



## CALL FOR APPLICATIONS

### Master project - Which futures for transportation could respect planetary boundaries?

#### Context

Transportation is a unique sector in several respects, in terms of contribution to sustainability. While it serves as a driver of growth and social connector, it generates strong negative externalities, particularly environmentally-wise. Overall, the consumption of and greenhouse gas emissions from transportation activities continue to rise, even though this sector has one of the highest mitigation potentials. Many technological solutions appear to align with the carbon neutrality goals set for 2050 at the latest, notably electrification. However, potential shifts in environmental impacts associated with these decarbonization plans, and more broadly, the deterioration of the sector's performance in dimensions other than climate change within planetary boundaries, raise questions. Indeed, respecting the nine planetary boundaries is a prerequisite for the safety of the human species, and moving beyond the current 'climate tunnel' vision adopted by most decision-makers is crucial to adopting planning strategies that offer a peaceful future for humanity.

#### Objective

The objective of this internship is to quantitatively examine the environmental performance of different carbon-neutral trajectories for the transportation sector on a global scale. This aims to identify trends to follow for evolving within the framework of planetary boundaries or returning to it, as six out of nine planetary boundaries have already been crossed. Defining these trends is crucial for both public and private decision-makers, as they will provide a quantitative framework to guide transportation policies for public authorities, as well as business model strategies and research and development for companies, with a holistic respect for the Earth system's capacities.

#### Approach & Method

The study's approach follows a five-step plan:

1. Quantitative assessment of the current global environmental externalities of transportation.
2. Analysis of global trajectories for the transportation sector in terms of intensity and modal shares.



3. Environmental assessment of different trajectories using life cycle assessment (LCA) or input-output evaluation based on planetary boundaries [4].
4. Simulations of the environmental impact of technical solutions and alternative behaviors on respecting these boundaries.
5. Conclusions and recommendations for global transportation trajectories that respect planetary boundaries, addressing the issue of impact allocations.

### **Deliverables**

- A descriptive report on the tasks conducted in word format with references under Zotero
- Zotero library file
- A presentation of the study at CIRAIG and potentially to industrial partner(s)
- Modeling files if applicable
- Participation to the preparation of an article, with co-authorship of the intern, if applicable

### **Supervision and conditions**

The project is supervised by:

- Manuele Margni, Ph.D., M.Sc. A., B. Ing. : Professor at Polytechnique Montreal, Professor HES-SO Valais Wallis, invited fellow at EPFL at IPESE with Pr. François Maréchal, Energypolis, Sion. mailto: [manuele.margni@hevs.ch](mailto:manuele.margni@hevs.ch)
- Anne de Bortoli, Ph.D., M.Sc., B. Ing. : postdoctoral researcher at CIRAIG, Polytechnique Montréal, invited researcher at Ecole des Ponts ParisTech. mailto: [anne.debortoli@polymtl.ca](mailto:anne.debortoli@polymtl.ca)

Location: CIRAIG, Polytechnique Montréal, 3333 Queen Mary Road, Montreal, Canada.

Compensation: internship grant of 1750\$/month.

Duration: 6 months


Application: Interested students must send an application file including a CV, a transcript (bachelor and master) and a cover letter to [anne.debortoli@polymtl.ca](mailto:anne.debortoli@polymtl.ca) and [manuele.margni@hevs.ch](mailto:manuele.margni@hevs.ch). Applications will be reviewed in chronological order and positions remain open until suitable candidates are found.

### **Skills and qualification**

Qualification implies having taken an EPFL LCA course or equivalent, as well as a good level in English.

Desired skills of the applicants are as follows:

- Rigor
- Ability to hierarchize information and summarize
- Ability to conduct large literature review
- Ability to work in team

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- Data analysis

Following knowledges are an asset, by order of importance:

- existing trajectories (likely climate-focused) for transportation, such as those based on the Shared Socioeconomic Pathways (SSPs) of the Intergovernmental Panel on Climate Change (IPCC)
- environmental/carbon budgets
- potential technologies for reducing environmental impact in mobility and freight transportation (electrification and batteries, hydrogen, etc.)

