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A Stochastic Approach To Liquefied Natural Gas (LNG) Ship Route Planning Model Under Weather Disruptions

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Abstract

This study is about a two-stage stochastic LNG inventory routing and scheduling problem under weather disruptions which can cover all contract durations including long-term, short-term and spot demand. We consider a fleet of heterogeneous LNG carriers with partial tank filling capability of cargoes to travel multiple customers in routes. In this case, as it has to satisfy numerous customers in a route, the sailing time of an assigned vessel may be longer than the time from the current transportation model which serves single demand point. Understanding the ideas of this model made us to pay attention on boil-off gas (BOG) losses during voyage so that the resulting model can be more accurate in estimating the overall shipping cost. The stochastic approach aims to use historical information to find a stable solution that withstands disruptions caused by dust storm in Persian Gulf as a test-bed. The proposed LNG scheduling model formulated as a multiple vehicle routing problem (VRP) considering weather disruptions as a random variable. Since the stochastic VRP is combinatorial optimization problem in nature, we use Monte Carlo sampling technique to overcome the computational burden while ensuring good quality of solutions. Performance of our approach was compared against the deterministic counterpart using two performance measures: expected value of perfect information (EVPI) and value of stochastic solution (VSS).