Optimizing integrated reference cases in the OCTAVIUS project - DTU Orbit (09/11/2017)

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Adding a carbon capture plant to a power plant reduces the efficiency of said power plant. In order to keep this drop in efficiency as small as possible, several optimisation studies are performed in the OCTAVIUS project. Based on the work of the European Benchmarking Task Force-EBTF within the CESAR, CAESAR, and DECARBit projects, two reference power plants are modelled in Ebsilon®Professional. The first is an 800 MWe coal case, the second a 430 MWe natural gas combined cycle (NGCC) case. For each power plant two separate capture plants are considered: one using 30 wt% MEA as solvent system, the other with CESAR1, a mixture of AMP and PZ as solvent system. This results in four different reference cases which are optimized by varying different process parameters and evaluating process modifications. In a second step, the integration of the capture plant into the power plant is evaluated. This is important especially for the coal fired power plant, where integration of waste heat from the capture plant or the CO_2 compressor intercoolers can lead to a significant increase in overall efficiency. The configuration of intercoolers for the CO_2 compressor is adapted to achieve the highest overall efficiency. For the natural gas combined cycle plant, integration is not that beneficial, since there is no heat sink available in the water steam cycle. In the end, the cost of electricity and cost of CO_2 avoided is calculated for all four cases. While the CESAR1 solvent system in a conventional absorber-stripper scheme is less costly (almost 17%) than the MEA solvent system in a process with Lean Vapour Compression for the coal cases, the result is the opposite for the two NGCC cases though the difference is not substantial.

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