Circular Business Model based on biofuels production from organic waste

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bioren Advanced biofuels research project

The management of refused derived fuels (RDF) in the light of development of circular economy seems to be very important issue. Currently the RDF fraction is mainly landfilled or incinerated. The solution changing this situation for the waste management hierarchy can be the BioRen project funded by H2020 (grant no. 818310). It is a part of a holistic municipal waste management center RenaSci located in Belgium based on recycling of different waste fraction previously sorted. The implementation of BioRen project assumes processing of the residual organic wastes of non-recyclable RDF fraction into second generation biofuels. It concerns the enzymatic treatment process (saccharification and anaerobic fermentation) into bioethanol, isobutanol and glycerol tert-butyl ether (GTBE). Residues received in this process are transformed into biocoal in hydrothermal carbonization process (HTC). The aim of BioRen project is to close the loop of waste management and to increase the economic and environmental efficiency of a whole value chain converting organic wastes into biofuels.

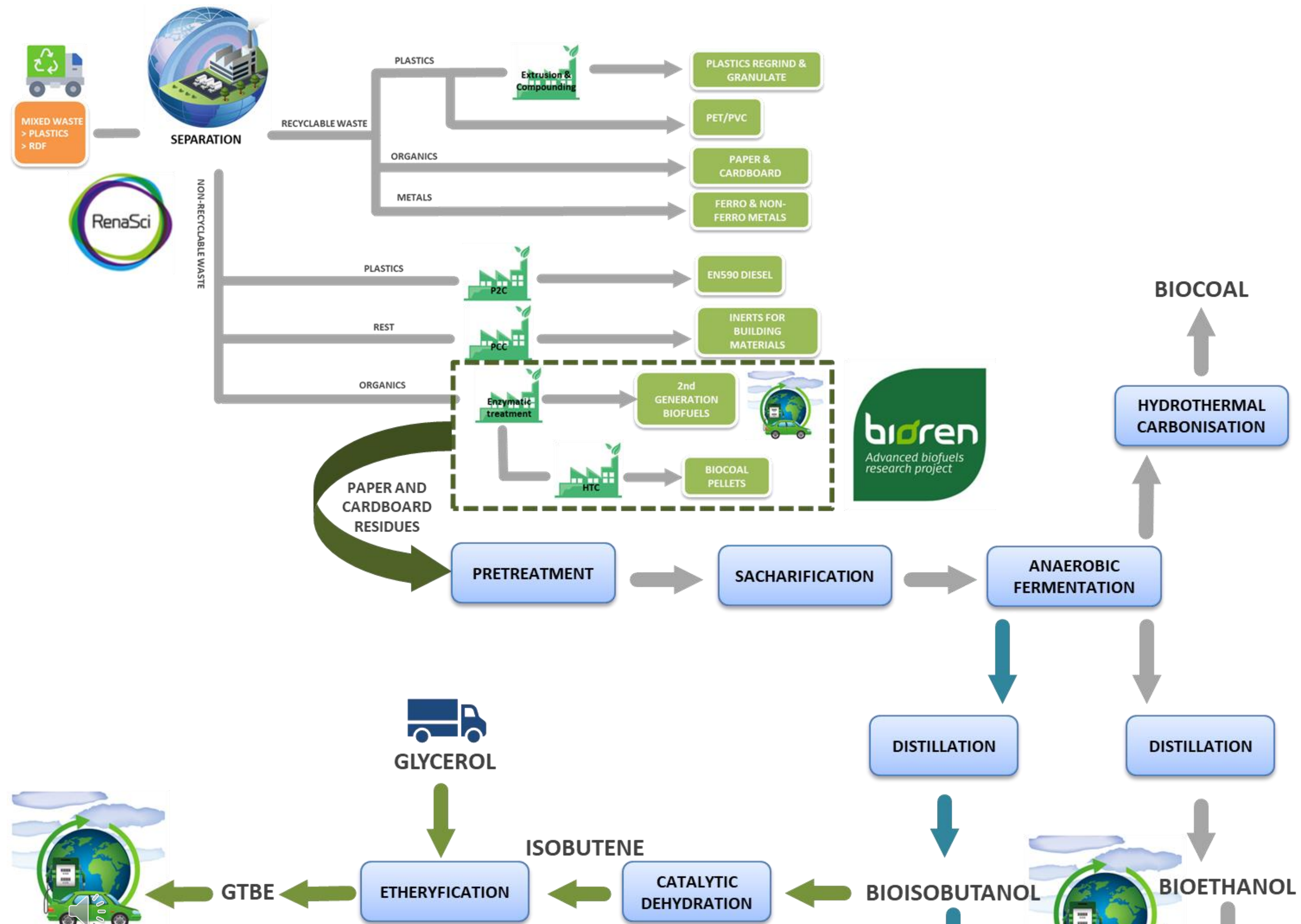

Fig. 1. the Renasci and the Bioren project scheme

INPUTS		
paper residues	35 000	t
pulp (from paper)	22 050	t
heat/steam	69 448	t
electricity	17 192 000	kWh
water	174 195	t
enzymes	160	kg
yeasts	5	t
glycerol	1 248.5	t
urea	6.75	t
NaOH	325.60	t

OUTPUTS		
ethanol	2 430	t
GTBE	2 497	t
biocoal	3 470	t
isobutanol	1 736	t
sludge post HTC	5 255	t
rejects after pretreatment	12 950	t
ENERGY USE		
Pre-treatment	9 192 000	kWh
Enzymatic treatment	4 000 000	kWh
Others	4 000 000	kWh

Fig. 2. Non-recyclable RDF fraction

The analysis was conducted based on literature and empirical data in regard to the level of advancement of the project. The system boundaries include processes from waste sorting and transportation, pretreatment, enzymatic pretreatment, distillation and hydrothermal carbonization of biomass residues. The functional unit was defined as one litre of chosen biofuel produced from OFMSW depending on the synthesis path.

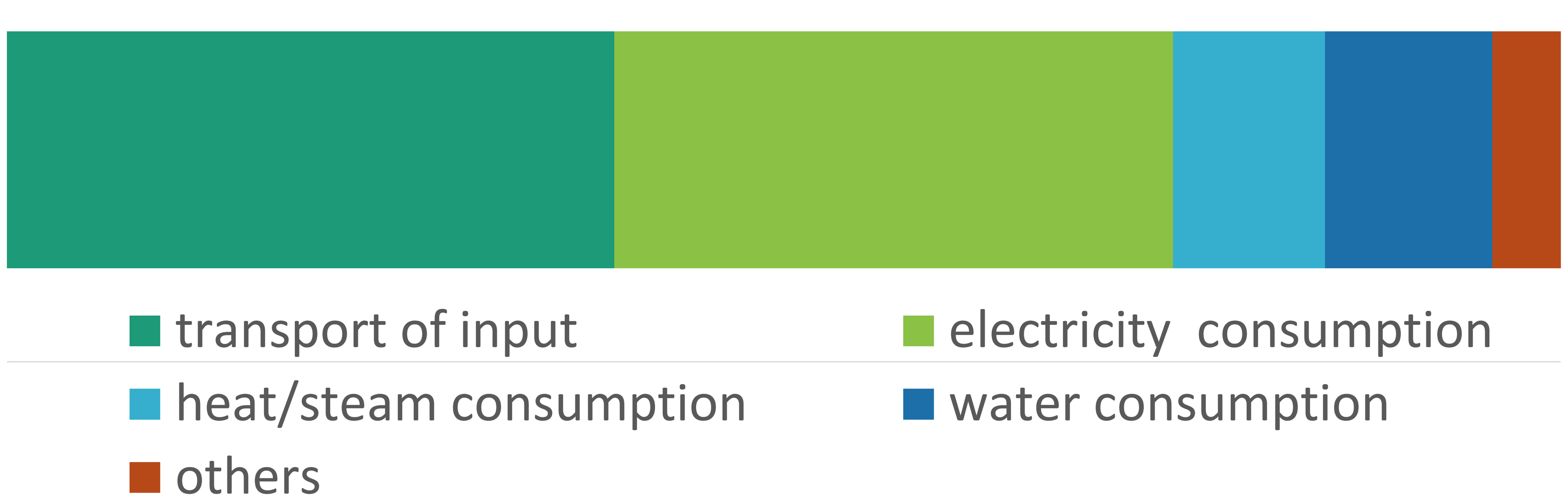

Fig. 3. The distribution of environmental impact for main chosen factors based on LCA analysis

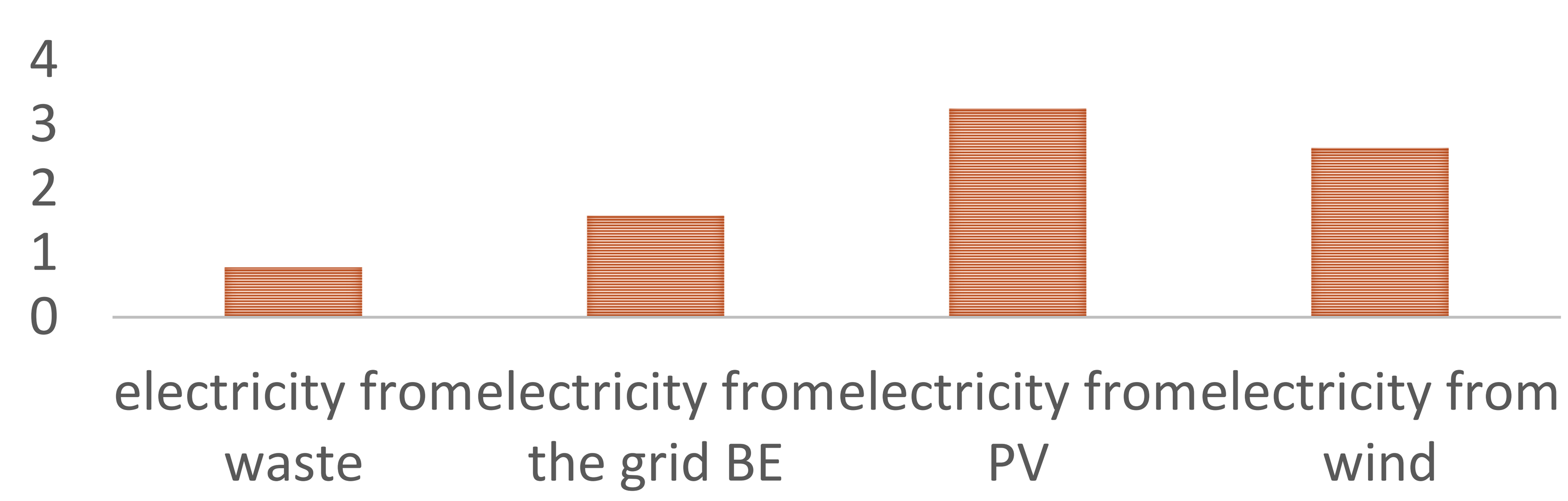

Fig 4. Energy consumption with different Energy source based on LCA analysis

The entire process has been patented as Smart Chain Processing. The supply chain is configured to lead to maximum material and energy recovery. In addition, the processing of the RDF residual waste stream and the production of biofuels is an added value. The integration of all processes leads to the valorization of residual waste. No waste or wastewater is generated along the entire supply chain, while the electricity and heat used come from waste processing. The plant is therefore also energy independent. The carbon capture technology is used to capture carbon dioxide emissions from energy processes.

The installation fulfils the integration conditions of closing the loop and creating additional monetary and non-monetary value. It also meets all circular objectives of reducing material and energy consumption, reducing emissions and waste generation, increasing competitive advantage and operational efficiency, and sustainability objectives.

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