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SESSION T2-7 LCA of Biomass- and Non-Fossil Conversion-Technologies for Liquid Fuels
3rd September 2019, Tuesday 10:30 - 12:00 am

Life Cycle Inventory of a pre-commercial demo plant using an innovative technology for the production of Sustainable Aviation Fuel (SAF) from flexible waste biomass

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Goal:

H2020 flexJET project (grant agreement no. 792216) consortium is building a pre-commercial plant for the production of advanced jet biofuel from waste vegetable oil and food waste, demonstrating the integrated SABR-TCR technology (traditional transesterification (TRANS) and Thermo-Catalytic Reforming (TCR) combined with hydrogen separation through pressure swing adsorption (PSA), hydro-deoxygenation (HDO) and hydro-cracking/isomerisation (HC)) to produce a fully equivalent SAF compliant with ASTM D7566 standard. Environmental impacts and benefits will be mapped through a Life Cycle Assessment (LCA), the first steps of which are within the scope of this study. Our purpose is to select the best suited LCA approach, to define the goal and scope of the analysis, to map and quantify all inputs and outputs from the SABR-TCR technology in the Life Cycle Inventory (LCI) phase and to identify alternative scenarios for results comparison.

Methods:

A literature review applied to biorefineries, to SABR-TCR system and its main products and co-products (including FAME and jet fuel), and to current uses of the feedstocks (waste vegetable oil and food waste, along with other organic feedstocks) was performed in order to map the state-of-the-art LCA approaches followed to define system boundaries, system functions, functional units, reference flows, data collection, allocation rules and other relevant aspects related to LCA methodology application within the specific sector. Building on this review, the scope of our analysis, in particular the system boundaries and functional unit of the SABR-TCR system developed within flexJET project, were determined. Furthermore, in order to compare the system's environmental performances with those of different ways to produce jet fuel and to valorise feedstocks, alternative scenarios were identified based on current conventional jet fuel production and the most significant fates of the feedstocks. As for the LCI phase, data will be collected from the integrated SABR-TCR plant design and will be used to quantify all relevant energy and material inputs and outputs and to create an inventory referred to the functional unit. The alternative scenarios inventories will also be generated. The collection of data will include a detailed process description, input and output flows and available characteristics of the products and co-products. The integrated SABR-TCR system generates multiple co-products, some of which are recycled as an energy source back into the plant, while others are used for other applications. Thus, appropriate data allocation procedures will also be adopted at this stage.

Results:

The input/output tables which will characterise each process included in the system boundaries will be used for LCA modelling by means of GaBi software and the GaBi Professional and Ecoinvent databases. The model will be structured on several levels, of which "Integrated SABR-TCR System" will be the main one and will contain the following sub-plans: "Feedstocks pre-treatment"; "Transesterification"; "Thermo-Catalytic Reforming"; "Pressure Swing Adsorption"; "Hydro-Deoxygenation"; "Hydro-Cracking & Isomerisation"; "Combined Heat & Power generation"; "Char management".