

MASTER THESIS PROJECT: LOCAL INFRASTRUCTURES FOR CCS CLUSTERS

Carbon capture and storage (CCS) has been identified as one of multiple technologies that can help achieve deep decarbonization of the heat and power and industrial sectors. For CCS implementation in Sweden, the likely case is that carbon will be captured and liquefied on industrial and or heat and power sites, transported to intermediate storage along the coast from where it is transported for final storage in the Norwegian North Sea. Gothenburg with its surrounding area has the potential to be of special interest for a CCS system with plenty of heat and power generation and industrial plants in the region as well as the proximity to Norway and access to a large port.

CCS from industrial and heat and power plants usually assume both absorption of CO₂ and regeneration of the solvent to take place on site, namely each site would invest in an absorber, stripper and the required heat generation. An alternative concept would be to absorb CO₂ on site and transport the CO₂-rich solvent to a central regeneration facility, where the CO₂, which can then be collected and sent to storage, is separated from the solvent. The regenerated solvent may then be transported back to the capture site and re-used. For this concept to work the feasibility with regards to transportation of CO₂ lean and rich solvent needs to be investigated, in addition, whether there are any economic or environmental benefits needs to be explored. This project will investigate these questions, using the Gothenburg region as a case study. To identify sites that would be suitable participants in a CCS cluster, existing databases containing information about industrial sites and heat and power plants will be used.

AIM

The overall aim is to design a local infrastructure system for carbon capture with a central regeneration unit and compare it to an conventional system with distributed regeneration. The systems will be compared depending on number, size and location of actors in the Gothenburg region. The potential benefit can be determined in terms of economics, environmental impact or technical feasibility. The project will include identifying a potential cluster of industrial and heat and power sites in the Gothenburg area that are suitable for CCS with regards to site specific parameters that are relevant to facilitate efficient carbon capture. Geographic data needs to be considered to choose a location for a shared regeneration facility based on the locations of the included sites and a potential intermediate CO₂ storage in the region. A comparison between the conventional setup of having both an absorber and a stripper located on site will then be compared to the alternative of having a central site for regeneration. The impact of the setups on the capture system as well as the transportation system will be investigated to get a comparison on how the different systems perform. If necessary, process simulations can be used to generate data to be used in the comparison of the CCS systems. General trends and insights should if possible be drawn from the results generated from the case study used in this project.



PRELIMINARY STRUCTURE OF WORK

Below is a tentative structure of the work, which of course may change after initial discussions. Also, results of the initial work may change the focus of the work. The aim is to make a new contribution and to limit the work to be within the scope of a MSc Thesis while maintaining a high quality.

- Establishing an initial time plan of the work.
- Initial literature review of carbon capture and storage and associated infrastructure, techno-economic evaluations of CCS-systems and relevant topics.
- Establishing a method framework.
- Based on a database of industrial sites, identify carbon capture potential and suitable sites to form a CCS cluster in the Gothenburg region.
- Design (a) local infrastructure(s) with a central regeneration unit for a carbon capture cluster.
- Evaluate if economic, environmental or other benefits from using shared solvent regeneration exist.
- Reporting.

ORGANISATION

The proposed project may be performed by one or two students with a chemical or mechanical engineering (or similar) background at the Division of Energy Technology at Chalmers. Courses in Heat and Power Systems Engineering, Industrial Energy Systems or similar is meriting. The research group has a long history in working with industrial site analysis and techno-economic evaluations of CCS systems. The following people will be supporting the work at Chalmers:

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For more information about the Division of Energy Technology check out our website:

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