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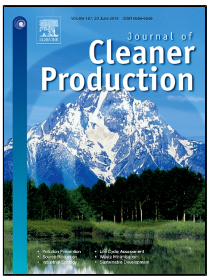

Dynamic simulation of the atmospheric environment improved by a focus on clean energy utilization of resource-based cities in China

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Dynamic simulation of the atmospheric environment improved by a focus on clean energy utilization of resource-based cities in China

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Abstract: Industrial structures in China's resource-based cities are unlikely to materially change in the short term, and the large quantities of air pollutants emitted by residents' energy consumption cause serious air pollution. It is therefore urgently required to frame policies that can be adopted to realize the sustainable development of a social economy under the constraint of atmospheric environment in China's resource-based cities. In this paper, we develop a dynamic optimization model by using input–output analysis with gross regional product (GRP) maximization as the objective function. This model contains three submodels: the socioeconomic submodel, atmo-environmental control submodel, and energy submodel. The model is applied to Tangshan City, a typical resource-based industrial city, to conduct a dynamic simulation with 13 terms from 2013 to 2025 and based on the data in 2012. The goal for the model operation is to realize the optimal development of a social economy under the restrain of certain emission levels of air pollutants. This goal is achieved by introducing a comprehensive policy that includes a residential clean energy promotion policy and an industry emission reduction policy, and industrial restructuring also plays a role by industrial subsidies. The simulation results demonstrate that sulfur dioxide (SO_2) and nitrogen oxides (NO_x) can be reduced by 53% and 45%, respectively, in Tangshan City in 2025 compared with their values in 2012 with an annual GRP growth rate of 6.2%. The total output of the clean energy in the simulation period is 41.4 million tons of standard coal. The goal of improving the atmospheric environment and sustainable development of social economies in resource-based cities can be achieved by coordinating the relationship among economic development, atmospheric environmental protection, and energy consumption through a dynamic optimization model with a comprehensive policy and industrial restructuring.

Keywords: *atmospheric environment; dynamic optimization model; input–output analysis; clean energy; resource-based cities*

1. Introduction

The State Council issued the *Sustainable Development Plan for National Resource-based Cities* (the State Council, 2013) in 2013. This plan defines 262 resource-based cities. These cities are