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Post-combustion capture processes integrated with coal-fired power plants
WP 2.1: Post-combustion capture
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EXCECUTIVE SUMMARY

The study is carried out in work package 2.1 "Post-combustion CO_2 capture" of the CATO project (CO_2 Afvang, Transport en Opslag) and is supported by TSA Power Generation

In this report the integration of post-combustion processes with a coal fired power plant is analysed.

The CO_2 capture processes considered are:
- Econamine FG Plus
- KS-1 solvent of Mitsubishi
- CORAL solvent of TNO.

The considered power plant is a new 800 MWe coal fired power plant with an efficiency of 46% net.

Econamine FG Plus

Application of the Econamine FG Plus solvent in the CO_2 post combustion process is possible after modification of the flue gas cleaning process to reduce the SO_x concentration and the dust concentration in the flue gas upstream of the CO_2 capture plant.
The steam demand for the regeneration of the solvent is rather high (3.2 MJ/kg CO_2 resulting in a LP steam flow of 222 kg/s). For that reason a modified LP-steam system is considered with the possibility to take a LP-section out of operation in case of CO_2 capture. Heat integration of the condensate of reboiler in steam/water system is required. Additional heat integration in the condensate flow of the power plant is limited due to the reduced condensate flow and will reduce the total energy consumption for CO_2 capture from 1.20 GJ/t CO_2 captured to 1.16 GJ/t CO_2 captured. The efficiency reduction of the power plant with full integration will be 9.9%-point compared to 10.2%-points in case of only condensate integration of the reboiler.
The required cooling capacity will increase with approximately 200 MWth (25%). For retrofit cases a main issue is the extra space needed for all the new equipment.

KS-1 solvent of Mitsubishi

Application of the KS-1 solvent of Mitsubishi in the CO_2 post combustion process is not possible at the moment for coal fired power plants even after modifications of the flue gas cleaning process to reduce the SO_x concentration.

The steam demand for the regeneration of the solvent is lower compared to the Econamine FG Plus process (2.8 MJ/kg CO_2 vs. 3.2 MJ/kg CO_2). Also with KS-1 solvent a modified LP-steam system is considered with the possibility to take a LP-section out of operation in case of CO_2 capture. Heat integration of the condensate of reboiler in steam/water system is required. Additional heat integration in the condensate flow of the power plant is still limited due to the reduced condensate flow and will reduced the total energy consumption for CO_2 capture from 1.10 GJ/t CO_2 captured to 1.06 GJ/t CO_2 captured. The efficiency reduction of the power plant with full integration will be 9.0%-point compared to 9.3 %-points in case of only condensate integration of the reboiler.
The required cooling capacity will increase with approximately 200 MWth (25%). For retrofit cases a main issue is the extra space needed for all the new equipment.

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