

# Carbon pricing and electricity market reforms in China

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**Abstract** As a large emerging economy, China is exploring to establish a carbon-pricing system to mitigate greenhouse gas emissions. The electricity sector which generates the greatest amount of China's carbon dioxide emissions should be covered by such a carbon-pricing system. The review of the three main stages of China's electricity market reforms shows that the degree of electricity marketization is relatively low, which might become an obstacle to carbon pricing. This paper develops theoretical and empirical models to analyze the impacts of carbon pricing on electricity supply under two scenarios, namely, marketization and regulation. It is concluded that the electricity market reform is a prerequisite for the development of carbon pricing. Without market-oriented reforms of electricity pricing in China, carbon pricing might lead to a shortage in electricity supply. Potential electricity market reforms to encourage market competition and promote market-oriented electricity pricing are also suggested.

**Keywords** Carbon pricing · China's electricity market · Reforms

## Introduction

During the decade of 2002–2011, the average annual growth rate of electricity production in China was 12 %,

which exceeded the country's GDP growth rate of 11 % per annum (NBSC 2012). To meet the expanding demand for electricity, various reform measures, such as electricity investment liberalization and the introduction of competition in generation, have been adopted (Xu and Chen 2006). By 2011, China's installed electricity capacity reached 1,063 million kW and was the largest electricity generation market worldwide (Editorial Board 2012). However, coal is still the major source and contributes to about 70 % of the total generation mix, which in turn is contributing significantly to China's CO<sub>2</sub> emissions (Kan et al. 2012). In 2007, China already surpassed the USA in energy-related CO<sub>2</sub> emissions (WEO 2006). China's CO<sub>2</sub> emission will be about 10–14 billion tons, and per capita CO<sub>2</sub> emission will be 7.4–9.8 tons by 2050 according to the projections by Jiang et al. (2010).

In response to the global climate change and energy crisis, Chinese government published a white paper titled *China's policies and actions to address the climate change* and made a commitment to reduce carbon intensity by 40–45 % below the 2005 level by 2020 (Xinhua News Agency 2011). To insure this commitment is met, China's 12th Five-Year Plan states that the country will improve its statistical accounting system used to monitor greenhouse gas emissions and establish a sound market of carbon trading. The latter is one of the main policy instruments of carbon reduction (NDRC 2011a). Carbon trading could be regarded as a specific form of carbon pricing. In this market, power generation enterprises are obliged to have emission rights to cover the CO<sub>2</sub> that results from their production, and emissions allowances can be sold and purchased (Kara et al. 2008). A market price for carbon emission would emerge. The “invisible hands” of the market would lead to emission reduction at the lowest cost (Chappin and Dijkema 2009). These changes may have a

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