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Cleaning the air from CO₂ – Life Cycle Assessment of a commercial Direct Air Capture plant

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The level of carbon dioxide (CO₂) in the atmosphere is rising despite all great efforts to reduce the amount, and its contribution to climate change is quite certain [1]. Between 2000 and 2010, the anthropogenic greenhouse gas (GHG) emissions increased by 2.2% per year [1]. Hence it is important to find ways to reduce and/or reuse CO₂ emissions and to remove CO₂ from the atmosphere.

Direct Air Capture of CO₂ is one possibility to lower the CO₂ level in the atmosphere. The company Climeworks developed a Direct Air Capture plant to remove CO₂ from atmosphere and create a valuable resource. In 2017 a new facility was opened in Hinwil (Switzerland) which removes 900 ton of CO₂ per year [2].



Figure 1. Direct Air Capture Plant in Hinwil [2].

For the operation of the plant and release of the CO₂ electricity and low grade thermal energy is needed (Figure 2), the question is, how ecological the process is? To answer this, a Life Cycle Assessment (LCA) was performed.

This presentation will show results in the category of climate change and other environmental impact categories. A focus including different scenarios will be on the necessary heat and power source.

In order to classify the results a comparison will be made with the commercially used Haber-Bosch process which produces much of the technically used CO₂ [3]. As the Haber-Bosch process is a multi-output process producing Ammonia and CO₂ a sensitivity analysis is conducted regarding allocation principles.

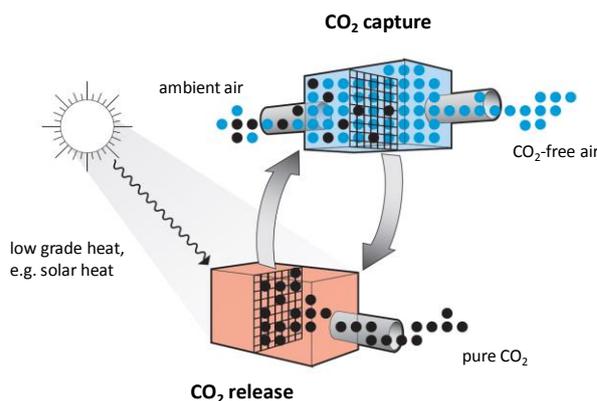


Figure 2. Direct Air Capture working cycle [2].

References

- [1] IPCC, 2014: Climate Change 2014: Mitigation of Climate Change. Part of the Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change
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