

The **Climate Finance and Policy Group (CFP)**, **Energy and Technology Policy Group (EPG)**, and **Electrochemical Energy Systems Laboratory (Lukatskaya Group)** offer a

Master thesis project: Assessing the innovation potential of electrochemical direct air capture

Research field and tasks

Rapid emission reductions are needed so that the Paris Agreement's target to limit global warming to well below 2°C remains attainable. Pathways in line with this target presume a swift transition to low-carbon energy sources and – on top – the deployment of carbon dioxide removal (CDR) technologies to remove historic emissions and compensate for emissions that cannot be completely eliminated.

Direct air capture (DAC) with carbon storage offers a scalable, permanent, and relatively easily measurable, reportable, and verifiable CDR method. However, DAC technologies are still in their infancy and high costs have hindered large-scale deployment of DAC. While there are advantages to DAC in its potential to address emissions from distributed sources, the development and deployment of DAC systems has been limited by their high cost and energy requirements.[1] Most research and development has focused on solid sorbent and liquid solvent DAC, both of which use thermal and electrical energy.

To overcome the high energy requirements of DAC systems using thermal energy, electrochemical DAC systems have been recognized as a promising alternative due to their potentially lower energy consumption at lower temperatures and pressures. [2] However, the technological maturity of electrochemical DAC systems is low, with most systems still at laboratory scale. It remains to be assessed how they compare with DAC systems using thermal energy.

This work will include:

- Gathering and analyzing techno-economic data
- Planning and conducting interviews with stakeholders in the DAC industry
- Distilling innovation mechanisms and barriers and relating them to techno-economic developments

Requirements

We are looking for an excellent student with an interest in climate change mitigation and CO₂ capture technologies, preferably with a background in chemical engineering, process engineering, mechanical engineering, industrial engineering, management and technology, science and technology policy, or other relevant disciplines. Some experience with data analysis and Python programming is an asset. Fluency in English is required.

Conditions

The main supervisors are Katrin Sievert, Tobias Schmidt and Bjarne Steffen from the Energy and Technology Policy Group (EPG) and the Climate Finance and Policy Group (CFP), and Anna de Vries and Maria Lukatskaya from the Electrochemical Energy Systems Laboratory. Applications from non-ETH students are welcome. The start date is negotiable.

Your application

Please send us your CV and transcript of records (with grades) and a short cover letter that describes your motivation, relevant experience, and preferences for the starting date. We also need the contact information of two references (no letter required). Please email your documents in one PDF file to Katrin Sievert (katrin.sievert@gess.ethz.ch). We will review the applications on a rolling basis until the position is filled.

References

[1] doi.org/10.1016/j.joule.2024.02.005

[2] doi.org/10.1039/D0EE03382K