



# Economic dispatch in the electricity sector in China: potential benefits and challenges ahead

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Half of the world's coal was consumed by China in 2015, of which 47.3% was in the power sector. The coal-dominated power generation mix is also the leading source of carbon emissions and air pollutants: 43% of Chinese carbon dioxide emissions came from the power sector in 2014, while the proportion of SO<sub>2</sub>, NO<sub>x</sub> and PM in the national total was 31.4%, 29.8% and 5.6% respectively. Despite coal being a cheap source of power generation, industrial electricity prices are higher in China when compared with many other countries, such as the United States. Therefore, conserving the energy in the power sector might be a good policy choice to address challenges of energy security, environmental sustainability and affordability.

The amount of coal consumed in the power generation sector is not only influenced by advances in technology, but also by the institutional rules governing the sector. Most power systems around the world will dispatch generators based on their position in the merit order (economic dispatch). Under this dispatch rule, lower-cost generation units have the priority to be dispatched first as long as grid security is not affected. However, coal-fired generation units in China are dispatched in a unique way called '*equal share*': all the generators of similar type receive approximately the same allotment of running hours in a year. This will waste energy because lower efficiency units are allowed the same running hours as higher efficiency ones. The Document Number 9, issued by the Chinese State Council in March 2015, signalled a new round of electricity market reform. One of the important tasks of this on-going reform is to change the electricity dispatch rule to a more market-based one. Therefore, to provide references for the cost-benefit analysis of the on-going electricity market reform, this study aims to quantify the economic dispatch savings in Chinese coal-fired power sector.

The main conclusions from our research are as follows:

1. The heat rates of coal generators in China exhibit huge differences across generators in different geographical regions. This indicates the possibility that some energy could be saved from economic dispatch, when compared with that from the current equal share dispatch. Moreover, the fact that negative correlations between the generator efficiencies and their allocated running time do exist in some provinces, further proves the necessity to implement economic dispatch.
2. The transition from the existing dispatch model to economic dispatch may face several major political and economic challenges. Currently, running hours allocated are insufficient for cost recovery, which hinders implementation of economic dispatch at a national level, and no



generation unit wants their piece of the cake to be eaten by others without further compensation. The over-supply status of coal-fired generation capacity in all provinces impedes implementation of economic dispatch at a regional level, since provinces are reluctant to import electricity from their neighbours via regional dispatch, since this would reduce their own fiscal income and development opportunities. Furthermore, the differences in generator heat rates among different ownership types hinder the reform of existing dispatch rules in a provincial level; this is because benefits of re-allocation among different ownership types will induce the tensions between central government and local government.

3. We find that 5.67% of the coal used for power generation would have been saved if provincial economic dispatch had been implemented in 2014, which equals to 0.05% of Chinese GDP in that year (based on cost of coal savings only). Moreover, the provinces with bigger saving shares are mostly concentrated in Northeast and Northwest China. Due to the great coal price differences among provinces, the total coal savings of 71.78 Mtce from shifting to provincial economic dispatch would be reduced to 45.89 Mtce (for regional dispatch) and 43.40 Mtce (for national dispatch) when the scope is enlarged. However, the energy saved from energy-efficient dispatch increases as the dispatch area expands – 78.27 Mtce in total can be conserved by national energy-efficient dispatch. Based on these findings, some policy implications are proposed as follows:

1. Dispatch reform will undoubtedly induce revenue re-allocation among different generators – therefore, the most important challenge will be how to reconcile the revenue realignment among generators so that some of them will operate more and others will operate less. A possible approach is to establish a two-part pricing scheme, which contains: 1) a capacity price paid in RMB per kW per year, based on the generator availability 2) an energy price paid in RMB per kWh, based on the generator output. This pricing scheme can compensate for the generators whose running time are reduced after implementation of economic dispatch.

2. Greater economic benefits can be earned from larger dispatch areas, even though the total energy saving potential may be reduced due to the coal price differences. To achieve these economic returns from wider dispatch areas, the first step is to introduce explicit carbon pricing at regional (or national) level, which will penalize inefficient coal plants with access to cheap local coal resources. The second step is to develop a proper mechanism to allocate the extra revenues coming from cross-border power exchanges in regional or national economic dispatch.

3. Under the current power operation regime in China, the electricity grid companies oversee the actual dispatch, and consumers are the rate-payers who must bear the costs of power generation. Without any change in the pricing mechanism, the economic dispatch reform might be simply an income transfer among generation companies, which is the major reason why the energy efficient dispatch reform piloted in 2007 failed. Therefore, it would be better to establish a cost pass-through mechanism to retail prices, since the benefits from lower overall system costs will be received by both the grid companies and rate-payers. Moreover, this approach would ensure support from all players in the power system as the dispatch reform proceeds.

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