

CO2 capture from seawater for production of green fuels

Background

Some sectors such as heavy transport with its planes, ships and trucks will continue to rely on fuels for many years to come. Emissions can be reduced by replacing fossil fuels with e-fuels made from hydrogen and CO₂. If the hydrogen is produced by renewable electricity and the CO₂ comes from a renewable source, no new CO₂ is emitted when the e-fuel is used.

CO₂ can be captured from sea water with the technology Direct Ocean Capture (DOC). The ocean holds some of the widespread emissions from heavy transport and the old emissions made since the industrial revolution.

Why sea water?

Both the atmosphere and the ocean contain CO₂. They constantly exchange this CO₂, so the amounts are in balance. However, the ocean takes out CO₂ from the atmosphere and convert it to other chemical compounds, which are not exchanged with the atmosphere. These processes allow the ocean to store 150 times more carbon per volume than the atmosphere. This higher concentration could make it easier to capture large amounts of CO₂ from the ocean compared to the atmosphere. DOC takes advantage of this high concentration when it takes out CO₂ from the atmosphere by capturing it from the ocean. Another benefit of sea water is that it's widely accessible. This allows for capturing CO₂ places where renewable energy is available to power the process and produce hydrogen.

How will the study be done?

A literature review reveals the status of the technology. Economic and environmental analysis and estimations will be conducted to form the basis for simulations of large-scale energy system with low CO₂ emissions. These simulations should be used to identify pros and cons for DOC as a CO₂ source integrated with hydrogen production for e-fuels. Other potential uses such as DOC for CO₂ storage will also be considered.

When and Who?

The project starts primo 2025 and runs three years from then. It's an industrial PhD project in collaboration between COWI and Aarhus University by the PhD student Frederik Erhard Gullach, Master of Science in Mechanical Engineering.

Impacts and perspectives

The green technologies are many and diverse. This study aims to identify the most viable ways of using the ocean as a renewable source of CO₂, allowing for well-founded decisions for the future of the technology.