Identification of early-stage CCU pathways with uncertainty analysis

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The abnormal climates over the world in 2020 implies the solution such as a carbon capture and utilization (CCU) is urgent. A CCU pathway is a combination of the carbon source, capture and conversion technologies, and the products. The right combination allows not only CO_2 mitigation but also profitability. The economic and environmental feasibility of the CCU pathways must be investigated to sort out the promising ones from the numerous options. However, many of the CCU technologies are not mature enough to be commercialized. As this immaturity puts uncertainties on the CCU system, the potential of the pathway as a mean value in addition to the economic and environmental risk should be analyzed before commercialization. The CCU superstructure for iron and steel industry is constructed, considering all the flue gases, appropriate carbon capture technologies and the products. For the sake of simplicity, a lumped model for chemical processes are used in the superstructure. Then the few optimal pathways are identified by superstructure optimization. Then the sensitivity analysis is conducted for the pathways to measure the uncertainties on the pathway evaluation result.