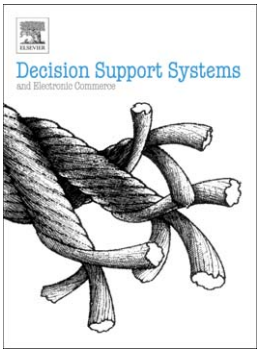

A bi-objective two-stage robust location model for waste-to-energy facilities under uncertainty

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Abstract

Waste-to-energy (WTE) facilities have begun to play an increasingly important role in the management of municipal solid waste (MSW) worldwide. However, due to the environmental and economic impacts they impose on urban sustainability, the location of WTE facilities is always a sensitive issue. With the frequent involvement of private investors in WTE projects in recent years, the uncertainties associated with MSW generation often impose a huge financial risk on both the private investors involved and the government. Therefore, decision support for the location planning of WTE facilities is necessary and critical. A bi-objective two-stage robust model has been developed to help governments identify cost-effective and environmental-friendly WTE facility location strategies under uncertainty, in which one objective is to minimize worst-case annual government spending, while the other minimizes environmental disutility. To efficiently solve the model, a novel solution method has been developed based on a combination of the ϵ-constraint method and the column-and-constraint generation algorithm. The proposed model is demonstrated via a case study in the city of Shanghai where the government plans to locate incinerators to release pressure on sanitary landfills. The computational results show that the proposed model and solution method can effectively support decision-makers. A further sensitivity analysis reveals several useful MSW management insights.

Keywords: Facility location, waste-to-energy, multiple objective programming, robust optimization, solid waste management