Design and operation of a future CCS infrastructure: Multi-period model

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CCS technologies separate CO2 from industrial and energy-related sources, transport them to a storage location, and isolate them from the atmosphere for a long period. Moreover, recent research work considers utilization of CO2 as fuels, chemicals, or nutrients. Most of the early attempts to design and model the future CCS infrastructure were either limited to examining an individual sub-processes (e.g., utilization, capture, storage, sequestration or transport) of technologies or focused on a predetermined CO2 emissions pathway. In this study, a multi-period programming model is developed for planning CCS infrastructure including CO2 utilization and disposal, as well as considering the variation of CO2 emissions and mitigation targets over a long-term planning horizon leading to phased infrastructure development. The proposed model is formulated as a mixed-integer linear programming and solved via a commercial software tool, GAMS. The results show that the optimal design of the future CCS infrastructure of Korea starts with small-size technologies together with reducing the CO2 currently emitted by steel plants. As emissions grows, more technologies of different sizes should be built to meet the mitigation target.