BioBoost for Biofuels

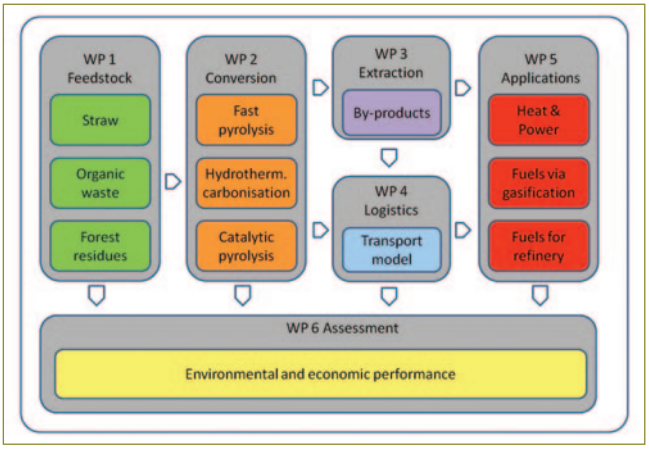
Substantial improvements have been made towards increasing the efficiency of biofuels production, as Nicolaus Dahmen and Ralph Stahl of the Karlsruhe Institute of Technology explain

TO increase the share of biomass for renewable energy in Europe, conversion pathways which are economic, flexible in feedstock and energy efficient are needed. The BioBoost project aims at making a substantial improvement towards increasing the efficiency of the use of biomass and organic residues in the future. The project focuses on de-central conversion of biomass to optimised, high energy density carriers, which can be utilised either directly in small scale combined heat and power (CHP) plants or in large scale applications for the synthesis of transportation fuel and chemicals.

Mainly dry as well as wet residual biomass and wastes are used as feedstock for conversion. Due to their secondary nature, these feedstocks have the potential for high environmental sustainability, and in the case of straw, it may even strengthen food production rather than competing against it.

However, perennial, ligno-cellulosic energy crops and forest residues are included as a possibility to compensate the seasonal occurrence of, for example, straw. These types of biomass are converted by means of fuel-flexible thermo-chemical processes such as fast pyrolysis, catalytic pyrolysis and hydrothermal carbonisation (HTC) to produce stable intermediate energy carriers in form of bio-oil, -coal or -slurry. These can be utilised separately or in different combinations. Based on straw, as an example, the energy density can be increased by a factor of 10 to 15, enabling economic long range transportation of the intermediates produced in regionally distributed conversion plants to supply central large scale gasification plants for biofuel production.

For demonstration, the BioBoost project has access to the first-of-its-kind bioliq-pilot plant for synthetic fuels production from biomass. Improvements can be achieved by catalytic pyrolysis,

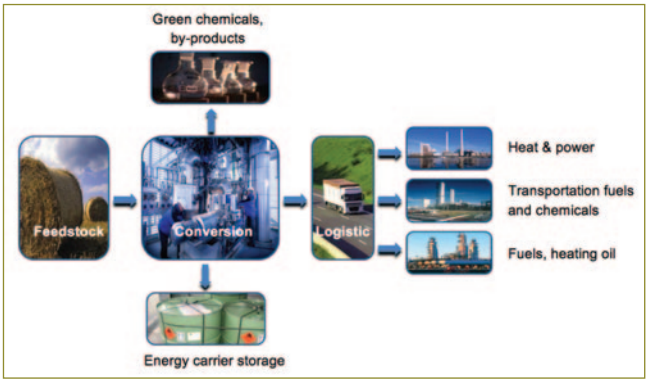


Work package scheme

which reduces oxygenates in the oil enabling power and refinery applications. With a catalyst producer, a variety of catalysts are tested in regard to identify the most efficient ones. The fast pyrolysis and HTC processes available in demo-size are optimised towards feedstock flexibility, product yield and quality.

A logistic model for feedstock supply and interrelation of de-central with central conversion scenarios with different types of energy carriers is set up and validated allowing the determination of costs, the number and location of de-central and central sites. A techno-economic and environmental assessment of the value chains supports the optimisation of products and allows for comparison of the processes under consideration and to other conversion routes. The application of energy carriers is investigated in existing and coming applications of heat and power production, synthetic fuels and chemicals and as bio-crude for refineries. Promising pathways are demonstrated over the whole chain.

AVACO2's demo plant for hydrothermal carbonisation



Project materials diagram

Project profile

Project Acronym: BioBoost (Biomass based energy intermediates Boosting biofuel production), a European collaborative FP7 project funded under contract 282873;

Call theme: ENERGY.2011.3.7-1: Development of new or improved sustainable bio-energy carriers;

Start: 01/2012, duration: 42 months;

Budget: €7.3m, funding: €5.1m;

Co-ordinator: Karlsruhe Institute of Technology (KIT)

Partners: 13 Partners from six member countries representing the chemical industry, energy suppliers and research companies and institutions.

KIT's bioliq pilot plant

A market implementation scheme of ramping up energy carrier production and subsequent phase-in of large scale gasification is developed regarding optimal technical and economic performance. Thirteen partners from industry, universities and other research institutions take part in the collaborative project, contributing to seven work packages:

Work Package 1 focuses on the technical and economical feedstock potential investigated by GIS tools based on spatial and statistical data. The determination of feedstock costs and the selection of the optimum conversion plant sites is based on transportation models including their year round feedstock supply. A GEO-portal is developed to present and display the GIS data;

WP 2 is dedicated to the biomass conversion processes fast pyrolysis, catalytic pyrolysis and hydrothermal carbonisation. Feedstock is sourced and feeding to the process plants is tested. The conversion products are characterised and the optimum energy carrier identified;

WP 3 investigates the recovery of high value chemical by-products and nutrients from the intermediate products of each process;

WP 4 sets up an holistic transportation model taking into account data from biomass supply, de-central energy carrier production and central utilisation installations. Special attention is paid to techno/economic properties and sustainability aspects, CO_2 footprint, safety aspects and risk analysis of the transport and logistics chain;

WP 5 is dedicated to the application of the energy carriers in de-central state-of-the-art and new energy systems for heat and power supply. In addition, the potential use as refinery feed is considered. In regard to supply large scale gasification plants for synthesis of fuels and chemicals, special attention is paid to the ramping-up phase;

WP 6 performs the technical, economical, environmental and social assessment including chain assessment, sensitivity and scenario analysis and a Life Cycle Assessment according to ISO 14040. The pathway scenarios are compared to each other, to the fossil pathways and the gasification of the energy carrier with synthesis to transportation fuels; and

WP 7 is dedicated to the dissemination of the results (e.g. in workshops, dissemination of the results and the concept to a wider community).

BioBoost

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