Comprehensive Evaluation of Environmental Economic Policies with Emphasis on Utilizing Renewable Energy in Beijing

ABSTRACT

Development of renewable energy is considered as an effective measure to control GHG emissions. Policies to promote development of renewable energy have received increasing attention in the last decades. As the most industrialized and urbanized region in China, Beijing plays a central role to highlight the impact of environmental policies on the development of renewable energy and the mitigation of GHG emissions. In terms of GHG emissions by industry, the electricity and heat industry is the largest emitting source in Beijing. The GHG emissions in the electricity and heat industry account for nearly 30% of the total GHG emissions in 2010. In terms of fuel type, coal combustion is the largest GHG emitting source in Beijing. The GHG emissions emitted by coal reached half of the total GHG emissions in 2010.

In 2011, Beijing government published the "12th Five-Year Plan of Economic and Social Development", whose environmental objective is to make CO_2 emission per unit GRP reduce 18% compared with 2010 level, namely the GHG intensity smaller than 56.1 t CO_2e/million CNY in 2015. Also the "12th Five-Year Plan of New and Renewable Energy Development" has been issued initially by Beijing government in order to enhance the utilization of renewable energy and reduce the GHG emissions. It is urgent to increase the share of renewable energy by reducing the consumption of fossil-oriented energy sources in the electricity and heating industry in order to decrease GHG emissions. In 2013, Beijing government published the Beijing governmental working report, which includes the objective of economic development that GRP in 2020 will be doubled by 2010. Based on this background, we proposed effective environmental economic policies to promote the economic growth and mitigate the GHG intensity.

In this study, based on the input-output table, we constructed a dynamic

input-output model into which renewable energy industries and economic policies i.e. emission tax are introduced, so as to analyze their effects on reducing GHG emissions and promoting economic growth, and to find out if the environmental economic policies are effective to realize the government's targets. The analysis not only explores the relationships among Beijing's renewable energy, economy and environment, but can also analyze the future trends of the economy and GHG intensity from 2010 to 2025. The objective function is the maximized GRP; subjective functions include material flow balance, value flow balance, energy supply-demand balance and investment-saving balance. We set the same GHG emissions constraint in case 1 and case 2, GHG emissions in term t are less than n times of that in base year (n=1.4-2.0). In case 2, renewable energy industries and carbon tax are introduced into the model. The simulation results prove that the integrated model can reflect the development of Beijing's economy with high reliability.

The simulation results show that the proposed environmental policy is effective to realize the government's targets. It illustrates that carbon tax of 60 CNY/t CO_2e is the optimal tax rate for Beijing city to promote renewable energy development, in addition to the economic development and GHG emissions mitigation. With the policies introduction, GRP growth rate will be 6.2% and the GHG intensity will be 41.9 t CO_2e/million CNY in 2025, 38.7% lower than 2010 level. Total generation amount of renewable energy from 2010 to 2025 will be 19,352 thousand tce. The share of renewable energy generation in the total electricity and heat generation reaches 8% in 2025. In this sense, the government's environmental and economic targets can be achieved.

This study provides a basis for us to evaluate and analyze the influence of environmental policies on economic development, energy structure adjustment and GHG emissions reduction. The comprehensive policies are proved to be effective to promote the development of renewable energy. Furthermore, it can provide useful suggestions for policy-makers. For example, the government should set a new objective of GHG intensity in 2015. The simulation results show that it can realize the target easily with the introduction of comprehensive policies in Beijing.