

Creating Renewable Energy Investment Portfolio in Turkey between 2018-2023: An Approach on Multi-Objective Linear Programming Method

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Abstract : The World Energy Outlook shows that energy markets will substantially change within a few forthcoming decades. First, determined action plans according to COP21 and aim of CO₂ emission reduction have already impact on policies of countries. Secondly, swiftly changed technological developments in the field of renewable energy will be influential upon medium and long-term energy generation and consumption behaviors of countries. Furthermore, share of electricity on global energy consumption is to be expected as high as 40 percent in 2040. Electrical vehicles, heat pumps, new electronic devices and digital improvements will be outstanding technologies and innovations will be the testimony of the market modifications. In order to meet highly increasing electricity demand caused by technologies, countries have to make new investments in the field of electricity production, transmission and distribution. Specifically, electricity generation mix becomes vital for both prevention of CO₂ emission and reduction of power prices. Majority of the research and development investments are made in the field of electricity generation. Hence, the prime source diversity and source planning of electricity generation are crucial for improving the wealth of citizen life. Approaches considering the CO₂ emission and total cost of generation, are necessary but not sufficient to evaluate and construct the product mix. On the other hand, employment and positive contribution to macroeconomic values are important factors that have to be taken into consideration. This study aims to constitute new investments in renewable energies (solar, wind, geothermal, biogas and hydropower) between 2018-2023 under 4 different goals. Therefore, a multi-objective programming model is proposed to optimize the goals of minimizing the CO₂ emission, investment amount and electricity sales price while maximizing the total employment and positive contribution to current deficit. In order to avoid the user preference among the goals, Dinkelbach's algorithm and Guzel's approach have been combined. The achievements are discussed with comparison to the current policies. Our study shows that new policies like huge capacity allotment might be discussible although obligation for local production is positive. The improvements in grid infrastructure and re-design support for the biogas and geothermal can be recommended.

Keywords : energy generation policies, multi-objective linear programming, portfolio planning, renewable energy

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