Energy carriers: Intermediates to boost biofuel production?

The recently finished BioBoost project investigated processes for local biomass pretreatment to a transportable bioenergy carrier and central upgrading to biofuel and power.

Biofuels produced from residues via the thermochemical pathway often apply two conversion steps: a low temperature pretreatment like pyrolysis or torrefaction and a high temperature step as e.g. gasification followed by fuel synthesis. The latter conversion units are known to be most economical for large capacities. However as large plant capacities require large amounts of feedstock the transportation distance becomes long and overall efficiency low.

The BioBoost project modeled pathways which split the conversion process in two parts at different locations: A decentral small scale pretreatment of residues like pyrolysis or carbonisation to efficiently transportable energy carriers and upgrading transportation fuels or power in existing or new built central plants. Biomasses like straw, forest residues and organic municipal waste have a low energy density and would be transported only over short distances, while the high energy density intermediate from the decentral plant would be efficiently transported by rail to central fuel conversion facilities.

The regional (NUTS3) availability of a large variety of different agricultural and forestry residues was assessed and investigated in fuel and power production chains. These included fast pyrolysis, catalytic pyrolysis and hydrothermal cabonisation as pretreatment steps, the transport of respective high energy intermediates and fuel or power production in synfuel plants, refineries or power plants. A sophisticated model was build which allows the comparison of conversion options of the feedstock, the best places and capacities for plants to be built and to determine costs and GHG avoidance for each location but also for scenarios on European level.

BioBoost demonstrated that modeling complete value chains – from locally available feedstock to transportation fuel plants is possible and gains deep insight into the properties determining the fuel cost. Whereas most models in the past worked with a fixed feedstock collection radius to determine feedstock cost free plant the BioBoost model identified most preferable locations in Europe to built decentral pretreatment plants with cost optimized amounts of gathered feedstock. High energy density intermediates like catalytic pyrolysis oil with low oxygen content or biosyncrude from fast pyrolysis could be transported over large distance to todays refineries with spare capacities of hydrogen for hydrotreatment of the oils to transportation fuels.

The economic disadvantages of smaller scale decentral pretreatment plants in terms of energy efficiency and investment cost can be compensated by savings in transport

and optimized logistics as well as by the ability to transport to existing large scale conversion facilities for fossil fuels. Scenarios were modeled for achieving a certain GHG avoidance by such fuels, determine costs of producing the first 5 million tons and a capacity ramping up scenario to maximum sustainable production capacity on European scale.

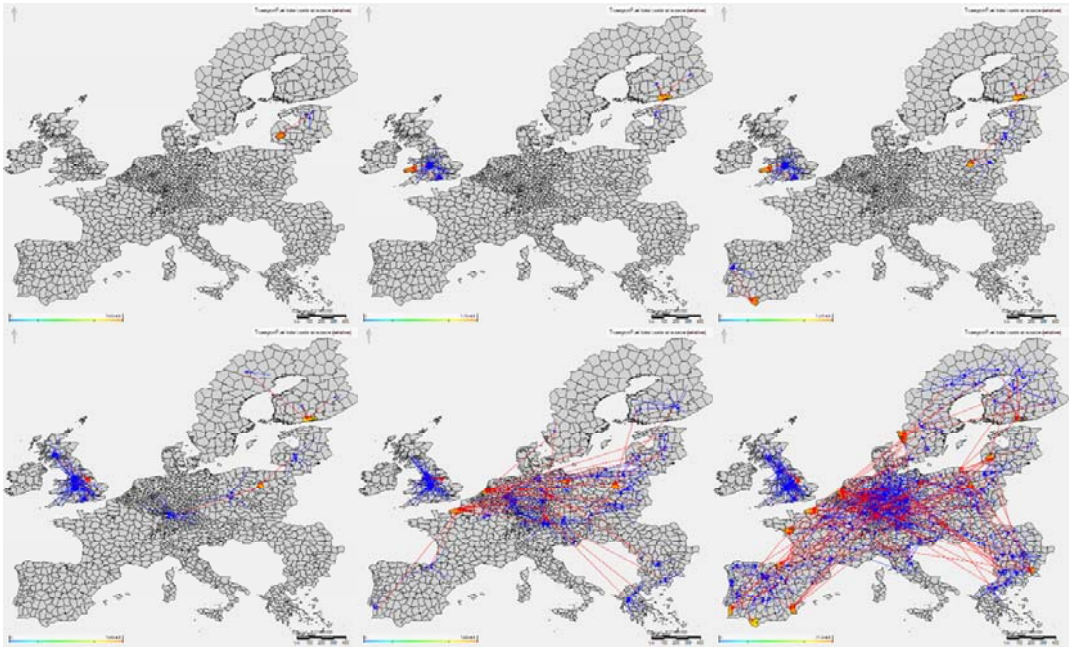

Figure Successive Ramping Up

BioBoost Energy intermediates boosting biofuel production

Coordinated by the Karlsruhe Institute of Technology (KIT)

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www.BioBoost.eu

The BioBoost film can be downloaded on www.BioBoost.eu.