



50680473-Consulting 08-2739 Confidential

**Post-combustion capture processes  
integrated with coal-fired power plants  
WP 2.1: Post-combustion capture  
Deliverable WP 2.1-11**

Arnhem, 31 December 2008

Author: P.J. Ploumen

By order of CATO and co-financed by the TSA co-funders (Technical Service Agreement  
Power Generation)

---

author : P.J. Ploumen  
B 40 pages 1 annex

08-12-31  
Pln/MS

reviewed : J. Middelkamp  
approved : R. Meijer

08-12-31  
08-12-31



© KEMA Nederland B.V., Arnhem, the Netherlands. All rights reserved.

This document contains confidential information that shall not be transmitted to any third party without written consent of KEMA Nederland B.V. The same applies to file copying (including but not limited to electronic copies), wholly or partially.

It is prohibited to change any and all versions of this document in any manner whatsoever, including but not limited to dividing it into parts. In case of a conflict between an electronic version (e.g. PDF file) and the original paper version provided by KEMA, the latter will prevail.

KEMA Nederland B.V. and/or its associated companies disclaim liability for any direct, indirect, consequential or incidental damages that may result from the use of the information or data, or from the inability to use the information or data contained in this document.

## EXCECUTIVE SUMMARY

The study is carried out in work package 2.1 "Post-combustion CO<sub>2</sub> capture" of the CATO project (CO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> post combustion process is possible after modification of the flue gas cleaning process to reduce the SO<sub>x</sub> concentration and the dust concentration in the flue gas upstream of the CO<sub>2</sub> capture plant.

The steam demand for the regeneration of the solvent is rather high (3.2 MJ/kg CO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> capture from 1.20 GJ/t CO<sub>2</sub> captured to 1.16 GJ/t CO<sub>2</sub> 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<sub>2</sub> 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<sub>x</sub> concentration.



Confidential

The steam demand for the regeneration of the solvent is lower compared to the Econamine FG Plus process (2.8 MJ/kg CO<sub>2</sub> vs. 3.2 MJ/kg CO<sub>2</sub> ). 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<sub>2</sub> 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<sub>2</sub> capture from 1.10 GJ/t CO<sub>2</sub> captured to 1.06 GJ/t CO<sub>2</sub> 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.

The rest of this document is confidential