Impact of CO_2 capture and methanation in coal power plants on global climate change

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In 2019, 37% of global electricity demand was produced by coal-fired power plants. The International Energy Agency (IEA) estimates that coal-fired power plants will account for 22% of electricity demand in 2040 in the Stated Policies Scenario (SPS). Renewable energy (solar, wind power, etc.) greatly depends on time and season, thus it is necessary to operate coal-fired power plants with the baseload power. In order to realize Korea's pledge of carbon neutrality in 2050, clean coal-fired power plants implemented with CO_2 capture, utilization, and storage (CCUS)should be considered.

This study performed a techno-economic assessment of 500 MW_e coal-fired power plants with 10% of the CO_2 methanation and 80% of the geological sequestration for CCUS. H_2 required for CO_2 methanation was produced from a water alkaline electrolysis using intermittent surplus renewable electricity. In addition, when CCUS technology was applied to coal-fired power plants worldwide, the effects on atmospheric CO_2 concentration and global surface temperature were predicted using the global carbon cycle.