CONFIDENTIAL

$CO_2$ Capture using Amine PRocesses: International Cooperation and Exchange

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# GAS PATH INTEGRATION STUDY

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**PUBLIC SUMMARY**

This report addresses the options and costing of gas path components resulting from the integration of a post combustion capture (PCC) plant into two power plants firing bituminous coal (800MW) and lignite (300MW), with three different scenarios being considered: existing plant, capture ready plant and capture equipped plant. The study assumed a generic layout including the following components:

1. Fan(s) located in different parts of the PCC plant.
2. Direct contact cooler (DCC).
3. $SO_2$ polisher (POL).
4. Absorber.
5. PCC bypass.

It evaluates five different configurations for each case:

1. Separate DCC and $SO_2$ polisher.
2. Combined DCC and $SO_2$ polisher in a single column.
3. Without DCC.
4. Without $SO_2$ polisher.
5. Without DCC/$SO_2$ polisher.

The capital and operating costs of each configuration are analysed. This has been done considering two or four treatment trains. The PCC total direct capital cost decreases in the order Separate DCC/POL > Combined DCC/POL > Without DCC ~ Without POL > Without DCC/POL.

In all cases studied the optimum configuration was with a single fan located downstream of the PCC absorber. In this location the $CO_2$ has already being removed and the flue gas is at its lowest temperature, thus reducing the size and capacity of the fan. It has been assumed that the same fan materials of construction would be used in all fan locations. This would need to be confirmed by fan manufacturers. It is possible that more expensive materials will be required with the fan located downstream of the PCC absorber. Similarly, it would be necessary to verify with fan manufacturers that a single fan can handle the total volumetric flow rate and pressure drop for the PCC plant.

It has been confirmed that the $SO_2$ concentration of the flue gas entering the absorber has to be maintained at the lowest level possible to avoid unnecessary consumption of MEA. In this study the optimum $SO_2$ concentration (pre-absorber) was assumed to be 10 mg $Nm^{-3}$ (6% $O_2$, dry) in all cases. This would be achieved by the $SO_2$ polisher (existing and capture ready plants) or by the FGD unit (capture equipped plant).

For the 800MW case firing bituminous coals, the optimum through life cost of gas path integration decreased in the order existing plant > capture ready plant > capture equipped plant for both the two- and four-train cases. It was found that in all these cases the DCC was not required. As the temperature of the flue gas exiting the FGD is 45°C, it is cheaper to remove the DCC (and save its capital cost) at the expense of losing the corresponding exported power revenue.

For the 300MW case firing lignite, the optimum through life cost decreased in the order capture ready plant > existing plant ~ capture equipped plant. The difference between the existing plant and the capture equipped plant was so small that they can be considered as almost identical cases for both the two- and four-train cases. In all these cases the DCC was required as the lost exported

power without it was significant. In this case the DCC would reduce the temperature of the flue gas from 54°C at the FGD outlet to 40°C before entering the PCC absorber.

The increased FGD capital and operating costs for achieving larger removal efficiency of $SO_2$ are significantly higher for the lignite case than for the bituminous coal case. This is a result of higher $SO_2$ concentration in the flue gas entering the FGD absorber for the lignite case.

The findings of this report indicate the importance of an economical analysis of the flue gas integration options on a fuel-by-fuel basis, including the case when a particular flue basket is planned for a power plant.

The rest of this document is project confidential.