PhD Position on the use of e-fuels in stationary HCCI engines

Context

The project BEST (Belgian Energy SysTem) studies the contribution of electro- and synthetic energy carriers to the security of supply of Belgium. The development of a holistic model will provide a deep insight in the role of these carriers in the energy system, as well as their energy and economic costs. The key issues of the uncertainties on the current state and the future of the system will be analyzed through a robust optimization approach. The impact of the integration of these carriers on the electricity grid is included in the study as well as several ways to improve the total efficiency of the use of these renewable fuels for different applications.
The project, funded by SPF Economie "Energy Transition Fund", is a collaboration between five universities: UCLouvain, UGent, ULB, UMons and VUB.

Description of the PhD

The PhD student will work on the restitution of the energy from the e-fuels (H_2, NH_3, CH_4, and CH_3OH) and their blends through combustion in homogeneous-charge compression-ignition (HCCI) engines. Based on the results of two previous PhD theses (Bahduri (2015) and Pochet (2020)), the main challenge is the increase of the specific power of the engine while keeping a high efficiency and low NOx emissions. This can be achieved through blends of the different e-fuels, the use of the available oxygen from electrolysis, and the injection of liquid water to damp the combustion. This thesis will focus on these three axes through simulations and experiments. The simulations will be performed to assess and improve chemical kinetic models, help define the experimental plan and interpret the experimental results. Experiments shall be carried out to gather original data on the fuels and their blends. The experimental HCCI bench is already available at the UCLouvain lab.

Results from the PhD thesis will be integrated in the energy system model developed in the frame of the project BEST.

Description of Team

This offer is for a PhD at UCLouvain (Louvain-la-Neuve) with two supervisors, Prof. F. Contino and Prof. H. Jeanmart.

Francesco Contino has a long experience in HCCI engines: he performed his thesis on the topic, and through the supervision of PhD students he published a dozen of papers on experiments and simulations in such engines. His research interests also lies in energy systems and how combined heat and power based on engines would be a key contributions.
Hervé Jeanmart focuses his research effort on three strands: Energy system, biomass conversion, and combustion. In combustion, fundamental chemical kinetic research is carried experimentally on low pressure burners and applied research is performed in engine related conditions. In both cases the focus is on the understanding on the underlying kinetic mechanisms.

Starting date: March 2020
End date: February 2024
Location: UCLouvain (Louvain-la-Neuve, Belgium)
Salary: 1950€ (approximate net income)
Profile: Candidates should be proficient in English, motivated and well aware of the energy context. Experience in programming and experimental work would improve the ranking.

Application: applications should contain a letter of motivation, a letter of recommendation, a short analysis of the project idea (max one page), and a short video (2 minutes max) explaining why we should hire the candidate. The application package should be sent to herve.jeanmart@uclouvain.be and francesco.contino@uclouvain.be.

More information on the project: www.best-energy.be

More information on working at UCLouvain:
https://jobs.uclouvain.be/content/WorkingatUCL/?locale=en_GB

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