

## Designing a Reliable Bio-fuel Supply Chain Network considering Link Failure Probabilities

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### Abstract

This study presents a pre-disaster planning model that seeks to strengthen the multi-modal facilities links for a bio-fuel supply chain system under limited budget availability. The model decides a set of links to invest with the objective of maximizing the post-disaster connectivity while simultaneously minimizing the bio-fuel supply chain related costs. The failure probability of the links between the multi-modal facilities are estimated using a spatial distribution which is developed from real world data. We developed a combinatorial Benders decomposition algorithm to solve this challenging *NP*-hard problem and considered the state of Mississippi and Alabama as a testing ground to validate this approach. Computational results show that the proposed solution approach is capable of solving the problem efficiently. We conduct a number of experiments by changing the reliability improvement cost, availability of budget, biomass supply changes, and decision makers risk averseness degree on bio-fuel supply chain network performance. Numerical analysis indicate that, under normal conditions, the minimum cost model provides an unit bio-fuel delivers of \$3.56/gallon. However, in case of a disaster, the unit bio-fuel delivery cost provided by the minimum cost model reaches up to \$3.96/gallon compared to \$3.69/gallon provided by the reliable model solution.

### Keywords

Bio-fuel supply chain network, multi-modal facility location, network reliability, disaster management.

### Biography

**Dr. Mohammad Marufuzzaman** received his Ph.D. in Industrial & Systems Engineering from Mississippi State University in 2014. He received his MASc degree in Industrial Systems Engineering from University of Regina, Canada in 2010 and B.Sc degree in Industrial & Production Engineering from Shah Jalal University of Science & Technology, Bangladesh in 2006. He joined Industrial & Systems Engineering department as an Assistant Professor in August 2015. His main areas of interest are in supply chain optimization with applications in renewable energy, stochastic programming, decomposition methods, solving large scale supply chain network problems and supply

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**Sushil Raj Poudel** currently is a PhD student in the Department in Industrial and System Engineering at Mississippi State University. He is majoring in Industrial Engineering with concentration on operation research. He received his Bachelors degree (in 2013) in Industrial and System Engineering from Mississippi State University. Sushil's research interests are in Bio-fuel Supply Chain and Transportation Network, Multi-modal Transportation Network and Disruption Management.

**Dr. Linkan Bian** is an assistant professor in Industrial and Systems Engineering Department at MSU. He received his Ph.D. in Industrial and Systems Engineering from Georgia Institute of Technology in 2013. He also holds a dual M.S. degree in Statistics and Mathematics from Michigan State University, and a B.S. degree in Applied Mathematics from Beijing University. Dr. Bian research interests focus on the combination of advanced statistics and stochastic methods for system modeling, diagnosis, and prognosis. Applications of his research include advanced manufacturing systems and supply chains. He is currently participating in a DoD project focusing on uncertainty quantification and process optimization in Additive Manufacturing processes. His research is also funded by FedEx Express. Dr. Bian's publications have appeared in journals such as Institute of Industrial Engineers (IIE) Transactions, Statistical Analysis and Data Mining, Naval Research Logistics, and several conference proceedings. He is a member of INFORMS and IIE.