

CAN IGCC GAIN MARKET COMPETITIVENESS BY CONSIDERING THE EXTERNAL COST OF CONVENTIONAL COAL POWER PLANTS IN CHINA?

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Overview

China has already become the world's second greatest energy consumer with high economic growth. As the main domestic resource, coal plays the most important role in electricity power generations and will continue to dominate for a long time. How to meet the rapidly growing electricity requirement as well as considering the global need of mitigation of greenhouse gas (GHG), and eliminating other harmful pollutants due to coal burning such as SO_x, NO_x and PM, will be a huge challenge to Chinese government. Integrated coal gasification combined cycle (IGCC) power plant is emerged as an attractive option for both economic development and environment protection. However, there are many barriers for the adoption of IGCC such as relative high capital cost. Based on a scenario exercise, by establishing China's electric sector model and externality quantification, this research aims to evaluate how much market competitiveness IGCC would gain if the external costs of electricity power plants are internalized and the corresponding emission mitigation as well.

The paper is organized as follows: After the introduction in Section 1, Section 2 provides a brief reviewing of methodologies of this research, including the energy modeling approach used, the characteristics of Integrated China Electricity Model, and the specification of external cost. In Section 3, three scenarios are designed and rationalized. The results of these scenarios are presented in Section 4. Further policy implications and perspectives based on the results are discussed in Section 5 and Section 6 makes a brief conclusion.

Methods

Multi-period market equilibrium model META Net (The Market Equilibrium and Technology Assessment Network Modeling System).

Results

For the change of China's electricity generations structure, IGCC does not penetrate into the market in a large scale in BAU scenario due to its relatively high capital cost. After the internalization of external costs, IGCC gains much competitiveness in the electricity sector, while the share of conventional coal power plants decreases sharply, causing the significant reduction of total electricity output at the same time.

As for emissions mitigation, due to the abolishment of conventional coal power plants and the wide adoption of cleaner electricity generation method, emissions of both CO₂ and airborne pollutants are eliminated extensively, so do the total external costs of electricity sector.

Conclusions

China's growing economy strongly depends on coal and will remain so for a long time. As for electricity sector, if only considering the economic factor, due to its lower price and shorter construction cycle, the demand of conventional coal would increase significantly with the economy growth and there is no space in electricity market for new technologies such as IGCC. However, the conventional coal-fueled electricity generations will toward a limitation if environmental is taken into account.

Internalization of external cost in the price of electricity is an important policy instrument towards the sustainable development in the energy use. IGCC gains competitiveness and penetrates into China's electricity market successfully when external costs of conventional coal-fueled electricity generation are internalized. Furthermore, internalization of external costs has a significant impact on reducing the emission from the electricity sector.

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