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SMART AND FLEXIBLE HEAT & POWER FROM BIOMASS DERIVED LIQUIDS FOR SMALL-SCALE CHP APPLICATION

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Small scale biomass-based Combined Heat and Power (CHP) has the potential to contribute significantly in solving the challenges Europe faces while pursuing the goal to make its energy system smart, clean, flexible, secure, cost competitive and efficient. Furthermore, CHP can play an important role in securing electricity supply by balancing a Renewable Energy Sources (RES) based grid ("dispatchable power") to compensate for fluctuating wind and solar electricity. For small-scale biomass CHP systems, a standardized fuel, enabling optimization of the conversion units and thus creating a cost competitive value chain, is highly preferred. A smart, demand driven unit should be capable of dealing with the fluctuating energy demand and/or varying availability of wind/solar power. In such a case, it is advantageous to use a sustainable liquid fuel and such concept is under development in the EC-Horizon project *SmartCHP™*.
The overall objective of *SmartCHP™* is the realization of a cost-effective and flexible energy system by using fast pyrolysis bio-oil (FPBO) in an efficient diesel-engine based CHP. Fast pyrolysis is a process to convert a variety of biomass resources into a uniform liquid fuel called FPBO, nowadays, produced on a commercial scale in Europe. (e.g. Finland, Sweden & the Netherlands). The FPBO originates from different types of lignocellulosic biomasses and/or residues.

Two diesel engines are available at BTG, a one-cylinder research engine (1C) and a 50 kW_e, four-cylinder prototype (4C). Both engines were supplied by ABATO and have been jointly modified to enable operation on FPBO. Modifications include a.o. a corrosion resistant fuel supply, a redesigned fuel injector & pump, increased compression ratio and dedicated engine control software.

The 1C engine has been tested on FPBOs of different origin like e.g. from sawdust, olive residue, miscanthus. In the past at least 20 wt% of ethanol was added to the FPBO to reduce viscosity and improve homogeneity resulting in easier operation. Current experiments were also performed with lower amounts of ethanol or even without any addition. Flue gas emissions are measured and fuel consumption is determined. Important aspect is also the long-term duration of the engine and several hundred hours of operation have been achieved, and analysis of lubrication oil have been carried out. In the presentation, the results of the test campaigns will be presented.

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