

PhD thesis offer within the PROCURA Project

Power to X and Carbon Capture & Utilization Roadmap for Belgium

A 4-year PhD position is currently available in the Department of Chemical Engineering at the University of Liège (Belgium). This offer is done in the context of the PROCURA project, a Belgian Energy Transition Fund project implying a total of 6 Belgian partners.

Research area - Procura Project:

To fulfil the requirements of the Paris agreement, deep decarbonisation goals should be met by 2050. Urging for a CO₂ neutral or even negative energy supply, renewable energy is key in our energy system. The investment costs of wind and solar energy have decreased remarkably over the past 10 years all over the world. In Belgium, these technologies are already competitive with conventional electricity generation techniques and expected to become the cheapest soon. Therefore, it is very important to study how these renewable technologies can substitute conventional power generation while ensuring security of supply and balancing the electricity system at all time horizons. Due to the intermittent nature of renewable energy production a buffer system is required to stabilize the electricity grid. This can be pumped hydro, battery-based storage or Power-to-X approaches where electric power can be used to generate X (X = hydrogen, methane, chemicals, liquid fuel, etc.). The integration of intermittent renewable energy production into end-uses by means of hydrogen is depicted in Fig.1.

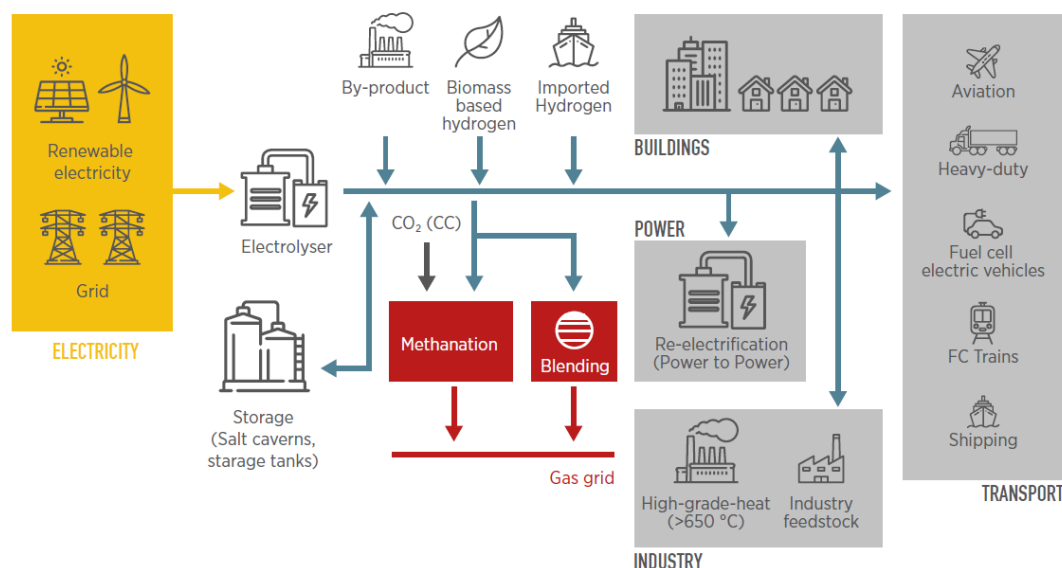


Fig 1: Integration of intermittent renewable energy production into end uses by means of hydrogen
 (Source: Hydrogen from renewable power, IRENA 09/2018)

The Power-to-X approach has the additional advantage that it produces hydrogen, a versatile renewable fuel which can displace fossil fuels in end-uses that are hard to electrify. It can also be combined with carbon capture & utilization schemes to produce high value chemical products, synthetic methane and liquid fuels. In summary, Power-to-X is especially useful in energy systems with a high share of renewables and a stringent decarbonizing target. Both are the case for Belgium and EU within the next years.

Description of the tasks:

In the PROCURA project, the main role of the University of Liège is to coordinate work package 1 (WP1) to evaluate the potential for CO₂ capture in Belgium and draw a roadmap for this purpose. After the review of existing and/or promising CO₂ capture technologies, large point-source CO₂ capture and direct air capture systems will be considered. Process models will be developed to supply material and energy balances for the CO₂ technologies identified as most relevant in the Belgian context. A comparison of the different technologies studied will be performed based on techno-economic, life cycle, and social impact assessments. The technologies will be graded using merit order curves, so to provide an easy-to-read support for decision makers in order to identify most relevant CO₂ capture applications. Finally, concrete case studies for the Belgian context will be specifically developed, targeting representative CO₂-emitting industries. In this task, the CO₂ capture processes will be considered as part of larger industrial systems, rather than as stand-alone units. As a consequence, their impact on other Belgian utilities (dynamic behaviour, electricity needs...) will also be considered so to deliver a first feasibility study for the selected cases.

The University of Liège is also implied in WP2 (power-to-chemicals), WP3 (Long term modelling – power-to-energy) and WP7 (Valorisation potential, market analysis and enabling conditions), so further tasks may be proposed in these areas dedicated to studying the deployment of CO₂ re-use technologies in Belgium.

The PhD thesis job includes participation to project meeting, presentation of results at national and international conferences, writing of scientific articles... Collaboration and exchanges (including research stays) with national and foreign universities are also encouraged.

The successful candidate will received a PhD student position for a 4-year period, starting ideally from July 1st, 2020. The grant amount is in accordance with university standards (~1800 €/month, net).

Candidate's profile:

Candidates must have graduated (Master's degree) in Chemical Engineering or similar field (process, mechanical, or environmental engineering...). They should have a strong interest in modeling and experience with AspenOne software (or similar flowsheeting tools) as well as in Python (or Matlab) is a plus. They should also be able to work in relative autonomy typical for PhD thesis, as well as to easily interact with academic and industrial partners. They should demonstrate ability to synthesize information from a literature review, and to use critical mind to evaluate possible solutions to a given problem. Ease to communicate in English (oral and written) is required, French is an additional asset.

Research environment:

The successful candidate will join a young and dynamic team within the Department of Chemical Engineering of the University of Liège (DCE). The DCE employs about 60 people mostly active in the fields of process engineering and materials science. It performs experimental research activities, as well as studies the modeling and control of physico-chemical and biochemical processes. It targets the development and optimization of innovative materials and processes that are also sustainable and financially viable. The present research project will be conducted in an international-friendly environment, with more than 10 different nationalities present in the DCE.

The DCE is also an active member of the FRITCO₂T platform (Federation of researchers in innovative technologies for CO₂ transformation) at ULiège, and a founding member of the CO₂ Value Europe Association.

More information about the Department of Chemical Engineering and previous publications in the field:

www.chemeng.uliege.be

<https://orbi.uliege.be/simple-search?locale=en&query=Gr%C3%A9goire+L%C3%A9onard+CO2>

Recruitment process:

Applications containing CV, cover letter and possibly reference letter should be submitted by e-mail to secretary.chemeng@uliege.be with in object the mention "Application PhD thesis PROCURA". Application deadline is March 31, 2020.

Candidates selected from this first round will be invited for an interview (possibly through Skype) during which they will be asked to briefly present a previous topic they worked on.

Start of the PhD should take place on July 1st, 2020.