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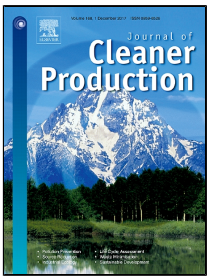

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A risk-based assessment of the household water-energy-food nexus under the impact of seasonal variability

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Abstract

This paper presents the applications of water-energy-food nexus model developed by the authors to assess the impact of seasonal variability (i.e., increase/decrease in number of summer days). A new risk-based approach has been implemented to assess the impacts on water, energy and food consumption. This approach incorporates the uncertainties associated with supply-demand balance and seasonal variability. The risk in this paper is defined as the probability of exceeding acceptable level of shortage in per capita demand for water, energy and food in any year of the planning period. Using the risk-based approach and the water-energy-food model, the impact of a number of demand management strategies and their-related water-energy-food is investigated in the city of Duhok, Iraq. This is to find the most effective strategy that achieves sustainable supply for water, energy and food. The results show that use of recycled grey water for non-potable applications is able to decrease the risk of exceeding acceptable shortage in water demand but increases the energy demand for water treatment. Additionally, using anaerobic digestion of food waste and wastewater sludge for energy recovery can decrease the risk of exceeding acceptable shortage in energy demand from 55 to 10% in 2026.

Keywords: water-energy-food nexus, risk, seasonal variability, supply-demand balance, demand management strategies

1 INTRODUCTION

Water, energy and food (WEF) are among essentials required to meet the basic human needs and ensure economic and social development. Clearly, there is an inextricable interrelationship between water, energy, food, and climate change. The stresses on water, energy and food resources increase due to the high influence of population growth, urbanisation and economic development as well as changes in

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