

PhD Position

on developing the missing LCA indicators for circularity and landscape as a way to adopt to new demands for the impact assessment modelling of energy systems

Profile

The [Life Cycle Group 'CyVi'](#) at the [Institute of Molecular Sciences \(ISM\)](#) and the [Bordeaux School of Economics \(BSE\)](#) both at the University of Bordeaux, and the Institute of Mechanics and Engineering here represented by the Mechanical and Industrial Engineering School (ENSAM) are looking for a PhD candidate to work on developing the missing LCA indicators for circularity and landscape as a way to adopt to new demands for the impact assessment modelling of energy systems and apply it within Life Cycle Assessment (LCA) and Life Cycle Sustainability Assessment (LCSA) case studies on wind power and photovoltaics use in France. The PhD project contributes to the 'Advanced Energy Systems Technologies' acceleration programme PEPR, which is part of the eponymous national strategy.

Since its creation in 2012 the CyVi Group has got an inter- and transdisciplinary orientation and has been specialized in advancing life cycle assessment methodology and carrying out case studies in multiple economic sectors. Key issues thereby are the development of life cycle impact assessment indicators, in particular for a better integration of resource challenges, and the improvement of life cycle inventory modelling and data. Applications of life cycle assessment have been carried for example for cases of chemicals synthesis, materials development and recycling processes as well as for systems such as photovoltaics, boats and urban areas.

BSE is a joint research unit of the University of Bordeaux, CNRS and INRAE. This laboratory is one of the main French economic research centres and aims to make a significant contribution to major contemporary societal issues. ENSAM is a French engineering and research institute of higher education. It is a grande  cole, recognized for leading in the fields of mechanics and industrialization. Founded in 1780, it is among the oldest French institutions and is one of the most prestigious engineering schools in France. See <https://artsetmetiers.fr/en>. The three CyVi, BSE and ENSAM teams have already collaborated together as part of a regional project.

The primary workplace will be the Bordeaux campus, with the candidate spending approximately two-thirds of their time at ENSAM and the remaining one-third at the CyVi group and BSE, both at the University of Bordeaux. Option of exchanges might come up with long standing collaboration partners such as the University of Augsburg in Germany and the University of Cape Town in South Africa. 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 chemistry, energy or material sciences, chemical, mechanical or process engineering, environmental or resource economics, informatics, geography, sustainable resource management, or related fields.
- Experience in life cycle (sustainability) assessment, material flow analysis, renewable energies, energy security, geographic information systems, landscape modelling, recycling, circular economy, supply chain management, stakeholder outreach, social acceptance.
- Interest in **interdisciplinary high-level research**, advanced research focusing on sustainability science and renewable energy solutions for the environmental and social transition.

- 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 general duties within the research groups.
- Proficiency in **programming languages such as Python**, and other informatic skills
- Strong interest in the circularity and social acceptance challenges of the energy transition, in particular with regard to the recycling and reuse opportunities of equipment and the landscape impacts of new installations, is important.
- Excellent knowledge of **English and if possible, also of French** are required.

Project context and description of the PhD thesis

The proposed thesis project, co-supervised by the CyVi group (University of Bordeaux) and in collaboration with BSE and ENSAM, will focus on developing the missing LCA indicators for circularity and landscape as a way to adopt to new demands for the impact assessment modelling of energy systems and apply it within Life Cycle Assessment (LCA)¹ and Life Cycle Sustainability Assessment (LCSA)² case studies on wind power and photovoltaics use in France.

Recently Cilleruelo Palomero et al.³ present how two circularity indicators are integrated into LCA software. With the current efforts on striving towards sustainable development both LCA circularity have become extremely popular. Both are addressing sustainability aspects, yet typically applied separately. LCA counts with dedicated tools and databases, while circularity is commonly calculated with simple tools or even just formulas in excel, ignoring the supply chain. Material Circularity Indicator (MCI)⁴ and the Circularity Index (CI)⁵ have been incorporated. into openLCA, and the LCA database Ecoinvent is adapted to trace circularity throughout. This allows to track circularity variables across supply chains and apply circularity indicators in LCA models. The idea of the PhD project is to build on this comprehensive framework and to contribute to the ongoing dialogue surrounding sustainable practices and circular economy integration within LCA for energy systems by checking the applicability of MCI and CI to energy systems and if adequate identifying or developing one or more additional circularity indicators.

A second aspect to be addressed in the PhD project is the landscape change due to the installation of renewable energy systems like wind power and photovoltaics and its general social acceptance. The present project aims at identifying and formalizing valid and legitimate criteria for sustainability assessment in a life cycle perspective using LCA methodology. In addition to identifying available indicators based on a review of literature, the PhD thesis will allow to adapt for and develop the missing indicators for landscape⁶ as a way to adopt to new demands for the impact assessment modelling of energy systems.

The set-up of indicators identified covering environmental impacts, circularity, landscape and social indicators will be applied and tested in one or more LCA and LCSA case studies of a project where a renewable energy production system is installed. The search of adequate case studies and corresponding socio-economic partners to work with will be part of the PhD project.

Funding: The LCA-TASE project (Life Cycle Assessment - LCA-based measures for industry and research to support the decarbonization of industrial processes 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 Advanced Energy Systems Technologies.

Duration of the thesis: 3 years

Length of employment: max. until the end of 2027

PhD Thesis director: Prof. G. Sonnemann, Univ. Bordeaux

PhD Thesis advisors: Dr. E. Mignard and Dr. O. Fuentes, Univ. Bordeaux

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:

Prof. Guido Sonnemann, Dr. Emmanuel Mignard, Dr. Olga Fuentes

Head, Researcher and Postdoc, The Life Cycle Group CyVi

Institute of Molecular Sciences (ISM)

University of Bordeaux

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Emails: guido.sonnemann@u-bordeaux.fr, emmanuel.mignard@u-bordeaux.fr and olga-patricia.fuentes-daza@u-bordeaux.fr

If you have any questions, please contact: Prof. Guido Sonnemann, Dr. Emmanuel Mignard, Dr. Olga Fuentes at the indicated email addresses.

References:

¹ISO/TC 207/SC 5 Life cycle assessment, 2006. ISO 14040:2006 – Management environnemental — Analyse du cycle de vie — Principes et cadre. ISO. <https://www.iso.org/fr/standard/37456.html?browse=tc>. (Accessed 15 January 2024).

² Valdivia S., Sonnemann G. (eds.) (2024) Handbook on Life Cycle Sustainability Assessment. Elgar Handbooks in Development

³ Cilleruelo Palomero J., Freboeuf L, Ciroth A., Sonnemann G. (2024). Integrating circularity into Life Cycle Assessment: Circularity with a life cycle perspective. Cleaner Environmental Systems 12 (2024) 100175

⁴ Ellen MacArthur Foundation. (2019). Granta and Life, Circularity Indicators: an Approach to Measure Circularity Methodology. Ellen MacArthur Foundation". <https://www.ellenmacarthurfoundation.org/material-circularity-indicator>. (Accessed 18 November 2023)

⁵ Cullen, J.M., 2017. Circular economy: theoretical benchmark or perpetual motion machine? J. Ind. Ecol. 21, 483–486.

⁶ Schüpbach B., Roesch A., Herzog F., Szerencsits E., Walter T. (2020). Development and application of indicators for visual landscape quality to include in life cycle sustainability assessment of Swiss agricultural farms. Ecological Indicators, 110, 105788