

# ***[EFFICIENCY VS. EQUITY: EVALUATING THE IMPACTS OF REFORMING AND INTEGRATING CHINA'S ELECTRICITY MARKET]***

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## **Overview**

This study conducts an ex ante analysis to quantify the economic and environmental impacts of reforming China's electricity sectors toward marketization and integration. Two reform scenarios (provincial market scenario and regional market scenario) adapted for the actual reform progress and future direction are considered and compared with the no-reform scenario. The impacts under different reform scenarios are quantified and compared using a partial market equilibrium model integrating high-frequency electricity load, production and trade data in five Southern Chinese provinces. It is found that replacing governmental planning with market competition can eliminate inter-firm inefficiency by reallocating production from high-cost firms to lower-cost competitors, thus result in wholesale price drop, carbon emission reduction, generation costs saving and social welfare improvement. Provincial market coupled with governmental-set trade can realize the majority benefits. Establishing regional market in which inter-provincial trade and domestic production are simultaneously optimally determined can further expand the regional benefits but also have heterogeneous impacts at provincial level.

## **Methods**

Three scenarios are defined to simulate China's electricity market reform. Planning scenario represents a counter-factual no-reform scenario. Two reform scenarios (provincial market and regional market) represents different market designs in terms of the level of marketization and integration. In the market scenarios, we assume a perfectly competitive partial market equilibrium model with inelastic demand. The hourly demand is supplied by a minimized generation costs subject to the physical constraints (e.g. generation capacity, transmission limits and reserve capacity requirement) as well as different market institution arrangements. Thus, we can simulate the market clearing prices, the inter-province import and export, and the generation mix structure under different market designs. Based on these results, the welfare impact (both the overall impact and the redistribution impact) and the carbon emission impact could be obtained and compared with the planning scenarios.

## **Results**

In the context of five provinces in Southern China, we found that replacing planning mechanism with market mechanism can potentially lead to substantial benefits in terms of generation cost saving, wholesale price reduction and carbon emission. Compared with the planning scenario, both market scenarios can achieve efficiency gains, which are estimated to be about 14.3-21.0 billion yuan ( on the order of 5.7-8.4%) in the year of 2018. The wholesale price could be reduced by 22.7-23.5% compared with the fixed benchmark tariff. The carbon emission can be reduced by about 12.4 million ton (2.4%) to 16.5 million ton (3.2%) in the two market scenarios, respectively. Although the regional as a whole benefit positive economic and environmental impacts from marketization and integration, individual provinces have heterogeneous impacts. Some provinces may trade off among local development, environmental protection and economic efficiency.

## **Conclusions**

Our research estimates the potential benefits of market reform and provides scientific sound measures for policy makers to evaluate the pros/cons of different market designs and formed informed roadmap of the reform and integration. And our analysis shows that different market design must be balanced against the cost of implementing. Although the regional market brings more efficiency gain, it results in an uneven distribution of the efficiency gains among the provinces. Considering the key role of the local governments in crafting and implementing the market reform, this can be a factor hindering regional market establishment.