4th Post Combustion Capture Conference (PCCC4)

CO_2 Capture assessment in the Mexican electricity sector 1st part

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Keywords: CO_2 Capture; NGCC; Efficiency; Model simulation; EGR; Integral System.

1. Abstract

The research evaluates the most advanced and proven Gas Turbine (GT) technologies to date in a 1x1 scheme (400 MW on average) for application of CO_2 capture schemes.

It has been demonstrated that the minimum energy required for the separation of CO_2 is higher in a Natural Gas Combined Cycle (NGCC) than in a coal-fired power plant. Therefore, existing schemes are evaluated to increase the CO_2 content in the Exhaust Gases (EG) for a NGCC, and thus help reduce the energy penalty and the investment cost in CO_2 capture system. The schemes analyzed are: Exhaust Gas Recirculation (EGR), Evaporative Gas Turbine (EvGT), Supplementary Firing Combustion (SFC), External Firing combustion (EFC) and alternating systems with Selective Exhaust Gas Recycle (S-EGR) and hybrid.

The TGs that prevail in Mexico: Mitsubishi (15%), Siemens (41%) and General Electric (44%) including M-501 GAC, SGT6-8000H and GE7HA.01 models were evaluated in Thermoflex 26®, which obtained Levelized Cost of Electricity (LCOE) of 31.46, 31.18 and 31.05 USD/MWh, respectively. The GE offers the lowest LCOE and EGR system was the scheme that less energy penalty presented.

In this first part only the EG conditions and the performance of the NGCC as a results are presented, which will be the input data in the next stage. Where the CO_2 capture system will be modeled in HYSYS V8.6®. The EGR implementation helped to improve the energy efficiency of the NGCC and increased the content of CO_2 from 4.2 to 7.1 mol% at 40% EGR. Likewise, EGR helps to reduce the LCOE in the integral system with CO_2 Capture by 3 USD/MWh.

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