Optimal LNG importation portfolio considering multiple risk factors

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PII: S0959-6526(17)30488-2
DOI: 10.1016/j.jclepro.2017.03.053
Reference: JCLP 9180

To appear in: Journal of Cleaner Production

Received Date: 20 March 2016
Revised Date: 1 January 2017
Accepted Date: 8 March 2017


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Abstract: Using a supply chain perspective, this paper determines optimal portfolio strategies for liquefied natural gas (LNG) importation based on multi-objective optimisation models. Unlike previous studies, this paper first constructs a quantitative maritime transportation risk indicator by considering maritime transportation distances and the risk of pirate attacks. Next, it comprehensively considers the economic risks of importation, the exporting countries’ political risks and the maritime transportation risks associated with developing optimal LNG importation strategies. Finally, from an emergency management perspective, different emergency scenarios are proposed to analyse how LNG importation strategies can be adjusted for extreme events occurring in LNG-exporting countries or along maritime transportation routes. A case study of China’s LNG importation decisions is analysed using the proposed novel analytical framework. The non-dominated sorting genetic algorithm-II (NSGA-II) is employed to obtain the Pareto solution sets of the multi-objective optimisation models. The empirical results show that if extreme events occur in Indonesia or if ships transporting LNG to China suddenly encounter pirate attacks along the North Africa–China maritime transportation route, China should adjust its LNG importation strategies in a timely manner to ensure the security of LNG importation. By considering various significant risks, the new analytical framework proposed in this study offers an effective tool for making decisions about the optimal portfolio for LNG importation.

Keywords: LNG importation portfolio, maritime transportation risk, political risk, emergency management, NSGA-II algorithm

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