



PhD position on the experimental use of un-cooled syngas in HCCI engines

Context

The project TTCogen (Tar Tolerant Cogeneration) aims at the development, optimisation, and long-duration testing of a direct syngas HCCI cogeneration from biomass gasification. Within the scope of cleaner and more affordable energy supply systems with a strong short-term potential, the investigation of HCCI engines comes two-fold. First, achieve high intake temperature operation (about 250°C, although the ideal temperature to avoid tar condensation is still unknown and variable) to allow the direct use of syngas produced from a biomass gasifier, hence avoiding the expensive need for a syngas cooler and condensed-tar purification system. Second, the promise of a higher efficiency with cleaner exhaust emissions than its gas engine counterpart, under the condition of undertaking HCCI's inherent challenges that are unburned fuel, low power density, cold start, and load control.

The project, funded within the SPW Win2Wal call, is a collaboration between CERDECAM, UCLouvain, and CogenGreen S.A.

Mission

The TTCogen project seeks a junior researcher (with the possibility for a PhD degree) to work on the dimensioning, development, experimentation, and optimization of the un-cooled syngas use in homogeneous-charge compression-ignition (HCCI) engines. Based on the results of previous PhD theses (Bahduri – 2015, Berger – 2018, Pochet - 2020), the main challenge is the increase of the specific power and the decrease of the unburned emissions of the engine while keeping a high efficiency and low NO_x emissions. More practical aspects such as cold-start abilities and load control strategies are to investigate. This can be achieved through the combination of various techniques such as turbocompression, exhaust gas recirculation, glow plug control and thermal stratification from direct water injection. The dimensioning phase will focus on these key performances and technical issues through simulations and past experiment analysis. The development and optimization phase will be based on experiments with simulation guidance. The experimental HCCI bench is to be derived (according to the performed research) from a market-based cogeneration supplied by CogenGreen S.A., placed at the CERDECAM-ECAM research labs, and directly coupled to a commercial biomass gasifier.

Results from the experimental research of the junior researcher will directly be used for his PhD thesis and will help CogenGreen S.A. for the development of a new industrial solution for local biomass cogeneration systems. Scientific communication including presentations in international conferences, peer-reviewed journal papers publications, and participation to steering committees and evaluations is expected. Participation to research-linked pedagogic activities is also encouraged at both institutions.

Team

This offer is for research activities at both CERDECAM for the experimental work (located within ECAM, Brussels, Belgium), and UCLouvain for the simulation and development phase (Louvain-la-

Neuve, Belgium), that can lead to a PhD degree delivered by UCLouvain. The junior researcher will be part of a research team including Francesco Contino (UCLouvain), Hervé Jeanmart (UCLouvain), Benjamin Berger (CERDECAM-ECAM) and Maxime Pochet (CERDECAM-ECAM), many other young researchers, as well as an experienced CogenGreen engineer and lab technicians.

Information

Starting date: 1st of September 2021

End date: 31st of August 2025

Location: CERDECAM (50 Promenade de l'Alma, 1020 Brussels, Belgium),
UCLouvain (2 Place du Levant, 1348 Louvain-la-Neuve, Belgium)

Position: Full time job (half-time CERDECAM, half-time UCLouvain, distributed according to the project phases and researcher needs). Funded by the Région wallonne (2020 Win2Wal call).

Salary: 1950€ approximate net income.

Profile: Candidates should hold an engineering degree (mechanical or electromechanical or other specialty if compensated by professional experience), be proficient in English and French (B2 level). Experience in programming and experimental work would strongly improve the ranking. Finally, the junior researcher should be motivated and well aware of the energy context, be able to work in team, have a strong critical and synthesis sense, be responsive and responsible, and have a good time management.

Application: applications should contain a CV, 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 ghl@ecam.be, pch@ecam.be, francesco.contino@uclouvain.be and herve.jeanmart@uclouvain.be. Master 2 students are eligible, under the condition of holding the necessary degree before the start of the project. Applications are expected for the 14th of May.

More information on the project and working at CERDECAM and UCLouvain:

<https://cerdecam.jimdofree.com/>

https://jobs.uclouvain.be/content/WorkingatUCL/?locale=en_GB

