PhD position on the introduction of impact mechanisms representing the economic dimension of sustainability from an energy sovereignty perspective: LCSA case study on renewable energies

Profile

The 'CyVi' Life Cycle group at the Institut des Sciences Moléculaires (ISM) and the Bordeaux Sciences Economiques (BSE) laboratory, University of Bordeaux, are looking for a PhD candidate to work on impact mechanisms associated with the supply risk of natural resources used in energy production and storage technologies.

Since its creation in 2012, the CyVi group has had an inter- and trans-disciplinary focus, specializing in life cycle approaches for chemicals. Key issues are the application of sustainability assessment using life cycle assessment (LCA), life cycle sustainability analysis (LCSA) and material flow analysis in the fields of chemical synthesis and materials science, as well as the improvement of associated methodologies and data.

Bordeaux Sciences Économiques (BSE) is a joint research unit of the University of Bordeaux, CNRS and INRAE. The laboratory is one of France's leading economic research centers, and aims to make a significant contribution to major contemporary societal issues. The two CyVi and BSE teams have already worked together on a regional project.

The PhD student will also benefit from interactions with the various partners of the LCA-TASE research project (BRGM, CEA, IFPEN, INRAE) funded under the PEPR TASE program. This project is designed to meet the conceptual and methodological requirements for 1) obtaining and analyzing the basic data needed to 2) assess the sustainability of systems based on renewable energies, and 3) characterize their potential in terms of supply risks and energy sovereignty for France.

The candidate will work on the University of Bordeaux campus. They will spend approximately two-thirds of their time at BSE and one-third at the Institut des Sciences Moléculaires, CyVi group. Exchanges and collaborations are possible with long-standing partners such as the University of Augsburg in Germany and the University of Waterloo in Canada.

Start date: October 1, 2024 or later, with a mandatory start before the end of 2024.

Requirements

- Master's degree in environmental economics, energy, sustainable development, supply chain management, energy policy or related fields.
- Experience in life cycle assessment (sustainability), material flow analysis, critical raw materials, energy security, geopolitics, supply chain management.
- Interest in high-level interdisciplinary research, advanced research focused on raw materials supply chain and energy sovereignty assessment.
- Enthusiasm for collaboration within research groups on assessing the sustainability of the energy transition using life cycle and supply chain approaches for raw materials and energy security, including the possibility of contributing to the supervision of master's and bachelor's students.
- Willingness to contribute to the management tasks of the project funding the PhD thesis, and to general tasks within research groups.

- Proficiency in programming languages such as R and Python and other computing skills.
- Strong interest in eco-design technologies for the energy transition.
- Excellent command of English and French required.

Project background and description of the doctoral thesis

The proposed thesis project, co-directed by BSE (Univ. de Bordeaux) and the CyVi group at ISM (Univ. de Bordeaux), aims to understand and model the impact mechanisms associated with the supply risks that accompany the development of renewable energies, with a view to energy sovereignty. The availability, quality and productivity of natural resources are factors that enable us to assess the scarcity of a resource at a given point in time. Dynamically, other effects linked to physical, technological or market factors will have an impact on the scarcity of the resource over time, and may generate a critical situation for the company or the economic system that depends on it. The need to measure criticality linked to resource use has emerged as a means of better informing the economic dimension of LCSA (Schrijvers et al., 2020) (Cimprich et al., 2019), which in practice assesses the life cycle costs of a product (life cycle costing) by focusing on financial costs (Neugebauer, Forin and Finkbeiner, 2016).

However, economic activities can have a wide range of positive and negative consequences, and it seems particularly important to extend the scope of economic evaluations. The aim of the thesis is to help introduce one or more economic impact mechanisms into an LCSA framework that goes beyond conventional cost-cycle analysis (CCA). The focus of the thesis is to study the impacts of systems based on renewable energies from the dual angle of LCSA and environmental economics. The thesis will draw on LCSA methodology and environmental economics concepts (weak and strong sustainability, total economic value), and will produce a literature review, apply an LCSA to a renewable energy case (wind or photovoltaic), conduct semi-structured interviews, and mobilize advanced statistical and data science methods. The following activities will be carried out:

- Delineating the subject from an energy sovereignty perspective;
- Application of LCSA to a renewable energy case, in line with the 10 principles (Leroy-Parmentier, N., Valdivia, S., Loubet, P., Sonnemann, 2023);
- Proposal of indicators and modelling of an economic impact mechanism associated with the supply risk of resources intended for renewable energies.

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 the sovereignty of energy systems.

Duration of thesis: 3 years

Duration of employment: maximum until the end of 2027

Doctoral thesis supervisor: Dr Maïder Saint Jean, Univ. Bordeaux

Doctoral thesis co-supervisor: Prof. Guido Sonnemann, Univ. Bordeaux

How to apply

Application deadline : **21 June 2024** at noon

Candidates should submit their application (cover letter, CV, list of publications and up to three potential referees, with address, telephone number and e-mail, as a single PDF file to:

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If you have any questions, please contact: Prof. Guido Sonnemann and Dr Maïder Saint Jean at the e-mail addresses given.

References

Cimprich, A. *et al.* (2019) 'Raw material criticality assessment as a complement to environmental life cycle assessment: Examining methods for product-level supply risk assessment', *Journal of Industrial Ecology*, 23(5), pp. 1226–1236. Available at: https://doi.org/10.1111/jiec.12865.

Leroy-Parmentier, N., Valdivia, S., Loubet, P., Sonnemann, G. (2023) 'No Title', *Int J Life Cycle Assess*, 28, pp. 704–740. Available at: https://doi.org/10.1007/s11367-023-02162-0.

Neugebauer, S., Forin, S. and Finkbeiner, M. (2016) 'From Life Cycle Costing to Economic Life Cycle Assessment — Introducing an Economic Impact Pathway', pp. 1–23. Available at: https://doi.org/10.3390/su8050428.

Schrijvers, D. *et al.* (2020) 'A review of methods and data to determine raw material criticality', *Resources, Conservation and Recycling*, 155(January), p. 104617. Available at: https://doi.org/10.1016/j.resconrec.2019.104617.