

## Doctoral position in sustainable biorefinery solutions from residual biomasses

Federal University of Toulouse, INSA, *Toulouse Biotechnology Institute (TBI)*

Toulouse, France

### **Title : Transforming residual biomass into quality food and feed products towards a sustainable national bioeconomy strategy – a life cycle optimization platform**

You dream to carry out research that will have real impact? You want to contribute to a cutting-edge “[Make Our Planet Great Again](#)” project and to develop the most comprehensive and integrated transition towards low fossil carbon use in Europe? Here is your chance!

The Cambioscop team at the Department of [Sustainable Chemical Engineering](#) is recruiting a doctoral researcher (PhD) to pursue applied research at the interface of disciplines that include consequential Life Cycle Assessment, Agroecology as well as Environmental & Natural resources economics. We are seeking exceptional early-career scholars committed to connecting interdisciplinary research to important sustainability challenges.

#### **About the position**

The PhD position is part of the [Cambioscop](#) 2018-2023 project, awarded in 2017 to Mrs. Lorie Hamelin. Cambioscop’s objective is to propose sustainable strategies for shifting towards low fossil carbon use in France, by 2050. Though the energy sector can be decarbonized, non-fossil carbon sources will still be needed for the chemical, material and food sectors. In this transition, one key source of carbon stems from residual biomass resources (agricultural residues, forest residues, organic waste, etc.). Yet, their use as a carbon feedstock for products and services relying at present on fossil carbon is not de facto sustainable.

A key step in Cambioscop is to determine, on the basis of an understanding of the 2020-2050 markets and of France’s residual biomass resources, which residual biomass stream to divert to which technology in order to ensure a competitive, sustainable and tailor-made bioeconomy for France. Cambioscop has 6 major interconnected platforms: 1) food & feed; 2) long-lasting bio-materials; 3) bio-oil & bio-gas; 4) platform molecules; 5) short-term hydrocarbons (this includes bio-plastics) and 6) electrolysis, upgrade, hydrogen.

The PhD position proposed here will develop Cambioscop’s food & feed platform and build upon ongoing Cambioscop work, among other the spatial quantification of residual biomasses available. The PhD project will aim to:

- (i) Identify technologies for converting residual biomass into proteins, fiber and other products for human and animal consumption (generically referred to as "biorefineries" herein), and uncover the challenges (societal, technical) related to these
- (ii) Produce the life cycle inventory of the most promising technologies, not only in terms of input and output products / co-product balances, but also in terms of energy balance and substance balance (carbon, nitrogen, phosphorus, particularly )
- (iii) Translate the inventory produced in (ii) into generic equations, so that the life cycle can be easily modelled according to the chemical and biochemical composition of the inputs

(iv) Document how the operating parameters of biorefinery technologies (e.g. temperature, pressure) influence the output products quality and environmental performance of the system

(v) Propose an upscaling, when necessary, of low TRL (technology readiness level) biorefinery technologies towards an industrial operation

Ultimately, the PhD project will propose how to allocate the different residual biomasses (previously spatially quantified) available in France to the various technologies documented in i-v, for food and feed supply. This will be done taking into account the demands for products and services (food and non-food) 2020-2050, identified by a PhD project underway in another part of the Cambioscop project. The vision is to decouple as much as possible the production of food from the need for arable land, and to identify solutions allowing to limit all the environmental impacts (climate change, eutrophication, acidification, particles, etc.) of the transition to a low fossil carbon economy.

The methodological tools to be used in the project will be at the interface between consequential life cycle analysis, ecodesign (use of process simulation software), and multi-criteria optimization.

### **Required qualifications**

The ideal candidate will hold a M.Sc in Environmental / Agricultural Engineering or a related field, be comfortable working in an interdisciplinary team & collaborating with practitioners and managers. Candidates should also be creative, possess strong analytical & system-thinking skills, have strong communication (spoken and written) & interpersonal skills, and the ability to work independently and as part of a team. Experience with Life cycle Assessment, Agroecology and/or land use changes is a strong plus. The PhD student will be supervised by Drs. [Lorie Hamelin](#) and [Ligia Barna](#). Proficiency in English is a requirement; knowledge of French is an advantage (but not a requirement).

The position is available for 3 years, and is based at INSA-Toulouse. Salary follows national directives including full social and health benefits, and is adjusted for work experience. The successful applicant will have opportunities for professional development (e.g., media and communications training) offered by INSA-Toulouse and/or INRAE, for presenting his/her research results at international conferences, and for research stays with the Cambioscop partners. Expected start date: February 2020 (possibility to start later, if the suitable candidate cannot start in the first trimester of 2020).

### **Application**

To apply, please submit the following by email to [hamelin@insa-toulouse.fr](mailto:hamelin@insa-toulouse.fr) using **Cambioscop PhD PDF APPLICATION** in the subject line of your email:

1. Cover letter describing your interest in, and fit for, the project
2. Curriculum vitae
3. Names and contact information of 2 referees
4. Grades transcript if available (bachelor and master level)

Applications will be reviewed on a rolling basis until the position is filled, but those received by **January 14<sup>th</sup>, 2019** will be guaranteed full consideration. Only short-listed applicants will be contacted.

### **Research in France**

For more information about life and research in France, you may refer to the Campus France website: <https://www.campusfrance.org/en/living-in-france> or to the Business France website: <https://www.welcometofrance.com/>

## **More about Cambioscop**

Cambioscop is among the [18 first projects selected](#) within the framework of the “Make Our Planet Great Again” initiative launched by the French President in 2017. The overall aim is to build a foundation for establishing geo-localized, time-dependent and sustainable strategies for the development of bioeconomy in France, which strive to optimize carbon circularity. Among others, the environmental- and cost-efficiency of 300 bioeconomy conversion pathways will be assessed, towards the horizon 2050. The vision is to contribute to the most comprehensive and integrated bioeconomy strategy in Europe. The project benefits from an advisory board including JRC-Sevilla (Circular Economy and Bioeconomy units), Utrecht University (Copernicus Institute for Sustainable Development), IINAS, University of Minnesota and Aarhus University (Centre for a Circular Bioeconomy). The project involves a total of 20 researchers (agronomists, engineers, biochemists, economists) from [TBI](#), [INRA-Rennes](#), [INRA-Grignon](#) and [Toulouse School of Economics](#). A video of the project is available [here](#).