École Polytechnique Fédérale de Lausanne
Distributed Electrical Systems Laboratory
EPFL-STI-DESL-ELL, Station 11, CH-1015 Lausanne

http://desl-pwrs.epfl.ch

Student project proposal

Project title
A Methodological framework for Assessing Avoided Emissions in a Research Laboratory

Project type ☐ MSc thesis ☐ BA semester project ☒ MSc semester project

Project responsible and e-mail
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Project description
Research group activities, particularly in higher education and scientific institutions, contribute to global carbon emissions through energy use, travel, procurement, laboratory operations, and digital infrastructure. Traditionally, carbon accounting has focused on Scopes 1-3, as defined by the Greenhouse Gas (GHG) Protocol [1], which cover direct, energy-related, and value-chain emissions, respectively. However, there is growing interest in Scope 4 (avoided GHG) emissions which account for the positive climate impact of research outputs, such as innovations or policies that reduce emissions elsewhere.

This project aims to develop a transparent, and practical methodology to assess Scope 4 emissions from the activities of a research group or a laboratory. The methodology will draw on recent advances in life cycle assessment (LCA), consequential modeling, and attribution frameworks, and will account for system boundaries, additionality, and the risk of double counting.

The student will conduct a literature review of current Scope 4 frameworks, analyze case studies and emission attribution methods, and propose a methodological framework or tool tailored to DESL's research outputs and potentially scaled to other EPFL labs. This work should help quantify the downstream emissions savings enabled by the lab's technologies or findings (e.g., in grid decarbonization, increase of reneables integration, efficiency improvements in ultra-fast transportation).

Tasks of the student
- Conduct a literature review on Scope 4 (avoided GHG emissions) in academic research and institutional carbon accounting.
- Identify and account potential scope 4 avoided GHG emissions linked to DESL research outputs.
- Design a methodological framework (and preferably a tool) to quantify avoided emissions based on case-specific attributes.

Requirements
- Familiarity with carbon accounting concepts (LCA, GHG Protocol, environmentally extended input–output analysis (EEIOA) approaches) preferable in research environments.
- Interest in energy systems, environmental engineering, or sustainability.
- Good analytical and communication skills; experience with data processing or modeling tools is an asset.

Literature

[1] Greenhouse Gas Protocol - Estimating and Reporting Avoided Emissions (https://ghgprotocol.org/estimating-and-reporting-avoided-emissions)

[2] Some publications on the topic:

- Kiehle, J., Kopsakangas-Savolainen, M., Hilli, M., & Pongrácz, E. (2022). Carbon footprint at institutions of higher education: The case of the University of Oulu.. *Journal of environmental management*, 329, 117056 . https://doi.org/10.1016/j.jenvman.2022.117056.
- Smith, W., Bebbington, A., Sircar, R., & Pulver, S. (2025). Doctoral Students as Carbon Accountants: Calculating Carbon Costs of a PhD in Neuroscience. *bioRxiv*. https://doi.org/10.1101/2025.01.20.633775.
- Helmers, E., Chang, C., & Dauwels, J. (2021). Carbon footprinting of universities worldwide: Part I—objective comparison by standardized metrics. *Environmental Sciences Europe*, 33, 1-25. https://doi.org/10.1186/s12302-021-00454-6.
- Valls-Val, K., & Bovea, M. (2021). CARBON FOOTPRINT ASSESSMENT TOOL FOR UNIVERSITIES: CO2UNV. *Sustainable Production and Consumption*. https://doi.org/10.1016/j.spc.2021.11.020.
- Mariette, J., Blanchard, O., Berné, O., Aumont, O., Carrey, J., Ligozat, A., Lellouch, E., Roche, P., Guennebaud, G., Thanwerdas, J., Bardou, P., Salin, G., Maigné, É., Servan, S., & Ben-Ari, T. (2021). An open-source tool to assess the carbon footprint of research. *Environmental Research: Infrastructure and Sustainability, 2*. https://doi.org/10.1088/2634-4505/ac84a4.