

Design and Optimization of Hydrogen Supply Chain Network: A Case Study

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Abstract

The hydrogen supply chain plays a crucial role in producing and utilizing hydrogen as a clean energy carrier. It is a complex and evolving system that requires coordination among various stakeholders, including governments, industries, and researchers, to ensure its effectiveness and sustainability. This project considers the problem of designing the hydrogen supply chain network with a case study in Oman. The primary objective of having a hydrogen supply chain network and designing it effectively is to create a system that optimizes the configuration and the flow of hydrogen and reduces related costs such as production and transportation costs. To achieve that, a complex planning challenge emerges when there is a need to align the production of green hydrogen with its consumption. The design problem at hand requires precision consideration of critical factors, encompassing the strategic determination of the quantity and placement of production facilities, the delineation of optimal routes for the pipeline network, and the formulation to construction schedule. The outcomes of this project are objective to offer valuable insights into the viability of hydrogen energy production in Oman, clarification whether it presents a beneficial prospect for the nation. Moreover, the findings will guide the formulation of strategies to maximize the potential benefits derived from the implementation of hydrogen energy infrastructure within the Oman context. A mixed integer linear programming formulation was developed to solve the problem. The model is implemented by IBM ILOG CPLEX OPL. The model included candidate locations for production; synthetic data was used to validate and understand the model. The research examines several scenarios involving candidate locations for production and transportation facilities. It critically evaluates transportation logistics, including pipeline and trucking options, to ensure efficient distribution while minimizing operational and capital costs.

Keywords

Optimization, Hydrogen Supply, sustainability