# ÉCOLE ANALYSE DE CYCLE DE VIE D'ÉTÉ ÉCOLOGIE INDUSTRIELLE

## **MONDAY 7 JULY**

11h00 - 12h00

Welcome of participants

This first hour will be used to welcome you, explain the week's program and get acquainted (icebreaker activities).

12h00 - 14h00 Lunch Break

14h00 - 15h30

Introduction to industrial ecology



# History, concepts and tools. Focus on territorial metabolism methods and the creation of industrial symbioses

In the form of a conference, this introduction will present the historical foundations of the scientific field of industrial ecology and will focus on two essential applications: territorial metabolism and industrial symbiosis. Through various case studies, the interest and limits of these two applications will be shared and discussed. The particularities of their implementation in France will be discussed, based on 20 years' experience.

**Speaker: Cyril Adoue**. Engineer and PhD from the Université de Technologie de Troyes, his thesis is part of the scientific field of industrial ecology ('Méthodologie d'identification de synergies éco-industrielles réalisables entre entreprises sur le territoire français', UTT, 2004). He is the author of UE C 'Mettre en œuvre l'écologie industrielle', PPUR, Lausanne, 2007, 120p. and 'Implementing Industrial Ecology', CRC-Press - Science Publisher, 2011. Over the last 20 years, he has taken part in 5 territorial metabolism studies and has supported more than thirty symbiosis initiatives in France and Europe.

15h40 - 17h10 Introduction to LCA



Life Cycle Assessment (LCA) is a standardized methodology for evaluating the potential environmental impacts of products and services from a life cycle perspective. Governed by the ISO 14040/44 standards, LCA serves as a crucial tool in understanding, comparing and reducing these impacts. This introductory conference will provide an overview of the four steps of LCA as defined by ISO 14040/44. You will become familiar with life cycle thinking and the key concepts and terminology of LCA such as functional unit, life cycle inventory or impact categories.

**Speaker: Lorie Hamelin**. Prof. Lorie Hamelin holds an INRAE Professor Chair in Sustainable Transitions towards Low Fossil Carbon Economies, based at INSA Toulouse (France). With over 15 years of international experience in Canada, Denmark, Poland and France, her work has shaped EU and university research agendas, and is published in top-tier journals such as Nature Sustainability and EES. She is a recipient of the prestigious French presidential "Make Our Planet Great Again" award and act as an expert advisor to National Priority Research Programmes in France, Sweden, and the EU.

### **TUESDAY 8 JULY**

09h00 - 10h30

#### LCA for use in consumer communications



Life Cycle Assessment is now used in most sectors, albeit at varying levels of maturity. The most advanced sectors now communicate on the environmental impacts of their products, for regulatory compliance reasons, or because they wish to highlight the performance of their products. The aim of this presentation is to give examples of the practical uses of LCA in the context of communication to the general public: environmental product declarations in the construction sector in France, and environmental labelling in the textile sector.

**Speaker: Laure Couteau**. Aeronautical engineer and holder of a Specialised Masters in Environmental Engineering and Management from the École des Mines de Paris, she worked 10 years in the industry before joining Solinnen in July 2021. She has 9 years' experience in Life Cycle Assessment (LCA) and Ecodesign in large companies (aeronautics, electricity transmission). Her main areas of study/interest are resources (particularly critical and strategic resources), energy and biomass.

10h30 - 11h00

Break

### **11h00 - 12h30** Practical group project on LCA



To help you grasp the content of the introductory lecture on LCA, you will work in groups of up to five to conduct a simplified yet comprehensive LCA of a CO2 capture system using an amine solvent. This hands-on exercise will be supplemented with theoretical insights and group discussions. The LCA will be performed in Excel to provide a clear understanding of the underlying calculations. The conclusion of the practical group project on LCA will be followed by a workshop on eco-design, to help you imagine how to apply what you have learned to your own projects.

#### Supervised by Sibylle Duval--Dachary, François-Xavier Dezert, Tejas Dilipsing Patil

**Sibylle Duval--Dachary** is a LCA research engineer at IFP Energies Nouvelles. She successfully defended her PhD thesis in July 2024, which focused on evaluating with dynamic LCA the potential for negative emissions of carbon capture and utilisation systems. Her current work encompasses both conducting research - primarily aimed at enhancing decision-making processes based on LCA results (e.g., addressing uncertainty and multi-criteria decision-making) - and applying LCA methodologies to real-world projects, including bioproducts and CCUS (Carbon Capture, Utilization, and Storage).

**François-Xavier** is a PhD student working on the environmental sustainability of hydrogen systems in France through Life Cycle Assessment. In particular, he works on the integration of prospective and risk insights for decision making.

**Tejas D. Patil** is currently working as a postdoctoral researcher at IFP Energies Nouvelles, where he focus on enhancing the interpretation step in Life Cycle Assessment. He completed his PhD in November 2024 from Université Gustave Eiffel, in collaboration with the German Aerospace Center, where his research focused on evaluating the environmental impacts of electrified vehicles and developing strategies for eco-sizing their components.

12h30 - 14h00

**Lunch Break** 

**14h00 - 18h00** Practical group project on LCA

### **WEDNESDAY 9 JULY**



Through the introductory lecture and practical group project, you acquired the fundamentals of so-called attributional LCA. However, one important aspect was not covered: the management of multifunctionality. In cases where a system produces multiple products, how should the environmental impact be divided among them? That's what you will find out in this session. Additionally, this session will give you an overview of consequential LCA, and how it differs from attributional LCA.



# THURSDAY 10 JULY

09h00 - 11h00

Territorial LCA: main principles and practical applications



This course provides an introduction to the principles of territorial Life Cycle Assessment (LCA), highlighting the key adaptations required—particularly during the goal and scope definition and Life Cycle Inventory (LCI) phases. Specific attention will be given to the definition of the object of study, system boundaries, and services provided. Practical examples of implementation will be presented, and ongoing research developments in the field will be discussed.

**Speaker : Eléonore Loiseau,** Researcher at INRAE (French National Research Institute for Agriculture, Food and Environment) on Life Cycle Assessment methodology.

She began her career by pursuing a PhD on broadening the scope of LCA studies through the development of approaches at the territorial level. After graduating in 2014, she continued her research on this issue at INRAE, developing and operationalising territorial LCA approaches to support the ecodesign of alternative production and consumption patterns. This includes research into the simulation of territorial trajectories using dynamic and prospective approaches, investigating coupling with integrated modelling.

#### 11h00 - 11h30

**Break** 

#### 11h30 - 12h30

#### Optimizing Resource Flows through Industrial and Territorial Ecology



These sessions introduces you to key methods and concepts for optimizing resource flows at the intersection of sustainability, systems engineering, and territorial planning. With a strong foundation in industrial and territorial ecology, the course emphasizes the application of multi-objective optimization and multi-criteria decision-making tools to real-world sustainability challenges.

Theses sessions will combine lectures with practical application. You will explore how to structure and formalize complex problems involving conflicting criteria, with a focus on designing efficient, collaborative resource exchanges between companies in eco-industrial parks.

**Speaker : Marianne Boix** is Associate Professor at the Laboratoire de Génie Chimique (LGC) in Toulouse, affiliated with Toulouse INP. Her research focuses on multi-objective optimization and multi-criteria decision-making for sustainable resource management, particularly in industrial ecology and the waterenergy-food nexus. She has supervised several PhD projects on eco-industrial park design and renewable energy systems. Dr. Boix is also involved in national research initiatives such as the ACT-4-IE project within the PEPR SPLEEN program, aiming to develop systemic tools for industrial ecology. She leads the Industrial Systems Engineering Master's program at ENSIACET and contributes to interdisciplinary teaching in eco-engineering and process integration. **Sydney Thomas** is a PhD candidate at the Laboratoire de Génie Chimique (LGC) in Toulouse, affiliated with the Toulouse INP. His research focuses on developing a multi-actor-based approach for designing eco-industrial parks, under the supervision of Marianne Boix and Stéphane Negny. His professional interests encompass higher education teaching and research, scientific communication, and consulting in innovative fields. He possesses technical skills in carbon footprint analysis, system dynamics modeling, and multi-objective analysis.

12h30 - 14h00

**Lunch Break** 

14h00 - 15h30

BeCircle: Promoting the circular economy and decarbonisation of regions



This session introduces the challenges of developing industrial synergies within a region, a description of the BeCircle tool and how it works and a case study.

**Mary Hanhoun** is a civil engineer specialising in the environment, with a doctorate in process and environmental engineering from INP Toulouse. She has been a research engineer at Engie Lab CRIGEN for 13 years, where she works on life cycle analysis, industrial and territorial ecology, and renewable energies. She is involved in studies for the implementation of circular economy strategies aimed at decarbonising industrial sites.

15h30 - 17h00

Optimizing Resource Flows through Industrial and Territorial Ecology

# FRIDAY 11 JULY



#### **Practical information :**

- Lunch included
- Transport, hotel, evening meal at your own expense (except Wednesday evening meal)
- Location : Toulouse INP ENSIACET. It's best to stay in a hotel close to INP-ENSIACET, as there are works underway on the public transport lines linking the campus to the city centre. For example, there's the Ibis Style Toulouse Labège, or the originals city hotel Ariane.
- Registration link: https://my.weezevent.com/ecole-dete-pepr-plin
- Contacts for questions : Sibylle Duval-Dachary (sibylle.duval-dachary@ifpen.fr) & Marianne Boix (marianne.boix@toulouse-inp.fr)