A multi-objective optimization approach for CCS infrastructure considering profit and life cycle assessment under uncertainty

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This study addresses an optimal planning problem of the carbon capture and storage infrastructure concerning techno-economic and life cycle assessment under uncertainty in the product prices, operating costs and life cycle inventory. The typical methodologies assess the performance of the problem under the variability of the uncertain parameters by optimizing the expected value of the objective function. This approach can have large probabilities of the value optimized in unfavorable scenarios. In this paper, we introduce a two-stage stochastic multi-objective mixed-integer linear programming model that takes into account the maximization of total profit and the minimization of total Eco-99 score under uncertainty. The proposed modeling is performed by appending the probabilistic risk metric to objective function as an additional optimized criterion. This can suggest different kinds of planning strategies to various kinds of decision-makers. The capabilities of our study are demonstrated through case studies based on Korea, for which valuable insights are obtained.