

## PhD Position on Real-time process monitoring using dynamic Life Cycle Assessment modelling: Application to the decarbonization of industrial processes

### Profile

The research group of the University of Bordeaux CyVi on life cycle assessment and sustainable chemistry at the Institute of Molecular Sciences, and the CEA-List, a specialist in smart digital systems, are opening a doctoral position on the subject of developing a real-time process monitoring approach using dynamic Life Cycle Assessment (LCA) modelling. The approach developed is to be applied to the decarbonization of industrial processes. This position has got funding from the PEPR SPLEEN programme that aims to implement structuring research in France to transform industrial processes to make them less greenhouse gas-emitting, in line with the priorities defined as part of the national “decarbonisation of industry” acceleration strategy for France 2030.

Since its creation in 2012 the CyVi Group has got an inter- and transdisciplinary orientation and has been specialized in life cycle approaches for chemical products. Key issues thereby are the application of sustainability assessment using life cycle assessment (LCA), life cycle sustainability assessment (LCSA) and materials flow analysis in the areas of industrial processes, chemistry and material science, and the enhancement of related methodologies and data. One supply risk assessment method and related Python based tool that the CyVi group has developed is the GeoPolRisk method. This tool allows to calculate characterisation factors for use in LCA and LCSA. See <http://www.ism.u-bordeaux.fr> and <http://cyvigroup.org/> for more information.

CEA-List is a specialist in smart digital systems. They develop innovative, competitiveness-boosting tech-driven solutions—protected by a broad portfolio of patents—and transfer them to our R&D partners. They run open innovation platforms to help our partners get their products to market quickly and effectively, and are very active internationally through our partnerships with academic research labs- CEA-List is one of the three institutes of the CEA (French Alternative Energies and Atomic Energy Commission) Technology Research Division. It has sites in the innovation hubs of Paris-Saclay and Grenoble, France. See <https://list.cea.fr/en/cea-list-the-ideal-partner-for-digital-innovation-projects/>.

The primary workplace will be the Bordeaux campus, with the candidate spending approximately two-thirds of their time at ISM and the remaining one-third at the CEA-List. Option of exchanges might come up with long-standing collaboration partners such as the Technical University of Braunschweig in Germany and the University of Waterloo in Canada. The Bordeaux campus in Talence is easily accessible with public transportation.

**Starting date:** 1 October 2024 or later, mandatory start before the end of 2024

### Requirements

- Should hold a master’s degree in mathematics and computer science, in particular environmental informatics, or chemical or engineering sciences, in particular in chemical engineering.
- If coming from chemical or engineering sciences, should have a basic culture and interest in programming and if coming from mathematics and computer science, should have a basic culture and interest in chemical engineering and sustainability assessment
- Experience in life cycle assessment, material flow analysis, greenhouse gas accounting, environmental management, supply chain management, industrial processes and sensors
- Interest in **interdisciplinary high-level research**, focusing on computer science for sustainability
- Enthusiasm for collaborating within research groups on sustainability assessment of the energy transition using life cycle approaches, including the possibility to contribute to the supervision of Master and Bachelor students.

- Willingness to contribute to the management tasks of the project funding the PhD thesis and to general duties within the research groups.
- Proficiency in **programming languages such as Python**, and other informatic skills  
Rigor, organization and analytical sense as well as autonomy, team communication skills and capacity for cooperation are important.
- Excellent knowledge of **English and if possible, also of French** are required.

## Project context and description of the PhD thesis

This thesis project aims to contribute to facilitating, through the transformation of information systems, the achievement of carbon neutrality by 2050. This is an ambitious objective, which will indeed require a profound overhaul of information, and a new integration of methods at the organisational and product level carried out until now in a distinct way.

That means the objective of the thesis will be precisely, from one or more case studies, to advance LCA methodology and application to achieve real-time process monitoring using dynamic LCA modelling to enable industrials to communicate and optimize in real-time their process in order to minimize their carbon footprint and other environmental impacts such as water footprint as relevant.

The development of a real-time process monitoring using dynamic LCA modelling (WP4) aims at:

- The development of a real time evaluation model of environmental impacts of a process within an industry as a basis to enable industries to communicate real-time carbon accounting and optimize their carbon footprint taking into account other environmental impacts such as water footprint as far as possible, working closely with the project DCARBO on monitoring of process emissions using sensors within the PEPR SPLEEN.
- Linking relevant material, water and energy flow information of sensors and cost accounting into LCA by:
  - Specification of sensor information needs to link real-time monitoring and dynamic LCA tools to enable real-time, dynamic LCA
  - Linking to another PhD thesis on the opportunities of using data from analytical accounting to enable real-time dynamic LCA.

The PhD thesis is expected to lead to the development of a model that allows the linking of sensors, monitoring and accounting data to dynamic LCA for real-time carbon- and water-footprint calculations. A case study of at least one company is to be set up as a demonstrator to validate real time model.

The work will make it possible to move forward on a few methodological/ technological challenges of great originality in research:

1. The reconciliation of accounting data (monetary) and physical data (necessary for the calculation of environmental impacts) internal to the company for the innovation of products
2. Obtaining reliable data from suppliers for organisational reporting (external/ scope 3 greenhouse gas emissions/ organisational LCA) and use of them for product LCA studies
3. Real-time accounting calculation for industrial processes of environmental impacts at product level
4. Prediction and anticipation of environmental impacts, in particular of carbon and water footprints, for eco-innovation

At the end of their doctoral work, the candidate will have acquired a sought-after skill in computer science applications for eco-innovation in the field of life cycle assessment, decarbonization of processes and related programming, allowing them to be one of the leading experts and pursue a career in research and teaching, consultancy or in industry or administration in favour of the transition to sustainability and orientated towards the carbon neutrality by 2050.

**Funding:** The LCA-SPLEEN project (*Life Cycle Assessment based metrics for industry and research to support industrial processes decarbonization while minimizing environmental impacts*) is funded by

France 2030 and operated by the French National Research Agency (ANR) as part of the Priority Research and Equipment Program (PEPR) on supporting the decarbonisation of French industry and the development of national industrial sectors for decarbonisation solutions. This is a fundamental challenge, given that industry is responsible for around 20% of France's greenhouse gas (GHG) emissions. The National Low Carbon Strategy aims to reduce industrial greenhouse gas emissions by 35% by 2030 and 81% by 2050, compared with 2015 levels.

**Duration of the thesis:** 3 years

**Length of employment:** max. until the end of 2027

**PhD Thesis co-directors:** Prof. G. Sonnemann, ISM, Univ. Bordeaux

**PhD Thesis advisors:** Dr. Ariane Piel and Jean-Francois Berrée, List, CEA

## Application

Deadline for application: **21 June 2024** at noon

Interested and highly motivated applicants should provide their application files (Motivation letter, CV, publication list and up to 3 potential referees with address, phone number and email) in electronic form in one pdf file), if possible, by the end of the deadline to:

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For any questions, please contact: Prof. Guido Sonnemann and Dr. Ariane Piel at the indicated email addresses.

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