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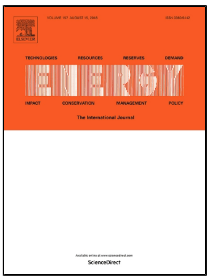

Multi-objective optimization for sustainable development of the power sector: An economic, environmental, and social analysis of Iran

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Multi-objective optimization for sustainable development of the power sector: An economic, environmental, and social analysis of Iran

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Abstract

This paper aims to analyze Iran's long-term power sector development from economic, environmental, social, and sustainable perspectives. For this purpose, a linear programming model is developed, which includes three objective functions: minimization of costs, minimization of CO_2 emissions, and maximization of created jobs. To provide a sustainable plan, analytical hierarchy process is employed to allocate expert-based weights to the objective functions. Moreover, to support the decision-makers, Pareto-optimal alternatives are explored by varying the weights of objectives. The multi-objective model is solved by applying a weighted method based on fuzzy membership functions. The results show that a sustainable scenario leads to high technology diversification. Furthermore, the combined cycle would be the dominant option in Iran's long-term generation mix. In addition, power generation from non-hydro renewables, solar PV in particular, should grow faster than the total electricity demand. The findings indicate that the economic scenario fulfills Iran's commitment to 4% reduction of emissions compared to the current trend; however, the sustainable and environmental scenarios would cause achievement of the superior 12% reduction goal. Multi-objective analysis shows that moving away from one's objective optimum value leads to significant improvements in other objective values.

Keywords: Multi-objective linear programming, Sustainable development, Power system planning, CO_2 emissions, Job creation, Renewable energy sources