activity on Arundo Donax Cuttings (L.) and First Assessments in Presence of Copper

Short introductive summary:

Notwithstanding the noteworthy potentialities, the interaction between PGPR (Plant Growth Promoting Rhizobacteria) and energy crops, specifically Arundo, is still poorly investigated. The addition of a PGPR can have a beneficial influence on several physiological traits as nitrogen assimilation or photosynthesis, or stress tolerance. The study had two main goals. The first was to analyse the interaction between a PGPR and Arundo donax (L.); the second was an initial analysis of the behaviour of the interaction in presence of copper (Cu). The PGPR strain used was Pseudomonas fluorescens 15A inoculated on rooted cuttings of Arundo grew on batches of axenic “soilless” substrate of perlite. The effects of the interaction were evaluated through biometrical and morphological parameters. The results emphasized the compatibility of P. fluorescens 15 A with A. donax. The studied strain 15 A induced morphometric responses (plant height, number of leaves, number of internodes, dry weight of the biomass) compatible with a phytostimulant action on Arundo. Moreover, a consistent adsorption of Cu on the bacterial rhizoplanic biofilm was observed.

Presenter: **Enrico SANTANGELO, CREA, Research Centre for Engineering and Agro-Food Processing, Monterotondo, ITALY**

Presenter's biography:

Dr. Enrico Santangelo has a Degree in Agricultural Science, and the PhD in Plant Genetic. He is researcher at CREA-IT where he has been involved in research activities concerning the mechanization of energy crops. Currently, he is working on the recovery and exploitation of agriculture residues.

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Session reference: 1DV.5.7
Subtopic: 1.3 Biomass Crops and Energy Grasses
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Production Potential of Arundo Donax L. in Soils Contaminated with Heavy Metals

Short introductive summary:

1. Marginal Lands
2. Soil Contamination
3. Heavy Metals in the Soil
4. Phytoremediation
5. Energy Crops
6. Contaminated Energy Crops Valorization

Presenter: **Leandro GOMES, Universidade Nova de Lisboa, Almada, PORTUGAL**

Presenter's biography:

I am an energy engineer and I am studying my PhD in Bioenergy at Unoversidade Nova in Lisbon, working with industrial crops on marginal soils.

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Session reference:	1DV.5.8
Subtopic:	1.3 Biomass Crops and Energy Grasses
Topic:	1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Somaclonal Ckx-Downregulated Line of Finger Millet as a Feedstock for Sustainable Bioethanol Production

Short introductive summary:

Bioethanol is considered at the moment as one of the most promising substitutes for petroleum Finger millet (Eleusine coracana) has recently gained significant attention as a bioethanol feedstock. Earlier, we were able to create several somaclonal lines of this crop, one of which (SE-7 or cv. Yaroslav-8) with decreased level of cytokinin-degrading enzyme expression (cytokinin oxidase/dehydorgenase, ckx), what significantly promotes biomass accumulation of this variety. In this study, we aimed to evaluate bioethanol production potential from straw and grains of finger millet varieties bred conventionally and from somaclonal variants. It was confirmed that somaclonal lines are showing same beneficial traits under field conditions (reduced height, increased tillering, etc.). Higher biomass/grain productivity in SE-7 line was observed (30% more than in its wild-type cv. Tropikanka). We have estimated that it is possible to produce up to 2021 L/ha of ethanol from seeds and up to 1802 L/ha from straw. Total ethanol output can reach 3823 L/ha (SE-7). Somaclonal line SE-7 with naturally downregulated ckx2 has outperformed by potential ethanol yield parental line by at least 33.4%.

Presenter: **Rostislav BLUME, Institute of Food Biotechnology and Genomics of Natl Academy of Sciences of Ukraine, Kyiv, UKRAINE**

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Session reference: 1DV.5.12
Subtopic: 1.3 Biomass Crops and Energy Grasses
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Effetts of Irrigation, Fertilization and Mechanical Harvesting on Yield Performances of Peanut (Arachis Hypogaea L.) Grown in Southern Italy

Short introductive summary:

The peanut (Arachis hypogaea) is an annual species of the legume family suitable for the hot and dry climate and loose soils. Although peanuts have been grown for over a century, currently in Italy the approximately 30,000 tons of seeds consumed each year, in the form of seeds or processed, are almost entirely imported. The aim of the research is to evaluate the possibility of reintroducing peanut cultivation in southern Italy, estimating the efficiency and adaptability of the potato-digger, already present in the experimental farm, in order to redevelop the marginal areas of southern Italy, minimize competition for the soil with traditional typical food crops and reduce costs, avoiding the purchase of the digger-inverter.

Presenter: **Rossella PISCOPO, University of Naples Federico II, Agriculture Dpt., Napoli, ITALY**

Presenter's biography:

Currently ph.D. student in Sustainable Agricultural, Forestry Systems and Food Security at the University of Naples Federico II, working on the identification of sustainable cultivation systems for the production of biomass from energy and energy efficiency in agriculture

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Session reference: 1DV.5.13
Subtopic: 1.3 Biomass Crops and Energy Grasses
Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Production Potential of Hibiscus Cannabinus L. in Marginal Lands of Tropical Regions

Short introductive summary:

Marginal lands are considered unsuitable for agricultural production or with low potential for the production of food or non-food crops due to their physical, soil-climatic, environmental and/or economic constraints such as poor drainage, low soil moisture, acidity and alkalinity, susceptibility to erosion, soil nutrient content, heavy metal contamination, among others. Soils that have these characteristics can cause negative damage to the ecosystem in general, with a consequent impact on crop productivity and human health. The cultivation of crops that are tolerant to marginal soils, and that can provide a feedstock for bioenergy, biofuels or bioproducts, offers a double opportunity: land reclamation and the economical exploitation of the biomass being produced which may bring an additional income to farmers.

Presenter: **Berta Lúcia CUMBANE, FCT - Universidade Nova de Lisboa, Ciencias e Tecnologia da Biomassa Dpt., Almada - Caparica, PORTUGAL**

Presenter's biography:

Graduated in Agronomic Engineering from the Eduardo Mondlane University. I completed the Master degree in Natural Resource Management and Conservation at the Technical University of Lisbon and the professional degree in Geographic Information Systems at Geopoint Portugal

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Session reference:	1DV.5.14
Subtopic:	1.3 Biomass Crops and Energy Grasses
Topic:	1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Long-Term Field Trials on Camelina; a Valuable Novel Oilseed Crop for the Biobased Industry

Short introductive summary:

The research work presented in this abstract is part of COSMOS project (H2020) and was carried out in the period 2015-19.

Presenter: **Efthymia ALEXOPOULOU, CRES - Center for Renewable Energy Sources and Saving, Biomass Dpt., Pikermi Attikis, GREECE**

Presenter's biography:

She is an agriculture engineer grantuated from the Agricultural University in Athens (AUA) with PhD on the “Adaptability and biomass productivity of the non-food crop Kenaf in Greece”. She is responsible for Energy Crops Unit in Biomass Department of Center for Renewable Energy Sources.

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Session reference: 1DV.5.16

Subtopic: 1.3 Biomass Crops and Energy Grasses

Topic: 1. SUSTAINABLE RESOURCES FOR DECARBONISING THE ECONOMY

Characterization of Charcoal Production in a Brick Kiln: a Case Study in Portugal

Short introductive summary:

Charcoal has been used for diverse purposes since ancient times, including art products, chemical reactants, soil amendments, and, most notably, as fuel for food preparation. Charcoal has a mature and large market around the world; moreover, charcoal production generates jobs in many rural areas, contribute to well-balanced forest management, give an extra value to certain agroforestry residues. Despite this importance, charcoal is often overlooked in national plans for the energetic valorization of biomass, namely in European countries. In Portugal, charcoal production is common in the Southern part of the country, being a major economic activity. The production is carried out using permanent brick kilns. Considering that the information on this type of carbonization process in Portugal is scarce, but yet essential for the promotion and improvement of this activity, this study analyzed the operating conditions of a charcoal kiln during regular carbonization cycles, including kiln temperature and pressure, intake air flow-rates, and a general overview of the pyrolysis gas composition. The information obtained is essential for preventing this activity to vanish.

Presenter: **Felix Ricardo CHARVET, Universidade de Aveiro, Environment and Planning Dpt., Aveiro, PORTUGAL**

Presenter's biography:

Felix is a fellow researcher at the Aveiro University. He has been conducting research at the University of Aveiro. His investigation is focused on the thermochemical conversion of biomass and gaseous fuels and technological development in the field of pyrolysis.

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Session reference: 3DV.6.1
Subtopic: 3.1 Production of Thermally Treated Solid Fuels
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Pilot-Scale Torrefaction of Agricultural Biomasses for Application as Reducing Agent in Non-Ferrous Metallurgy

Short introductive summary:

The use of biomass in metallurgy can be a solution to decrease fossil-based CO2 emissions. There is a need for efficient technologies to produce biomass-based products to replace fossil-based coal used as reducing agent in the metallurgical industry. One promising technology is biomass torrefaction, a thermochemical process carried out between 200°C and 350°C under a default-oxygen atmosphere. The aim of the present work, within the framework of the European project DIGISER++, is to investigate the necessary pilot-scale torrefaction conditions for the production of biocoal with coal-like properties. To our knowledge, no work has investigated agricultural biomass for non-ferrous metallurgy applications. In this work, two agricultural biomasses were torrefied at pilot scale to target coal-like properties. These biomasses were severely torrefied for a short time under a N2-based atmosphere at the pilot-scale furnace Centorré (100-200 kg/h). According to results, both agricultural biomasses are suitable for the production of biocoal at pilot scale. The most performing torrefaction conditions correspond to severe temperature and short duration of torrefaction.

Presenter: **Elvira RODRíGUEZ ALONSO, CEA Grenoble, Grenoble, FRANCE**

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Session reference: 3DV.6.2

Subtopic: 3.1 Production of Thermally Treated Solid Fuels

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

The Effect of Potassium Carbonate Wood Impregnation on Torrefaction Kinetics

Short introductive summary:

This study employed a kinetic simulation filled with experimental results of thermogravimetric analysis (TGA)to describe the kinetics of torrefaction for Eucalyptus grandis wood impregnated with three different concentrations of potassium carbonate (K2CO3).

Presenter: **Edgar A. SILVEIRA, University of Brasilia, Mechanical Engineering Dpt., Brasília, BRAZIL**

Presenter's biography:

Professor at the Department of Mechanical Engineering, University of Brasilia. PhD in Mechanical Sciences from the University of Brasilia (Brazil) and in Fiber and Wood Sciences from the University of Lorraine (France)

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Subtopic: 3.1 Production of Thermally Treated Solid Fuels

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Potassium Impregnation Assessment of Mild Biomass Pyrolysis by Catalytic Torrefaction Severity Factor

Short introductive summary:

This study examines the potassium impregnation catalytic effect by applying the torrefaction catalytic effect index (TCEI) and the catalytic torrefaction severity factor (CTSF), two new indexes of torrefaction severity.

Presenter: **Edgar A. SILVEIRA, University of Brasilia, Mechanical Engineering Dpt., Brasília, BRAZIL**

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Session reference:	3DV.6.5
Subtopic:	3.1 Production of Thermally Treated Solid Fuels
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Production and Characterization of Biochar from Woody Biomasses under Different Pyrolysis Conditions

Short introductive summary:

Biocarbon is a promising alternative to substitute fossil reductants for reducing greenhouse gas emissions and increasing sustainability of the metallurgical industry. Biocarbon can be produced from a wide range of raw biomass materials and carbonization conditions. In the present work, spruce and birch wood chips were pyrolyzed in a fixed bed reactor under different pyrolysis conditions with continuous monitoring of gas products and collection of condensates. The studied woody biomasses were pyrolyzed under different conditions with change of pyrolysis temperature program (i.e., highest heating temperature and residence time), purge flow (i.e., with and without gas purging) and constraint of volatiles and tarry vapors in the reactor. The produced biocarbon samples were characterized by a combination of proximate analysis, elemental analysis and scanning electron microscopy. The results showed that production conditions, together with chemical and physical properties of feedstocks, determine yields and properties of product streams (biocarbon, gas and condensate) and energy efficiency of biocarbon production processes. Pyrolysis of birch wood with continuous purging of N

Presenter: **Liang WANG, SINTEF Energy Research, Thermal Energy Dpt., Trondheim, NORWAY**

Presenter's biography:

Liang Wang is a research scientist at SINTEF Energy Research in Trondheim Norway. His research focuses on thermal conversion and utilization of biomass and wastes for renewable energy and green fuel production and substainable metal prodcution processes.

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Session reference: 3DV.6.6
Subtopic: 3.1 Production of Thermally Treated Solid Fuels
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Ash Removal from Bamboo Fuel Using Methanol

Short introductive summary:

Bamboo can be a good fuel for co-firing biomass due to the fast growth rate, but due to the large potassium content in ash, its use has been restricted. In this study, methanol was used to extract potassium from bamboo so that clinker production from bamboo ash can be suppressed. Potassium removal rate was determined experimentally and expressed using exponential model successfully.

Presenter: **Yukihiko MATSUMURA, Hiroshima University, Graduate School of Advanced Science and Engineering, Higashi-Hiroshima, JAPAN**

Presenter's biography:

Mar. 1994 Ph.D. (Eng.) from Dept. of Chemical Energy Engineering, University of Tokyo
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Session reference: 3DV.6.7
Subtopic: 3.1 Production of Thermally Treated Solid Fuels
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Thermochemical Pathways Comparison for Municipal Lignocellulosic Waste as Biofuel

Short introductive summary:

The environmental problem related to landfill overload, caused by the irregular dumping of municipal solid waste, has been an issue in Brazil. Some pathways for these residues' conversion are the thermochemical processes. Syngas production by gasification and torrefaction solid fuel upgrade produces a significant increase in biofuel's calorific power. The present works aim to perform an energy assessment of the fuel potential contained in the municipal wood waste of Brazil's capital, comparing its application on gasification and combustion of torrefied product. Six lignocellulosic residues produced a unique blend. The feedstock was collected, ground separately, and mixed in proportions established by its representation within the Brasília's urban forest ecosystem. The aim is to compare the proposed biofuel viability by applying a numerical solver for gasification processes simulation with its burning after torrefaction treatment. Obtained results can improve municipal solid waste management besides generating heat from municipal facilities and the industrial sector.

Presenter: **Maurício SIMÕES SANTANNA, University of Brasília, Mechanical Engineer Dpt., Brasília, BRAZIL**

Presenter's biography:

I am a student of the masters degree program of University of Brasilia in Energy and Environment Lab from Mechanical Engineer Department. My work is about the production of a biofuel from the residues of pruning trees and the application on a gasifier software.

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Subtopic: 3.1 Production of Thermally Treated Solid Fuels

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Current Practices of Charcoal Production in Southern Portugal: a Case-Study on a Large Production Site

Short introductive summary:

Charcoal is one of the oldest and most important biofuels produced across Europe, specially used in metallurgy, with production sites and methods known for millenia, and playing an important role in shaping certain forests. Likewise, the Portuguese region of Alentejo is well known for its historical link with charcoal production, with an ongoing project addressing the current situation of this activity (charclean.web.ua.pt) revealing hundreds of kilns in operation. This indicates that charcoal production is a relevant - albeit almost unknown - branch of the Portuguese biomass sector that cannot be ignored in the context of an integrated and well-balanced biomass valorization system. In order to promote this activity within national/regional bioenergy planning, this work provides an update on the current charcoeling practices in Southern Portugal, as obtained during an extensive monitoring campaign in a large production site with more than 20 brick kilns in operation, incling the aspects related to the carbonization stage (kiln loading, firing, coaling, cooling and unloading), and remaing stages related to feedstock preparation and charcoal handling.

Presenter: **Felix Ricardo CHARVET, Universidade de Aveiro, Environment and Planning Dpt., Aveiro, PORTUGAL**

Presenter's biography:

Felix is a fellow researcher at the Aveiro University. He has been conducting research at the University of Aveiro. His investigation is focused on the thermochemical conversion of biomass and gaseous fuels and technological development in the field of pyrolysis.

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Subtopic:	3.1 Production of Thermally Treated Solid Fuels
Topic:	3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Torrefaction of Almond Shells and Olive Stones: Characterization as a Potential Reducing Agent for Metallurgical Industries

Short introductive summary:

Torrefaction of almond shells and olive stones biomasses, which are typically considered as agricultural wastes in the southern regions of European Union, were evaluated in this work for manufacturing reducing agent materials for metallurgical applications. Four different temperatures have been tested using the laboratory scale furnace: i) 250 °C; ii) 280 °C; iii) 300 °C; iv) 350 °C, with a residence time higher than 45 min, respectively. The raw and torrefied biomasses have been characterized using thermal-gravimetric, proximate, ultimate and calorific analyses. The carbon/oxygen ratio and the higher heating values were increased as a result of the torrefaction severities (from 20 MJ/kg of both raw biomasses to 30 MJ/kg at 350°C). The greater mass losses were evidently obtained at higher temperatures (67.35% and 65.04 % at 350 °C for almond shells and olive stones, respectively). The fixed carbon also increases with the torrefaction severity, being higher than 67 % w/w at 350 °C. The kinetic profiles were fitted using the pseudo-first order rate equation (PFORE), enhancing the up-scaling of the process for a larger bio-coal production.

Keywords: Almond shells, olive stones

Presenter: **Hary DEMEY, Commissariat à l’Energie Atomique et aux Energies Alternatives, CEA/DRT/LITEN/DTCH/SCPC/LRP Dpt., Grenoble, FRANCE**

Presenter's biography:

Hary Demey is a research engineer, working at the French Alternative Energies and Atomic Energy Commission (CEA). He has obtained his doctoral degree on chemical engineering processes at the Polytechnic University of Catalonia (UPC) –Spain, in which he has obtained the CUM LAUDE honorific mention.

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Session reference: 3DV.6.10
Subtopic: 3.1 Production of Thermally Treated Solid Fuels
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Evaluation of the Energy Potential of Red Mangrove Litter (Rhizophora Mangle) as Biofuel through Torrefaction

Short introductive summary:

In this work, the energy potential of red mangrove (Rhizophora mangle) litter from ¨ Estero Salado¨ , specifically or the banks of the “Malecón Universitario” located in the city of Guayaquil, Ecuador as densified and torrefied solid biofuel was evaluated. A pellet configuration in size of 6 mm in diameter and 80% dry mangrove litter and 20% binder material in composition, was made using a pellet machine followed by a torrefaction process carried out at 230 °C and finally burned in a combustion chamber for evaluation of the energy potential. The physicochemical characterization of the raw and torrefied pellets was performed taking as reference the ISO 17225-6: 2014 and ISO/TS 17225-8: 2016 standards. Results are in good agreement in terms of heating value, ash percentage, moisture, durability, and density in both cases. After torrefaction, an enhancement factor of 1.26 for heating value, decrease in diameter, length, and particle density of 6.16%, 7.44% and 12.57%, respectively is observed as well as, lower rate of mass loss during combustion at 300 °C and a considerable increase in hydrophobicity. It turns out that the red mangrove litter shows a high energy potential fo

Presenter: **Luis VELAZQUEZ-ARAQUE, University of Guayaquil, Chemical Engineering Dpt., Guayaquil, ECUADOR**

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Mechanical Engineer, National University of Tachira, Venezuela, 2003.
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Session reference: 3DV.6.11
Subtopic: 3.1 Production of Thermally Treated Solid Fuels
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

A Preliminary Study on Torrefaction Pretreatment of Hemp Stem for Waste-To-Energy Valorization of Woody Biomass from Flower Hemp Cultivation.

Short introductive summary:

Hemp cultivation gained an important role in recent years. Two major production chains can be defined, one dedicated to the cultivation of hemp for the production of fiber and wood and the other relating to the production of inflorescences for the market of derivative products containing cannabidiol, better known as CBD.
The problem that will be highlighted and addressed in this article is related to the enhancement of cannabis production waste for CBD. In particular, since flowers are the only useful part of crops dedicated to this purpose, to date the stems of plants are considered a difficult waste to exploit.
To solve the problem, the possibility of decreasing the mechanical properties of hemp fibers has to be investigated, so as to permit the transformation of this material into an economically sustainable fuel. It was therefore decided to pre-treat the stems of the plants with a torrefaction process, to sufficiently weaken the fibers to be mechanically treated.
In conclusion, a first estimate is defined of the minimum energy necessary for the roasting of the plant stems, sufficient to weaken the fibers to make the mechanical transformation of the stems of hemp plants i

Presenter: **Massimiliano PARENTI, University of Modena and Reggio Emilia, Engineering Dpt, Modena, ITALY**

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Session reference: 3DV.6.14
Subtopic: 3.1 Production of Thermally Treated Solid Fuels
Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Conversion Of Sugarcane Straw Into A Bio-Coal For Use As A Fuel And Reducing Agent In Iron Ore Direct Reduction Processes To Produce Sponge Iron

Short introductive summary:

Leaching, roasting and carbonization pre-treatments were applied to sugarcane straw residue in order to modify its physicochemical properties and transform it into a bio-coal. Straw was chopped and washed with tap water (20°C, soak 24 hours, stirring 30 minutes, concentration 6.67%). The washed straw was roasted at 270°C for 20 minutes in a reactor, at atmospheric pressure with limited oxygen. Then, the roasted material was charred at 600°C for 90 minutes. The bio-coal obtained has 66.54% of fixed carbon, 0.27% of sulfur, 34.33 MJ/kg of higher heating value (values measured on a dry basis), and O/C and H/C ratios of 0.08 and 0.49 respectively, resembling a mineral coal, with suitable characteristics for its use as a fuel and reducing agent in iron ore direct reduction processes to produce sponge iron. Furthermore, the product is friable, hydrophobic and resistant to biodegradation.

Presenter: **Estela ASSUREIRA, Pontificia Universidad Católica del Perú, Engineering Dpt., Lima, PERU**

Presenter's biography:

I am a Mechanical Engineer and Master of Science from the Pontificia Universidad Católica del Perú (PUCP). At PUCP I am a principal professor at the Engineering Department teaching Fluid Mechanics and Turbomachinery courses. Since 1981, I am a Director of Coal and Biomass Research Group.

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Session reference: 3DV.6.15

Subtopic: 3.6 Biorefineries

Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Biochar Production in the Superheated Steam Torrefaction Process for Ornamentl Plant Cultivation

Short introductive summary:

Torrefaction is a thermal process used for exactly that purpose. It concerns thermal degradation of biomass in temperatures of between 200 and 350°C. Important part of the process is very thorough control over parameters such as humidity, heating value or abrasion resistance which helps to determine final biomass quality. Our research focuses on maximizing the quality of torrefied biomass using the best possible combination for various parameters, aiming to obtain biochar to be used as an additive to fertilizers for ornamental plant cultivation The main goal is to present obtained parameters and other information obtained from four new biomass: Jerusalem artichoke stalks, spruce wood chips, chokeberry bushes and lavender bushes in order to select an innovative technique of torrefied biomass. The tests will be carried out at a temperature of 300 – 350 °C, aiming to produce the best quality new bio-products using superheated steam. Until 2021, no other team of scientists has undertaken research on these types of biomass in terms of their impact on the cultivation of ornamental plants

Presenter: **Wiktoria LEWANDOWSKA, Politechnika Lódzka, Wydzial Inzynierii Procesowej i Ochrony Srodowiska, Lódz, POLAND**

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Topic: 3. BIOMASS CONVERSION TO INTERMEDIATE BIOENERGY CARRIERS, SUSTAINABLE BIOFUELS AND BIO-BASED PRODUCTS

Biogas - Global Challenges, Markets and Cooperation Opportunities

Short introductive summary:

Decreasing electric energy incentives for biogas technologies challenge the energy sector in many countries. There is a large amount of excess biomass and biowaste that could be transformed into heat, power and fuel. Agricultural residues and waste as well as organic urban waste often poses environmental and financial problems in countries in the global south that can be reduced by using these resources for biogas production. Therefore, adapted technologies are needed to increase revenues and benefits from energy services, organic waste treatment, digestate, and negative carbon emissions.
DiBiCoo is funded under the EU Horizon 2020 programme (Contract No. 857804) and supports the biogas and biomethane industry by preparing markets for the export of sustainable biogas and biomethane technologies from Europe to importing countries, more specifically Ghana, Indonesia, Ethiopia, Argentina and South Africa, to exploit their biogas potential. This is achieved by the development and application of an innovative digital matchmaking tool, capacity building activities and the preparation of demo cases up to the investment stage in all five importing countries.

Presenter: **Felix COLMOGREN, WIP Renewable Energies, Munich, GERMANY**

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Session reference: IDV.7.1
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Sustainable Land, Livelihoods and Energy Initiative- Serbia: Restoration of Degraded Land at Scale Using Short Rotation Wood Biomass Plantations (SRPs) in Pursuit of Clean Energy, Bioeconomic Growth and Other SDGs

Short introductive summary:

The Sustainable Land, Livelihoods, and Energy Initiative--Serbia is an Austrian Development Agency-funded project to scale up bankable short rotation bioenergy plantations for heat and power on degraded land in Serbia, with implementation based on science-based best practices in partnership with CIFOR-ICRAF (World Agroforestry) to support sustainable development and bioeconomic innovation along with green house gas and smog mitigation, climate resilience, land restoration, and biodiversity in a holistic approach with baseline metrics and protocols for replicability. A related finance mechanism, the Sustainable Serbia Finance Facility, is under development to facilitate private investment and growth to scale.

Presenter: **Bonnie NORMAN, E3 International, Bethesda, USA**

Presenter's biography:

As President of E3 International, Ms. Norman leads its global team in creating value for our clients and a more sustainable and resilient world. She is a recognized international expert on green investment banking. Formerly a corporate real estate executive, she has an MBA from Harvard University.

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Session reference: IDV.7.2
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Alternative Feedstocks to Promote Bio-based and Circular Economy in Industrial Intensive Sectors: the RETROFEED Project Approach

Short introductive summary:

Circular economy involves keeping materials in use for as long as possible through actions such as recycling and reuse. The RETROFEED project will contribute to this practice through retrofitting the core equipment of energy intensive industries and incorporating innovative monitoring and control systems to provide support to plant operators in the decision-making process while managing the production facilities, through a Decision Support System (DSS). These actions are attempted at enabling the use of alternative feedstocks promoting bio-based and circular concepts in five different sectors: ceramic, cement, aluminum, steel and agrochemicals.

Successful incorporation of alternative materials is contingent upon their market availability and competitive pricing. A detailed study has been performed to analyse the feasibility of adoption of the bio-based and recycled alternatives, where applicable, for each industrial partner, considering both supply/demand trends and specific process requirements. Internal wastes as potential sources of revenue or materials reclamation have also been scrutinised to fully realize the benefits of a circular economy.

Presenter: **Sebastián ZAPATA, Circe Fundation, Fuente Obejuna, SPAIN**

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Session reference: IDV.7.3
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

RES4LIVE Project: Energy Smart Livestock Farming towards Zero Fossil Fuel Consumption

Short introductive summary:

The H2020 RES4LIVE project: "Energy Smart Livestock Farming towards Zero Fossil Fuel Consumption" will be a first attempt for 100% replacement of the fossil fuel consumption of the industrial livestock farming sector with the aid of cost-effective RES technologies. The adaptation of RES technologies and machinery, and their demonstration at a large-scale on farm level, require supporting measures with respect to spatial planning, infrastructure, different business models and market organization, trends that are not all under control from a farmers' perspective.

Presenter: **Dimitrios TYRIS, Agricultural University of Athens, Athens, GREECE**

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Session reference: IDV.7.4
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

BIOFIT Case Studies - How to Adapt Existing Industrial Facilities

Short introductive summary:

The BIOFIT project (www.biofit-h2020.eu) is a HORIZON2020 initiative that aims to facilitate the introduction of bioenergy retrofitting in five specific industries, namely first-generation biofuels, pulp and paper, fossil refineries, fossil firing power and Combined Heat and Power (CHP) plants. Within the project 10 case studies for retrofitting existing facilities have been studied in detail. The case study assessments cover most of the options for integrating biomass into existing industrial facilities, promising an easy to implement route to rolling out these technologies and making a significant impact on GHG emissions in the near term. We will present highlights from these case studies, describe challenges that we have encountered and lessons learned about how existing industries can be adapted to use more biomass and produce more bioenergy and biofuels.

Presenter: **Dina BACOVSKY, BEST - Bioenergy and Sustainable Technologies, Sustainable Supply and Value Chains, Wieselburg-Land, AUSTRIA**

Presenter's biography:

Dina Bacovsky graduated from Vienna University of Technology with a Degree in Process Engineering. She is Head of the Unit Biofuels at BIOENERGY 2020+. She is active in two IEA Technology Collaboration Programmes (TCPs): Advanced Motor Fuels TCP and Bioenergy TCP, and in ETIP Bioenergy.

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Session reference:	IDV.7.5
Subtopic:	6.1 Advances in Large Scale Gasification
Topic:	6. INDUSTRY TRACK

Progress in the Transition Towards a Biobased Economy and New Biobased Business Cases: the Vanguard Initiative Bioeconomy Pilot

Short introductive summary:

The Vanguard Initiative new growth through smart specialisation is driven by a political commitment made by regions to use their smart specialisation strategy to boost new growth through bottom-up entrepreneurial innovation and industrial renewal in European priority areas. The Vanguard Initiative seeks to lead by example in developing interregional cooperation and multi-level governance for supporting clusters and regional eco-systems to focus on smart specialisations in priority areas for transforming and emerging industries. Within Vanguard, the Bioeconomy Pilot aims at supporting the deployment of high TRL technologies, through the setting up of transregional value chains in an industry-driven process, where public support comes into play to help bridging the valley of death. We have mandate to facilitate networking and access to competence and funding through European Regions. We operate along four main Demo Cases: Lignocellulosic Biorefineries, Bioaromatics, Biopolymers and Liquified Biomethane.

Presenter: **Maurizio BETTIGA, Lombardy Green Chemistry Association, Milan, ITALY**

Presenter's biography:

Maurizio Bettiga, PhD in Industrial Biotechnology, is Senior Researcher Chalmers University and founder of the bioeconomy and circular economy consultancy firm "EviKrets Biobased Processes Consultants". At EUBCE 2020 he represents the Vanguard Initiative Bioeconomy Pilot.

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Session reference: IDV.7.7
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Towards the Decarbonisation of the Energy Intensive Sector: Presenting RE4Industry Project

Short introductive summary:

The EU has started a progressive decarbonisation with the aim to become carbon neutral by 2050. Energy Intensive Industries (EII) are expected to play an important role in this transition as they represent almost a quarter of the final energy consumption, but a clear long-term vision and strategy is required in order to remain competitive while contributing to the decarbonization targets of the EU. The H2020 project RE4Industry, officially launched on 14th September 2020, will be working in the following 36 months on determining the most suitable, economically and technologically feasible renewable solutions for EIIs in the short-term (2030) and long-term (2050) visions, together with the definition of an action plan for industrial decarbonisation pointing at transforming the EU industrial landscape into a large market niche for the uptake of RE.

Presenter: **Clara JARAUTA-CÓRDOBA, CIRCE - Centre for Energy Resources and Consumption, Zaragoza, SPAIN**

Presenter's biography:

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Session reference: IDV.7.8
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

LMT Process: A Revolutionary Approach Improving the Feasibility of M2E Business

Short introductive summary:

A new alternative method presented here-called as Livestock Manure Treatment(LMT) process – can handle both problems at considerably low cost. It is a simple mixture process controlling the moisture content level of manure slurries during each stage of the process and mixing ratio of three components - raw manure slurries, patented assorted feed containing chemical compound, and sawdust. Through laboratory experiment and field test it is found that NH3 is reduced to 0 ppm within 5 to 20 minutes depending on the type of livestock manure after the mixture of three components. In addition, nearly 80% moisture content of manure level drops naturally to less than 30% in average within 20 days after the mix with no additional cost, and no emission of harmful gases as well. Through a simulation analysis with 10-year operation of a hypothetical factory setting, it is found M2E business with LMT process can increase IRR significantly compared to the business without LMT process.

Presenter: **Hyun Gyu KIM, Kongju National University, Business Administration Dpt., Kongju, REPUBLIC OF KOREA**

Presenter's biography:

I am a professor at Kongju National University in Korea.

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Session reference: IDV.7.10

Subtopic: 6.1 Advances in Large Scale Gasification

Topic: 6. INDUSTRY TRACK

Bioenergy Retrofitting in Europe's Industry - BIOFIT Results

Short introductive summary:

The BIOFIT project (www.biofit-h2020.eu) is a HORIZON2020 initiative that aims to facilitate the introduction of bioenergy retrofitting in five specific industries, namely first-generation biofuels, pulp and paper, fossil refineries, fossil firing power and Combined Heat and Power (CHP) plants.

Spurred by innovation, bioenergy technologies are becoming more advanced and diverse, leading to the production of a variety of advanced transport fuels (first- and second-generation bioethanol, biodiesel and bio-kerosene), intermediate bioenergy carriers and high efficiency, low carbon emission production of power, heating and cooling. Besides erecting entirely new bioenergy plants, retrofitting existing facilities, meaning the replacement of part of a plant or installation with state-of-the-art equipment, can be a good alternative solution to replace fossil fuels or to upgrade outdated renewable technology. Retrofitting often results in lower capital expenditure (CAPEX), shorter lead times, faster implementation, lower production time losses and risks. The BIOFIT project is now nearing its end, and key results can be presented.

Presenter: **Patrick REUMERMAN, BTG Biomass Technology Group, Enschede, THE NETHERLANDS**

Presenter's biography:

Senior consultant Biomass and Bioenergy, with more than 20 years of experience. Main fields of interest are combustion, anaerobic digestion, biodiesel production and carbonisation. Broad knowledge of conversion technologies for biomass and waste.

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Session reference: IDV.7.11
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Logistics and Feasibility of an International Fast Pyrolysis Bio-Oil Supply Chain - a Case Study of the MUSIC Project (HORIZON 2020)

Short introductive summary:

Intermediate bioenergy carriers (IBC) are formed when biomass is processed to energetically denser, storable and transportable intermediary products analogous to coal, oil and gaseous fossil energy carriers. IBCs can be further refined to final bioenergy or bio-based products or directly used for heat and power generation. Fast Pyrolysis Bio-Oil (FPBO) is a liquid IBC that is derived from solid biomass residues by rapid heating of biomass in absence of oxygen. In Europe, the first plants producing pyrolysis oil on commercial scale started operation, or are under construction, in The Netherlands, Finland and Sweden.

In a recent EU-sponsored study the logistics and the techno-economic feasibility of a long-distance supply chain scenario comprising decentralized production of FPBO in Sweden/Finland, transport of FPBO to a Dutch seaport, and centralised upgrading of FPBO to an advanced drop-in marine transport fuel was investigated. As part of the exercise a logistics optimization model was also developed. First results indicate that the investigated supply chain is economically viable, and that there seem to be no insurmountable showstoppers.

Presenter: **Patrick REUMERMAN, BTG Biomass Technology Group, Enschede, THE NETHERLANDS**

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Session reference: IDV.7.12
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Market Uptake Support for Intermediate Bioenergy Carriers - The MUSIC project (HORIZON 2020)

Short introductive summary:

The MUSIC project (www.music-h2020.eu) is a HORIZON2020 initiative that aims to facilitate market uptake of intermediate bioenergy carriers by developing feedstock mobilisation strategies, improved logistics and IBC trade centres. The papers introduces the key activities of the MUSIC project as well as early project results, which include: a first series of detailed value chain assessment case studies; GIS-based biomass mobilisation tools to assess (current and future) biomass availability and cost in the case study regions; the smartphone app BINTER that supports biomass trading in Greece; assessments of IBC technologies, market developments and the EU and national legislative framework; a first summary paper for policy makers.

Presenter: **Patrick REUMERMAN, BTG Biomass Technology Group, Enschede, THE NETHERLANDS**

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Session reference: IDV.7.13
Subtopic: 6.1 Advances in Large Scale Gasification
Topic: 6. INDUSTRY TRACK

Horizon Europe – Actions for bioenergy, biofuels, and renewable fuels

Monday 26 April, 12:15 - 14:00

Short introductive summary:

This information event Workshop is organised by the Clean Energy Transition Unit of the European Commission's General Directorate of Research and Innovation/Clean Planet Directorate.

The event will aim at informing on the Horizon Europe Programme and in particular on actions related to biomass. It will include a presentation on Horizon Europe European Partnerships targeting on clean energy and mobility. These are the European Partnerships on Clean Energy Transition, Zero-emissions Waterborne Transport and Clean Aviation Joint Undertaking. The programme will focus on global challenges and in particular on cluster 5, Climate, Energy and Mobility, presenting the actions for Sustainable, Secure and Competitive Energy Supply. A presentation and discussion regarding actions for bioenergy, biofuels and renewable fuels planned under the work programme of 2021-2022 will take place.

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Advances in Bio-fossil fuels
Marchand Phillipe, Former Total (France), France