A multi-objective optimization for a design of biomass to hydrogen (B2H2) supply system

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Biomass to hydrogen (B2H2) system is one of the promising solutions that can substitute current fossil fuel-based energy system. Whereas, there is a lack of studies for design and operation or investment strategy of the B2H2 system. In this study, we propose a new multi-objective optimization model to systematically design and analyze an investment strategy of the B2H2 system considering three different evaluation criteria: economic, energy security, and environmental impacts. In the system, we include different technologies (e.g., hydrogen production, biomass and hydrogen storage, and transportation) and activities (e.g., biomass cultivation and collecting) along with various external factors related to energy economy such as energy price fluctuation and demand uncertainty. The capability of the proposed model is validated through a case study of design problem for energy supply to transportation sector of future Korea. As a result, we identify the optimal configuration of the system and main cost drivers, national energy security level, and local CO_2 emission rate.