Central European Biomass Conference

15th to 18th January 2014, Graz, Austria

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Torrefaction: Scenarios for biomass-to-end-use chains for the investigation of the diffusion into European energy markets

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This work will illustrate the methodological approach and selected results of scenario calculations for biomass-to-end-use chains with torrefied biomass (TBM). Economic feasibility and environmental sustainability are key issues of modern biomass utilisation in particular regarding the transition to a future low carbon economy. New preparation technologies have to be critically examined and diffusion potentials under different market conditions need to be investigated to derive solid recommendations for stakeholder and policy makers. Therefore it is important to consider their impact on the possible future energy supply structure. The basis for the development of scenarios is a set of clearly differing and consistent storylines. Within this work various biomass-to-end-use chains and their development in different scenarios are shown. The results presented in this work have been developed within the European research project SECTOR (Solid Sustainable Energy Carriers from Biomass by Means of Torrefaction), funded under the 7th framework programme.

A biomass-to-end-use chain simulation tool (BioChainS) was developed which is capable of assessing the high number of production and utilisation pathways based on torrefaction that could become relevant in the near future. The statistical programming environment of R (RStudio, 2012) was used to connect the different parts of the model. The first part mainly consists of the cost summation of biomass supply including the purchase of the feedstock, its preparation to a high-energy dense solid biofuel, its consumption (e.g. combustion) at the end user and every single transportation step that occurs within this biomass-to-end-use chain. The chain links are allowed to form all possible combinations as long as no linkage restriction is violated. Technological and economic data of the solid biofuel preparation steps, the consumption and handling properties and physical properties of the feedstock were obtained from the experimental research of the SECTOR-project. Regional costs of feedstocks, labour, fossil fuel, electricity, interest rates and taxes were gathered in extensive literature researche and from internal sources.

For the second part, the deployment scenario simulation, exogenous scenario data was defined following four main storylines. Based on a discussion during an expert workshop held within the project, we identified the following main aspects to be modified for different deployment scenarios: Biomass availability, demand for (torrefied) biomass and technological development. All these dimensions may be strongly affected by policies, which therefore form a higher-level aspect to be discussed separately. Using these dimensions, four main storylines were drawn to facilitate the quantification of the model input data as well as the discussion. These storylines will form the main paths of the different deployment scenarios of torrefied biomass and the torrefaction technology in this work.

The main outputs of BioChainS are comparative chain assessments and deployment scenarios for torrefied biomass in the time range between 2020 and 2030. A large range of production and utilisation pathways based on torrefaction, that could become relevant in the near future are addressed and their biomass-to-end-use chains are evaluated in terms of socio-economics and GHG-emissions. Cost-efficient and environmental sound deployment strategies for torrefied biomass under different framework conditions are outlined in the paper. Further work within the SECTOR-project will extend selected examples of the comparative biomass-to-end-use chain assessment with a full environmental assessment and overall conclusions and recommendations for stakeholders, policy makers and international sustainability forums will be derived.