Comparisons between oxy-fuel combustion and IGCC technologies in China coal-energy industry

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Abstract
A comparison between oxy-fuel combustion plants and IGCC plants has been carried out. Oxy-fuel combustion performs better for the retrofit of exist pulverized coal plants after the evaluation of efficiency, retrofit cost and O&M cost. China is currently and will depending on coal for its energy for a long time. Plenty of PC plants are used in existing power plants due to its lower coal consumption.
One way to reduce CO_2 emission with CCS is to equip existing power plants with appliances for capturing CO_2 without modifying substantially the material and the process of generation. This situation is totally different with United States and European countries. IGCC is a promising technology which has been developed for decades in those developed countries. However, in China, the technology is not as mature as developed countries. China needs to find a CO_2 capture technology which is fixed for China's situation. After the comparisons it is concluded that although IGCC with pre-combustion is a promising technology in European countries and United States, oxy-fuel combustion is more suitable based on China's situation.

Introduction
Oxy-fuel combustion is a process which burning fossil fuel in nearly pure oxygen rather than in air. The process eliminates nitrogen from the flue gas by combusting the fuel in a mixture of oxygen and recycled flue gases. While an Integrated Gasification Combined Cycle (IGCC) is a technology that turns coal into synthesis gas (syngas). It then removes impurities from the coal gas before it is combusted. In this paper, we will make a comparison between these two technologies.

Assessment of the development of oxy fuel combustion as CCS technology in China
Southeast University and Huabei Electricity University have studied the characteristics of pulverized coal combustion, thermodynamics analysis and pollutant control in O_2/CO_2 mixtures using numerical simulation . Tsinghua University has reported a decrease of SO_2 and NO_x emissions based on the characteristics of coal combustion and pollutant emissions under oxyfuel conditions . Huazhong University of Science and Technology have investigated desulphurization under oxyfuel combustion in a vertical tube electrical heating reactor and established a small oxy-fuel combustion test system . Zhejiang University is looking into oxyfuel combustion in circulating fluidized bed combustors .We can see all of the researches related in China are laboratory scale, the stage of the technology development are still in the primary compared to European countries. In 2007, there were more than 10 IGCC and poly-generation projects proposed in China, though many of these have been more recently put on hold. The only one proceeding at present is a so-called "green gen" program launched by the China Huaneng Group , which is one of the top 10 power companies in the world and is the

largest coal-based power generator in China, representing about 9% of China's generating capacity.

Conclusions

We can conclude from these experimental results that oxy-fuel combustion pulverized coal combustion is technically and economically feasible for retrofitting existing power plants. Generally CO_2 capture reduces the net electricity efficiency compared to the conventional air firing power plants without CO_2 capture, however, the efficiency and costs of oxy-fuel combustion are less or comparable if the CO_2 capture is also included in the conventional power plants. However, IGCC with pre-combustion is more technologic than IGCC with post-combustion and oxy-fuel combustion based on the technological development at present. IGCC with 80% CO_2 capture has the same efficiency with conventional coal fired plants and more capital investment costs and power production cost than IGCC plants with 60% CO_2 capture. From my point of view, if we need to build new plants for CO_2 capture, IGCC with pre-combustion is a better choice, but for retrofitted plants, oxy-fuel combustion plants are technologically and economically better than post and pre-combustion.

After the comparison of the two technologies, we can see that oxy-fuel combustion performs better for the retrofit of exist pulverized coal plants after the evaluation of efficiency, retrofit cost and O&M cost. China is currently and will depending on coal for its energy for a long time. Plenty of PC plants are used in existing power plants due to its lower coal consumption. One way to reduce CO_2 emission with CCS is to equip existing power plants with appliances for capturing CO_2 without modifying substantially the material and the process of generation. This situation is totally different with United States and European countries. IGCC is a promising technology which has been developed for decades in those developed countries. However, in China, the technology is not as mature as developed countries. China needs to find a CO_2 capture technology which is fixed for China's situation. After the comparisons, although IGCC with pre-combustion is a promising technology in European countries and United States, oxy-fuel combustion is more suitable based on China's situation.

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