Comprehensive analysis of the potential of introducing renewable energy to reduce GHG and SO_2 emissions in Chonqing city, China

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Abstract

Because of the serious damage caused by acid rain, Chongqing city was designated as an Acid Rain Control Zone by the Chinese Central Government. The main factor responsible for the acid rain is the ever-increasing emission of sulfur dioxide (SO_2) due to utilization of coal as the primary energy source to meet increasing energy demand. Simultaneously, CO_2 emission has dramatically increased with coal utilization. In order to transform the current energy structure, alternative renewable energy technologies must be identified and proved feasible and effective. This research aims to comprehensively analyze the benefits of small-scale hydropower and wind power technologies to reduce SO_2 and Greenhouse gases (GHG). For this purpose, we constructed a dynamic comprehensive evaluation model based on an Input-Output (I/O) analysis for the period 2010-2020. The simulation results indicate that the introduction of small scale hydropower and wind power technologies have a positive impact on Chongqing's socio-economic, environmental and energy development in the first half of the study period. However, the results also show that the scarcity of renewable energy technologies to meet the increasing energy demand as well as the stricter emission constrains affect both economic growth and SO_2 and GHG reduction efforts from the latter half of the study period. To address this weakness, the study suggests that additional advanced renewable energy technologies are necessary as well as specific regulations to meet air pollution reduction targets. Last but not least, some feasible policies are proposed by analyzing the potential economic benefit of reducing air pollution and GHG emissions in terms of improved quality of life and environmental conservation. We argue that these benefits could offset the lower GRP growth obtained by the proposed policy.

Keywords: acid rain, greenhouse gas, dynamic input-output model, renewable energy technology, simulation analysis