**IEAGHG Information Paper: 2017-IP33; CEMCAP**

Industrial activities accounts for 20% of the total global anthropogenic $CO_2$ emissions. Iron & steel industry, cement production, chemical manufacturing and petroleum refining make up a total of 61% of industrial emissions. Consequently, application of CCS in energy-intensive industrial sectors symbolises an important reduction of direct emissions in industry. However, due to the different nature of $CO_2$ sources, it is not possible to find a common CCS solution for all the industries and each of them must be considered separately.

CEMCAP is a collaborative H2020 project, coordinated by SINTEF, focused on carbon capture technologies applied to the cement industry. The strategy is based on the use of different systems at full and partial capture to evaluate their economic viability. CEMCAP will use existing pilot-scale tests rigs together with a designed and built clinker cooler for oxyfuel cement plants. In addition to their experimental section, techno-economic studies will be assessed.

Recently, the CEMCAP project has released their deliverable 3.2 “CEMCAP framework for comparative techno-economic analysis of $CO_2$ capture from cement plants” (for more information, see link below), which contains transparent and valuable information on their last advances and economic assessment.

In the deliverable 4.2 “Design and performance of CEMCAP cement plant with MEA post combustion capture”, CEMCAP compared the use or partial and full capture systems with the cement plant without capture system. This techno-economical assessment pointed out the cost of cement, $CO_2$ captured and $CO_2$ avoided. As expected, the costs increased with the installation of carbon capture systems. However, the cost of captured $CO_2$ and avoided $CO_2$ are lower in the case of full capture compared to partial capture. Those results agreed qualitatively with outcomes from the literature, as for example, the IEAGHG technical report (2013/19) with some differences in values obtained due to different assumptions. As extracted from their deliverable 4.2 “Design and performance of CEMCAP cement plant with MEA post combustion capture”:

"*The total cost calculated in this work is lower than the 51.4 €/t cement reported by IEAGHG [IEA, 2013] for the case without $CO_2$ capture. The main reasons for this difference are the higher capacity factor assumed in the CEMCAP project (91.3%, vs. 80%), leading to lower CAPEX and fixed OPEX per ton of cement in CEMCAP, and the lower price of electricity assumed in CEMCAP (58.1 €/MWh vs. 80 €/MWh). The higher cost of electricity, however, benefits to cases where power is generated in addition to steam (coal or gas CHP). Indeed, in such cases, the high expected revenues from the electricity sales decrease the internal cost of steam required for the $CO_2$ capture. Comparatively, this results in higher cement and $CO_2$ avoided costs for the cases with $CO_2$ capture in this report than reported by [IEA, 2013]*"

Remarkably, the consortia carried out a sensitivity analysis on the parameters considered for the study (fuel, electricity price, carbon tax and steam supply). Those had a limited impact on the cost of the cement without capture while its importance increased on the cases with capture. However, the use of carbon tax will highly influence the cement cost in a traditional plant while it will not be that significant in the industry with capture system. Moreover, the steam supply source and electricity price have a noticeable impact on the cost of cement and $CO_2$ avoided. For example, if 30% of the required steam can be extracted from the cement plant, the cost of $CO_2$ avoided can be reduced by 14%.

This study covers multiple carbon capture scenarios in the cement industry, including different technologies, capture rate, steam sources and electricity cost. The conclusion of those results is to

highlight the importance of considering multiple variables when comparing different carbon capture systems, such as steam demanding technologies to emerging configurations which do not require the use of steam.

For more information: https://www.sintef.no/projectweb/cemcap/

The IEAGHG Technical Report (2013/19) “Deployment of CCS in the Cement Industry” can be found here: http://ieaghg.org/docs/General_Docs/Reports/2013-19.pdf

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