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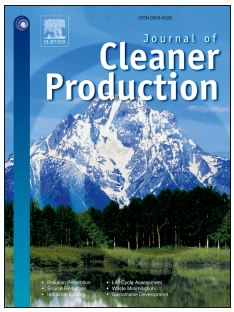

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Dynamic Modeling Application for Simulating Optimal Policies on Water Conservation in Zhangjiakou City, China

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Abstract

Zhangjiakou City, one of the organizers of 2022 Olympic and Paralympic Winter Games, is designed as a water conservation area of Beijing because of its unique location, but it's an extremely water-deficient area and has poor economy. The dual constraints of its water resources endowment and external policies force the developers of Zhangjiakou City to confront the dual restriction of the water supply support guarantee and control of water pollutants. The purpose of this paper was to realize water conservation on the premise of sustainable economic development. A linear optimization model, based on a dynamic input–output analysis, was developed to simulate the complex interrelationships between water resources and the social economy, and explore the optimal policies. The simulation results show that from 2013 to 2025, the targets of water conservation, including water retention and water environment control, will be achieved with an annual chemical oxygen demand emissions reduction rate of 12.6% and a constant annual real gross regional product rate of 4.3%. The optimal policies contributes to increasing reclaimed water supply, easing the groundwater exploitation, and optimizing the structure of industries and water demand. The evaluation is suitable for simulating economic development with strict constraints of environmental conservation in other regions with insufficient natural resources.

Keywords

Water conservation; Linear optimization model; Dynamic input–output model; Policies simulation; Economic development

1. Introduction

Balancing and coordinating the linkage between economic growth and environmental conservation is significant to sustainable development (Llop, 2007), because of the mutual constraints between them, especially in developing countries. Resources required by

Abbreviations: COD, Chemical Oxygen Demand; CNY, Chinese Yuan; GRP, Gross Regional Product; I–O, Input–Output; CAST, Cyclic Activated Sludge Technology; MBR, Membrane Bio-reactor.

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