

3rd Generation Absorption Technologies Demonstrated at Industry

Publieke samenvatting / Public summary

Aanleiding

Lowering the cost of CO₂ capture is an important step in enabling CCUS. CO₂ absorption using solvents is the most mature capture technology. Developing advanced solvents with improved properties can lead to significant cost reduction of the process. Within 3GAIN, we will demonstrate CO₂ capture from an industrial flue gas using two 3rd generation solvents: STAR and CarbonOrO. STAR is developed for high pressure desorption, whereas CarbonOrO targets low temperature desorption. STAR is an ammonia-based system which allows for CO₂ to be desorbed at high pressures (up to 10 bar), thus lowering the cost of the downstream CO₂ compression unit. In the STAR solvent formulation, taurine is added to ammonia to lower the solvent volatility and increase the kinetics of CO₂ absorption, further lowering the process costs. CarbonOrO is a phase-change amine blend system. While traditional amine desorbers operate at 120°C or above; CarbonOrO desorber temperature is as low as 70°C, saving 10-25% in energy. 3GAIN targets at least 30% cost reduction, as compared to the benchmark amine system (30 wt% aqueous monoethanolamine solution).

Doelstelling

Within 3GAIN, we will demonstrate the process of CO₂ capture using STAR and CarbonOrO. STAR will be used to desorb CO₂ at high pressures, between 6 and 10 bar, whereas CarbonOrO will be used to demonstrate low temperature (70°C) desorption. The demonstrations will be performed using TNO's

Projectinformatie / Project information

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Algemene informatie / General information

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mobile CO₂ capture plant (CRIS), which will be installed at Plant One in Rotterdam. Industrial flue gases will be used in the demonstrations. The project will bring both STAR and CarbonOrO1 from TRL 4 to TRL 6 for the application of flue gas. The performance of STAR and CarbonOrO will be benchmarked against that of 30 wt% monoethanolamine (MEA) solution, the state-of-the-art solvent for CO₂ capture. By performing an economic assessment of a full scale application, we will show that STAR and CarbonOrO have the potential of lowering the CO₂ capture costs by 30% as compared to state of the art MEA.

Korte omschrijving

The activities can be divided into five work-packages (WP). In WP1, the necessary modifications to TNO's mobile CO₂ capture plant (CRIS) will be performed. In WP2, benchmarking campaigns with MEA, CarbonOrO and STAR will be performed in the lab. After that, in WP3, CRIS will be transported to Plant One, where the demonstration campaigns for STAR and CarbonOrO will take place, using real flue gas. Finally, in WP4, we will perform a techno-economic assessment of the processes, and compare the results to that of MEA for a full scale application. Management and dissemination activities will be carried on in WP5.

Resultaat

CO₂ capture will be demonstrated using industrial flue gases. The innovative solvents STAR (TNO) and CarbonOrO will be demonstrated at TRL6 and benchmarked against the commercial MEA solvent. Based on the experimental results a full scale industrial operation will be simulated. This serves as input for a technical-economic evaluation resulting in commercial CO₂ capture costs for the solvents STAR and CarbonOrO. The novel third generation solvent systems are expected to significantly outperform first and second generation solvent systems, based on energy requirements (a.o. desorption at temperatures below 100°C desorption at elevated pressure), stability of the solvent (a.o. no aerosol formation, limited solvent degradation), and possibility for innovative process design (lower

CAPEX).

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

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