ENHANCED BIOMASS TO ENERGY CONVERSION

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Biomass has the potential to play a significant role in the world energy scenarios due to its abundance and to the neutral contribution to the CO_2 balance when it is used as fuel.

Biomass energy content can be exploited through the direct combustion of the biomass or through the preliminary conversion of the biomass into solid, liquid and gaseous fuels followed by the combustion process. Different thermo-chemical processes can be used to produce fuels from biomass, e.g. pyrolysis, gasification, Fischer-Tropsch synthesis.

Pyrolysis is a thermo-chemical process in which organic material is decomposed in absence of oxygen in a solid residue (i.e. char), in a liquid product (i.e. pyro-oil) and in a gaseous phase. Due to the higher density of solid and liquid products, pyrolysis can be considered a densification process, which is supposed to decrease the transport burdens from the field to the final use of the bio-fuels. In particular slow pyrolysis allows for the production of similar amounts of liquid, solid and gaseous fractions. Light gases could supply the heat needed in the process.

The present activity is oriented to the analysis of biomass to energy routes based on pyrolysis processes. The experimental characterization of the pyrolysis process is carried out for different biomass species, in order to understand the yield and composition of the different product fractions, and in particular of bio-oil. Specific aspect as the thermal requirements of the pyrolysis process are also investigated.

In the perspective of bio-oil recovery, manipulation and upgrading, a further aim of the activity is the exploration of the hazard footprint of bio-oils.

Finally, the sustainability of bio-energy systems based on the pyrolysis process and their compatibility with the territory still is assessed based both on reference and experimental data produced in the activity. Conventional Life Cycle Assessment (LCA) methodology as well as advanced methodologies for sustainability assessment are further developed and applied to the assessment of the biomass to energy supply and conversion chain.

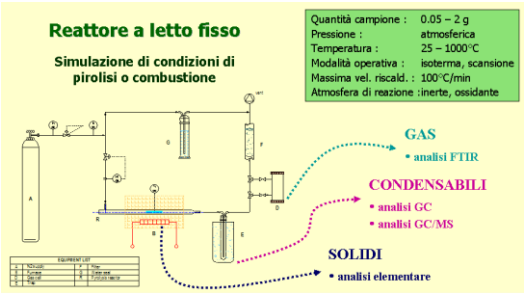

Fig.1 Fixed bed reactor for experimental characterization of feedstock

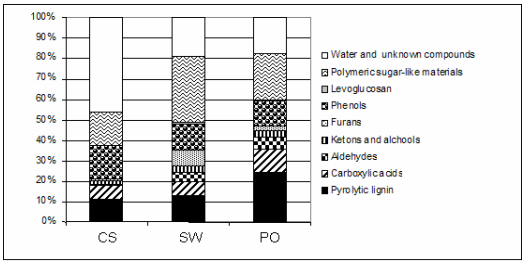

Fig.2 Example of pyrolysis products from different biomass types.

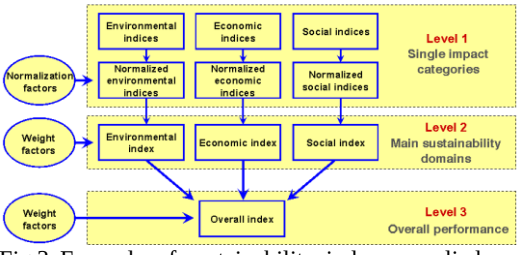

Fig.3 Example of sustainability indexes applied to supply chains.

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RESEARCH PROJECTS

Asse 1 PON-FESR 2007-2013. Attività I.1.1 Creazione di Tecnopoli - CIRI Energia ed Ambiente - UO Bioenergia

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