Guest Editorial Preface

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Energy optimization is one of the key ways to generate cost savings. To fully optimize your energy resources, we need to know more about the behavior of the facility's occupants and their interaction with the environment. A good first step in any energy optimization project is to perform a comprehensive energy analysis, where energy experts examine the energy usage patterns and demands of a facility and identify opportunities to improve energy efficiency.

Decision-making is the cognitive process of selecting a course of action from multiple alternatives. Fuzzy decision-making originates from the ideas proposed by Bellman and Zadeh (1970), who introduced the concepts of fuzzy constraints, fuzzy objective and fuzzy decision. Fuzzy decision-making deals with non-probabilistic uncertainty and vagueness in the environment in which the decision-making takes place. Fuzzy set approaches to decision-making are usually most appropriate when human evaluations and the modeling of human knowledge are needed. A rational approach toward decision-making should take human subjectivity into account, rather than employing only objective probability measures. The fuzzy set theory implements classes or groupings of data with boundaries that are not sharply defined. The benefit of extending crisp theory and analysis methods to fuzzy techniques is the strength in solving real-world problems, which inevitably entail some degree of imprecision in the variables and parameters measured and processed for the application.

This special section presents the quality papers, which show how to make decisions under fuzziness for energy optimization and engineering.

In the first paper, Oztaysi et al. utilize two fuzzy multi criteria decision- making methodologies, axiomatic design (AD) and analytic hierarchy process (AHP), for ranking both renewable and conventional energy alternatives. In the first phase AHP is utilized to determine the importance of the criteria and in the second phase fuzzy AD is used to evaluate the experts' assessments. Conventional and renewable energy alternatives are evaluated according to technical, economical, air quality and site selection perspectives.

In the second paper, Cavallaro aims at developing an approach based on fuzzy-sets to handle the uncertainty of nuclear power costs in Italy. The underlying aim is to appraise the economic advantages of nuclear power compared with other traditional energy sources, namely coal and natural gas. Having illustrated the general state of the art of nuclear power in terms of production, installed power and economics, a more detailed evaluation follows to select the most important economic and financial parameters involved in calculating the industrial cost (overnight cost, O&M, fuel, etc.) to then build the fuzzy functions and process them using the fuzzy TOPSIS method in order to obtain a final ranking of alternatives analyzed.

In the third paper, Jinturkar and Deshmukh use a fuzzy goal programming approach for

rural energy resource allocation for heating and cooking. The detail survey is conducted to determine the potential of biogas and biomass and to find energy consumption pattern in the four villages of Buldhana district, Maharashtra, India. Four fuzzy objective functions and six constrains, based on the local availability are considered in the model. Four scenarios are developed which are equal priority, cost priority, emission priority and local resources priority. Due to vast uncertainty in energy data at micro level, fuzzy goal approach is found suitable to take into consideration the variation in energy consumption rate. The proposed model can provide the best possible options for micro-level energy planning to the decision maker.

In the fourth paper, Sadeghi and Hosseini try to investigate different factors that either challenge FLP application in energy modeling field or strengthen it as a serious competitor for other strategies under uncertainty like Stochastic Programming and Minimax Regret Strategy. Unfamiliarity of energy modelers and planners with this method, no favor of academic circles, confusion of modelers and planners stemmed from plurality of fuzzification and defuzzification methods and finally the lack of effective and comprehensive softwares for solving FLP problems are some of important obstacles against FLP application in energy planning field. In contrast, variant methods for different problems, simplicity, flexibility, and possibility of FLP application in current supply energy models are strong points that propound FLP as an effective approach.

I hope that this issue will provide a useful resource of ideas, techniques, and methods for recent research on Fuzzy Decision Making in Energy Optimization and Engineering. I am grateful to the referees whose valuable and highly appreciated works contributed to select the high quality papers published in this issue.

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