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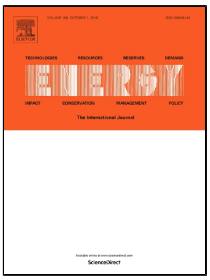

A generalized fuzzy chance-constrained energy systems planning model for Guangzhou, China

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A generalized fuzzy chance-constrained energy systems planning model for Guangzhou, China

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Abstract: In this study, a generalized fuzzy chance constrained programming method is developed for the energy system planning in Guangzhou under multiple uncertainties. Through integrating the generalized fuzzy programming and chance-constrained programming into an inexact optimization framework, this method can handle uncertainties expressed as probability distributions, fuzzy sets and fuzzy random variables. Solutions of energy supply, power generation, capacity expansion, air pollutant emissions, forest planning, and system cost under different levels of α-cut are obtained considering the constraint violation risk. The results show that the consumption of coal will decline gradually, while natural gas will become the main source of energy supply in the future; the power structure of the city changes from coal to clean energy (e.g., solar, wind, hydro and other renewable energy), and the city's energy supply security is enhanced by stimulating the utilization of renewable energy and reducing the utilization of imported energy. Moreover, a rational use of ecological land is of great significance. Forests can absorb carbon dioxide and will play a positive role in reducing greenhouse effects. When the preferred α value is predetermined by the decision makers, the energy selections can also be obtained directly from the resulting fuzzy membership function. The solutions obtained in the study will help managers to optimize the existing city energy structure, make