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## Energy price reform in China

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### **Abstract**

China has determined to assign the market a decisive role in allocating resources. To that end, getting energy prices right is crucial because this sends clear signals to both producers and consumers of energy. While the overall trend of China's energy pricing reform since 1984 has been moving away from the prices set by the central government in the centrally planned economy and towards a more market-oriented pricing mechanism, the pace and scale of the reform differ across energy types. This article discusses the evolution of price reforms for coal, petroleum products, natural gas, electricity and renewable power in China, and provides some analysis of these energy price reforms, in order to allow the market to play a decisive role in resource allocation and help China's transition to a low-carbon economy.

**Keywords:**

Energy prices; Tiered prices; Differentiated tariffs; Coal; Electricity; Natural Gas; Petroleum products; Renewable power; Desulfurization and denitrification; State-owned enterprises; China

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## 1. Introduction

Before the 1978 economic reforms, China's economic management structure was modelled principally on that of the former Soviet Union, an essential feature of which was the adoption of a state-set pricing system. Under this system, the state-set prices of goods, including energy, reflect neither the production costs nor the influence of market forces. The structure of state-set prices was also irrational: the same types of goods were set at the same prices regardless of their quality, resulting in the underpricing and undersupply of goods of high quality. This system remained unchanged for a long period, and its inflexible and restrictive nature became increasingly apparent.

In 1984, the government required state-owned enterprises (SOEs) to sell up to a predetermined quota of goods at state-set prices, but they were allowed to sell any production above the quota at prices within a 20 per cent range above the state-set price. In February 1985, the 20 per cent limit was removed and prices for surplus could be negotiated freely between buyers and sellers (Wu and Zhao 1987). At that point, the dual pricing system was formally instituted—introducing, among other things, economic efficiency in the use of resources—and was generally considered a positive, cautious step towards full market pricing.<sup>1</sup> According to a survey of 17 provincial markets in March 1989, SOEs still received part of their allocation for energy inputs—particularly crude oil and electricity—at the state-set prices, which were much lower than market prices, four years after the introduction of the dual pricing system (Zhang 1998).

Confronted with energy shortages and insufficient investment in energy conservation, China had been reforming its energy prices as part of sweeping price reforms initiated in 1993. The

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<sup>1</sup> See Wu and Zhao (1987) and Singh (1992) for general discussion of the pros and cons of the dual-pricing system, and Albouy (1991) for its impact on coal.

pace and scale of the energy pricing reform differ across energy types. This article discusses the evolution of price reforms for coal, petroleum products, natural gas, electricity and renewable energy, providing some analysis of these energy price reforms and suggesting a few areas where further reform would allow the market to play a decisive role in resource allocation.

## **2. Coal prices**

Coal dominates China's energy mix. Its price has been set at different rates since 1993, according to its use. Under the two-track system for coal prices, the price for non-utility use (so-called market coal) was determined by the market, whereas the price of coal for utility use (so-called power coal) was based on a 'guidance price' set by the National Development and Reform Commission (NDRC)—often at rates lower than prevailing market rates. Coal producers are required to sell to large power producers at the controlled prices for utility coal (IEA 2009). However, as the share of coal going to utility use increased and coal prices rose while power tariffs remained fixed, electricity generators found it increasingly difficult to obtain coal and cover the cost of generation (Rosen and Houser 2007). In 2004, the NDRC abolished its guidance price for power coal and set price bands for negotiations between coal producers and electricity generators. The NDRC widened those bands in 2005; in 2006, it scrapped them altogether (Williams and Kahrl 2008).

With electricity tariffs remaining controlled and flat, many electricity generators were unable to absorb the ensuing fuel cost increases and suffered huge losses. Responding to electricity generators' concerns, the NDRC in May 2005 proposed a coal–electricity price 'co-movement' mechanism through which electricity tariffs would be raised if coal prices rose by 5 per cent or more in no less than six months and electricity generators would be allowed to pass up to 70 per cent of increased fuel costs on to grid companies, and grid companies could pass those costs on to consumers. However, because of fears of inflation, the co-movement policy was not implemented even when the conditions were met, and power

tariffs continue to remain flat while coal prices rise (Williams and Kahrl 2008; Fisher-Vanden 2009; Li 2009). This increased the pressure on electricity generators and led to lobbying efforts to receive higher tariffs.

In December 2012, the State Council announced it would abolish the two-track system for coal prices. The price of coal for utility use, as for that of coal for non-utility use, would be determined by the market. Moreover, it revised the coal–electricity price co-movement mechanism so that electricity tariffs would be adjusted if fluctuations in coal prices went beyond 5 per cent or more in 12 months, and electricity generators would be allowed to pass up to 90 per cent of increased fuel costs on to grid companies, instead of the existing 70 per cent threshold (State Council 2012).

To implement the co-movement mechanism in a more open and transparent manner, the NDRC (2015) further specified the details of its operation in December 2015. Since the beginning of 2016, within a one-year cycle, electricity tariffs will be adjusted if utility coal prices increase by RMB30–150 per tonne relative to the 2014 average reference prices for utility coal. The more frequent the fluctuations in coal prices, the lower are co-movement coefficients. When coal prices rise less than RMB30 per tonne, generators have to absorb the total fuel cost increase; the co-movement mechanism is also not triggered if coal prices rise more than RMB150 per tonne.

It should be noted that this co-movement mechanism is not an automatic trigger, and it may not be implemented even if the conditions are met. Indeed, the average increases in coal prices in the whole of 2017 and into the beginning of 2018 fell within the specified range, but the co-movement was not implemented. This could be because implementing the mechanism by raising power tariffs would hurt the profitability of downstream power users in the current, less favourable global economic environment.

### **3. Petroleum product prices**

Domestic crude oil prices have tracked international prices since 1998, but this has not been the case with petroleum products. While China has raised its producer prices of gasoline and diesel several times, domestic oil refiners have still been feeling the pinch because crude oil prices have been linked directly to international prices and thus have been allowed to rise, while prices for refined oil products have not. To address this disconnect, the government has implemented, since May 2009, a pricing mechanism whereby domestic petroleum product prices are adjusted upward if the moving average of international crude oil prices—based on the composite Brent, Dubai and Cinto crude oil prices—rose by more than 4 per cent within 22 consecutive working days. However, this cycle of price adjustments has triggered widespread complaints, as it often failed to reflect fluctuations in the international market.

In March 2013, the NDRC launched a market-oriented petroleum product pricing mechanism to better reflect refiners' costs and adapt to fluctuations in global crude oil prices in a more timely manner. This automatic pricing mechanism shortens the adjustment period to 10 working days and removes the 4 per cent threshold. The composition of the basket of crudes to which oil prices are linked is also adjusted (Liu 2012; Zhu 2013).

In January 2016, the NDRC further specified that no price adjustments would be made if international crude oil prices fell below US\$40 a barrel. Confronted with high costs of domestic production, this floor price is said to maintain domestic production close to current levels, in response to China's stagnating domestic oil production and a growing hunger for foreign oil (Zhang 2016).

### **4. Natural gas prices**

The natural gas price has long been set below producers' production costs and does not reflect the relationship between supply and demand or the prices for alternative fuels. This has

not only led to Chinese domestic gas producers' being reluctant to increase investments in production, but also constrained the imports of more costly natural gas from overseas. In June 2010, China increased the domestic producer price of natural gas by 25 per cent (Wan 2010). In December 2011, China carried out a pilot reform of the natural gas pricing mechanism in Guangdong province and the Guangxi Zhuang Autonomous Region. This reform replaced the long-used cost-plus pricing method with the 'netback market value pricing' approach. Under this mechanism, pricing benchmarks are selected and pegged to prices of alternative fuels formed by market forces to establish a price linkage mechanism between natural gas and its alternatives (NDRC 2011).

Since July 2013, the pilot scheme trialled in Guangdong and Guangxi has been implemented nationwide for all volumes above the 2012 gas consumption level. At the same time, natural gas prices were raised for nonresidential users based on a two-tiered approach. Under this reform, the NDRC sets caps on citygate gas prices for different provinces, instead of setting the ex-factory prices for domestic onshore and imported piped gas, while consumers and suppliers are allowed to negotiate their specific prices as long as they do not exceed the price ceilings. Moreover, a lower price is set for the 2012 consumption volume, with citygate prices capped. A higher price is set for any volumes above the 2012 consumption level. This price is pegged to 85 per cent of the basket price of alternative fuels such as fuel oil and liquefied petroleum gas using a 60 per cent and 40 per cent weight, respectively. The government intended to steadily raise the lower-tier prices so both price bands converged by 2015 (NDRC 2013b). Given the declining costs of alternative fuels, natural gas prices for nonresidential users were lowered in November 2015 and again in September 2017 (NDRC 2015, 2017b, 2017c).

Given that residential natural gas prices have been capped at levels much lower than those for nonresidential users, provinces such as Jiangsu, Henan and Hunan implemented tiered tariffs for household use of natural gas. The NDRC (2014) mandated in March 2014 that this pricing mechanism

would be expanded to the whole country before the end of 2015. The pricing mechanism set three price bands associated with three tiers of consumption, with the first covering 80 per cent of the average monthly consumption volumes for household users, and the second the next 15 per cent. The third tier would cover any consumption above 95 per cent of the monthly household average. Consumption at the second and third tiers is charged accordingly at 120 per cent and 150 per cent of the first-tier price, respectively (NDRC 2014). Based on this guidance and taking its own circumstances into account, each province determines the consumption volume for each tier.

In the meantime, China has gradually allowed the market to determine the prices for a variety of gases. Since 2013, the prices for shale gas, coalbed methane and coal gas have been completely liberalised. Liberalisation continued with LNG prices, in September 2014; with prices for all other direct users, except gas used for fertilisers, in April 2015; prices for gas storage facilities, in October 2016; and prices for natural gas for fertilisers, in November 2016. Fujian province has piloted citygate gas prices since November 2016. Since September 2017, the prices for all volumes traded at the Shanghai and Chongqing gas exchange centres are set by the market (NDRC 2013c, 2015, 2017b).

As a result of these reforms, prices for more than 80 per cent of natural gas consumption for nonresidential use are determined by the market, of which more than 50 per cent is entirely set by the market and about 30 per cent is set by the flexible mechanism of reference prices supplemented with allowable fluctuation ranges (NDRC 2017c; Zhu 2017). Despite significant progress, more work needs to be done to formulate a fully market-oriented price. For specific prices, reforms involve introducing differential pricing policies to reflect seasonal price disparities, off-peak price disparities, interruptive gas prices and gas storage prices. More fundamentally, further progress in natural gas pricing reforms requires the deepening reform of the whole natural gas industry chain by opening the natural gas upstream and downstream markets and regulating the midstream pipeline transport market, as market-oriented natural

gas prices can only be formed based on a competitive natural gas industry structure. The NDRC has been laying the foundation for third-party access to pipeline networks by reforming the network transportation price mechanism under the principle of allowable costs plus reasonable profits. In August 2017, the NDRC (2017a) released the verified pipeline network transportation costs for 13 natural gas long-distance pipeline transport enterprises under the common method, principle and standards. On average, the verified pipeline network transportation costs of these enterprises have been cut by 15 per cent, reducing a burden of RMB10 billion on downstream enterprises (Zhu 2017). The National Energy Administration needs to develop a third-party access policy so that parties as well as owners are able to access the pipeline network, formulating specific procedures and regulations for pipeline network access and establishing a platform for pipeline network information disclosure. Moreover, various types of investors should be encouraged to participate in the construction of pipeline networks, liquefied natural gas (LNG) terminals, gas storage facilities and other related facilities. By ownership unbundling, setting up an independent system operator and building an independent transmission operator, China could gradually separate natural gas pipeline transport and production and marketing, eventually leading to the independence of the pipeline network (Dong et al. 2017).

## **5. Electricity tariffs**

The electricity industry in China was nationalised when the Communist Party assumed power in 1949, and has been in a process of reform since the 1980s (Ngan 2010; Zeng et al. 2016). In 2002, the State Council (2002) issued unbundling reform to separate power plants from power grids. Dismantling the vertically integrated power system into independent companies was the first attempt to establish a market-oriented mechanism, and it has since influenced China's power management mechanism. While China's unbundling reform has achieved a degree of success in the generation sector (Xie et al. 2012), electricity tariffs have remained under the control of the central government since the split-up of the State Power

Corporation and the separation of electricity generation from its transmission and distribution in 2002. While electricity tariffs were raised a few times under the coal–electricity price co-movement mechanism, they remain flat and regulated. This not only reduces the effectiveness of moves to address the daunting challenges in cutting emissions and strengthening industrial upgrading, but also complicates the implementation of pilot carbon trading schemes in the Chinese power sector. Carbon trading creates a new impetus for power pricing reforms to allow the pass-through of carbon costs in the electricity sector.

China launched a new round of power industry reform in March 2015 (CCCPC and State Council 2015), in which pricing mechanism reform features prominently. Grids will not make profits by charging the gap between the on-grid price and the electricity price for users. Instead, they are supposed to earn their income by charging a transmission and distribution fee, which is determined by the NDRC. The scheme, piloted in Yunnan province, encourages large power users to negotiate directly with generators. Generators then sell power to the grid at transaction prices, which are negotiated by generators and users. As a result, the combination of the transaction price, transmission and distribution fee and government funds forms the price of electricity for industrial and commercial users, who account for more than 80 per cent of national power usage. The volume of power transacted and traded on the market increased from 10 per cent of total electricity sales in 2015 to 23 per cent in 2016 (Zhu 2017). The government aims to further increase this proportion. Meanwhile, tariffs for residential and agricultural power use continue to be regulated by the government (CCCPC and State Council 2015).

In the course of this comprehensive and complex power pricing reform, the government has offered power price premiums for desulfurisation and denitrification, and has charged differentiated, tiered power tariffs with the aim of conserving electricity and protecting the environment (NDRC 2013a, 2013c; NDRC and MIIT 2013).

## **5.1 Power price premium for desulfurisation and denitrification**

With the burning of coal responsible for 90 per cent of China's total sulphur dioxide emissions, and coal-fired power generation accounting for half of the national total, the Chinese Government mandated that new coal-fired units must be equipped with a flue-gas desulfurisation (FGD) facility and plants built after 1997 must have begun to retrofit an FGD facility before 2010. During the twelfth five-year-plan period, electricity generators were required to install flue-gas denitrification as well. All coal-fired plants across the country with unit capacity of 300 megawatts (MW) or more and those in the eastern region and provincial capitals with unit capacity of 200 MW were required to install denitrification facilities.

While electricity tariffs remain controlled and flat, the government has offered a premium for all new coal-fired units since 2004. Given that China's sulfur dioxide emissions in 2005 were supposed to stay at the 2000 level but were in fact 5 per cent above that level, in 2007, the government decided to extend the premium to electricity generated by existing coal-fired power plants (that is, those built before 2004) with FGD facilities installed to encourage the installation and operation of FGD facilities at large coal-fired power plants (NDRC and SEPA 2007). The premium was equivalent to the average estimated cost of operating the technology. Other policies favourable to FGD-equipped power plants have been implemented—for example, giving them priority in grid connection and allowing them to operate longer than plants that do not install FGD capacity. Some provincial governments provide even more favourable policies, leading to priority dispatching of power from units with FGD in Shandong and Shanxi provinces. With the declining capital cost of FGD, newly installed desulfurisation capacity in 2006 was greater than the combined total over the previous 10 years, accounting for 30 per cent of total installed thermal (mostly coal-fired) capacity. By 2011, the portion of coal-fired units with FGD rose to 90 per cent of the total installed thermal capacity—from just 13.5 per cent in 2005 (Sina Net 2009; CEC and EDF 2012).

As a result, China met its 2010 target of a 10 per cent cut in sulphur dioxide emissions one year ahead of schedule. The Harvard China Project estimates that China's sulphur dioxide reduction policy in the eleventh five-year-plan period resulted in negative economic costs and enormous benefits to human health—between 12,000 and 74,000 premature deaths avoided in 2010 (Nielsen and Ho 2013).

In November 2011, the government also offered a premium for electricity generated by power plants with flue-gas denitrification in 14 provinces or equivalent. At the beginning of 2013, the price premium was extended to all coal-fired power plants equipped with denitrification facilities (NDRC 2013a), and was increased to RMB0.01 per kilowatt hour (kWh) in September 2013 (NDRC 2013c).

## **5.2 Differentiated power tariffs**

The NDRC (2006) ordered provincial governments to implement differentiated tariffs that charge more for companies classified as 'eliminated' or 'restrained' types in eight energy-guzzling industries, including cement, aluminium, iron and steel and ferroalloy from 1 October 2006. While provinces such as Shanxi charged differentiated tariffs even higher than the level required by the central government (Zhang et al. 2011), other provinces and regions have been offering preferential power tariffs to struggling local energy-intensive industries. The NDRC and five central ministries and agencies jointly ordered utilities to stop offering preferential power tariffs to energy-intensive industries by June 2010 and instead charge the punitive differentiated tariffs. Those utilities that failed to implement the differentiated tariffs were to pay a fine five times that of the differentiated tariffs multiplied by the volume of electricity sold (Zhu 2010).

## **5.3 Tiered power tariffs**

With China's residential electricity demand set to increase as income grows and the price of residential electricity remaining below actual costs, the NDRC implemented three-tier tariffs for

household electricity use in July 2012. The effectiveness of the new tariff mechanism depends on the price and income elasticities of residential electricity demand among income groups. However, very little information exists regarding these parameters in China. Based on the monthly microlevel data of Beijing urban households from 2002 to 2009, Jin and Zhang (2013) estimate these two parameters with both the almost-ideal demand system and the linear double-logarithmic model specifications. Their estimated price elasticity is close to unity and increases as income grows. This suggests that it might be effective to use pricing policies for demand-side management to adjust the electricity consumption of high-income groups. On the other hand, given that the estimated income elasticity is low, supporting policies are needed for low-income groups severely hit by increasing tariffs. In this regard, the authors suggest that either directly subsidising low-income families or rationally setting the price levels of different tariff blocks can help improve the distributional effects of tariff reform.

From the beginning of 2014, the NDRC expanded the three-tiered electricity pricing approach to the aluminium sector to phase out outdated production capacity and promote more rapid industrial restructuring (Gao 2013; NDRC and MIIT 2013). A similar tiered pricing policy applies to other industries, such as cement, to force upgrades in the drive for sustainable and healthy development.

## **6. Renewable power tariffs**

From a long-term perspective, widespread use of renewable energy is a real solution for energy supply problems. Increasing the share of renewable energy in the total primary energy supply not only enhances energy security, but also is good for the environment and conducive to good health. China has set targets for alternative energy sources to meet 15 per cent of its energy requirements by 2020 and the share of non-fossil fuel use to be 20 per cent by 2030.

The Chinese Government initially supported solar energy through ‘golden sun’ investment subsidies (Zhang 2011, 2013).

After years of simply taking advantage of overseas orders to drive down the cost of manufacturing solar panels, feed-in tariffs for solar power were enacted in July 2011 to create China's own solar power market. Wind power had benefited from bidding-based tariffs since 2003 (Zhang 2010, 2011, 2013). With total installed capacity of 5.9 gigawatts (GW) at the end of 2007, China had already surpassed its goal to achieve 5 GW by 2010, and met its 2020 target of 30 GW of wind power 10 years ahead of schedule. With both power demand and installed wind power capacity increasing faster than planned, and further deterioration of the environment, combined with the fact the country is facing great pressure both inside and outside international climate negotiations to be more ambitious in combating global climate change, China has raised its wind power target to 200 GW of wind power capacity in operation by 2020. This revised target is 170 GW more than the 30 GW target set in September 2007, and three times the United Kingdom's entire current power capacity.

In August 2009, the supportive policy for wind power was replaced with feed-in tariffs. Under this policy, four wind energy areas were designated based on the quality of their wind energy resources and the conditions they provided for project engineering and construction (NDRC 2009). On-grid tariffs were set accordingly as benchmarks for wind power projects. The levels were comparable with the tariffs the NDRC had approved in the previous several years in most regions, and were substantially higher than those set through bidding. By letting investors know the expected rate of return on their projects by announcing on-grid tariffs upfront, the Chinese Government aims to encourage the development of high-quality wind energy resources. In the meantime, this system will encourage wind power plants to reduce the costs of investment and operation and increase their economic efficiency, thus promoting the healthy development of the wider wind industry in China (Zhang 2010, 2011, 2013).

Under China's Renewable Energy Law, registered power generators are granted access to grids, which are required to purchase the full amount of renewable energy generated. Over

the past 10 years, the cost of wind power projects has been declining (IRENA 2018) but on-grid tariff benchmarks in each zone remained unchanged until 2015. This induces wind power developers to focus only on production costs and not demand, and thus has led to a huge surplus in installed capacity—in particular, in northern and western China, where there are richer wind resources and where the installed capacity is concentrated, but which are far from the load centres.

Consequently, a large amount of generated wind power has to be curtailed due to limited local demand or grid system stability constraints (Xia and Song 2017). China now aims to increase its total installed wind power capacity to 200 GW by 2020 and implement a green dispatch system to favour renewable power generation in the electricity grid. In this context, China needs to significantly improve its power grids and coordinate the development of wind power with the planning and construction of grids, including smart grids. New transmission lines should be constructed at the same time as wind power farms are built. Given the significantly scaled-up wind power capacity planned for 2020, China should now place more emphasis on companies ensuring the actual flow of power to the grid than on meeting capacity (Zhang 2010, 2011, 2014). Taking all these issues together, policies for feed-in tariffs and guaranteed purchases of renewable power need to be adapted to the new situation and alternative policies explored to solve the curtailment problem and to encourage wind power developers to choose locations close to the load centre.

## **7. Conclusions**

China has determined to assign the market a decisive role in allocating resources. To that end, getting energy prices right is crucial. Since 1984, China has been making great efforts towards reforming energy prices, and has made great achievements. However, such reforms are far from complete. While under the current pricing mechanism for petroleum products prices fluctuate along with global crude oil prices, they decouple from the domestic market. Future reform of the petroleum product pricing mechanism should take domestic factors into account so that prices can better reflect the

relationship between domestic supply and demand. From a long-term perspective, however, a complete marketisation of petroleum product prices will depend on the extent to which the central government is able to break the monopoly power of the three national oil corporations over oil imports, exploration, production and pipeline networks.

While the price for more than 80 per cent of China's natural gas consumption by nonresidential users is determined by the market, more work needs to be done to formulate a fully market-oriented price. Fundamentally, further progress requires deepening reform of the whole natural gas industry chain under a guiding principle of opening the upstream and downstream markets and regulating the midstream pipeline transport market. In this context, reforming the network transportation price mechanism and laying the foundation for third-party access to the pipeline network are crucial. The NDRC is moving in the right direction, verifying the transportation costs of long-distance natural gas pipeline enterprises under the common method, principle and standards. It needs to develop a third-party access policy so that parties as well as owners are able to access the pipeline network. China could gradually separate natural gas pipeline transport and production and marketing, eventually leading to the independence of the pipeline network.

While China has been reforming its electricity industry structure since 2002, the two main grid corporations—the State Grid and China Southern Power Grid—undertake the transmission, distribution and sale of electricity. As the only designated buyers of electricity from generators and distributors and sellers of electricity, they hold a monopoly in their respective areas. This monopoly power and the lack of competition in the electricity market have often attracted criticism. In my view, however, to establish a competitive power market, splitting the grid is not necessary, but separating the sale of electricity from grid transmission and distribution is a must. Only then can electricity sales be opened up and electricity-selling companies independent of grids set up in each region. This has been the key goal of a round of power

industry reform China has undertaken since March 2015. Grids will not make profits by charging the gap between the on-grid price and the electricity price for users. Instead, grids will earn their income by charging a transmission and distribution fee determined by the NDRC. However, this could raise a variety of thorny issues, one of which is dispatching power when selling prices differ but the grid's source of income has already been set. Another could be how to lower power tariffs. This requires either power generators or grids giving up some profits in the value chain, given that power generators have low profit margins and the grids' source of income is based on the verified transmission and distribution fee and allowable profits. For renewable power, the policies of a feed-in tariff and guaranteed renewable power purchases help the widespread use of renewable power. These favourable policies must be adapted to the new situation of a surplus and mismatch between generation locations and the load centre, and alternative policies must be explored to solve the problem of curtailment and to encourage wind power developers to choose locations close to the load centre, in addition to increasing the grid transmission capacity and transporting electricity from western and northern China to the south-east by building more ultra-high-voltage transmission lines.

For coal, whether the revised coal–electricity price co-movement mechanism will be able to address potential conflicts between coal producers and power generators remains to be seen. This is because a one-year cycle of adjustment is long and the reference prices for utility coal remain stable relative to the rapid pace of China's overall reform and changing market conditions. Moreover, although the two-track system for coal prices has been abolished, it is still very difficult to establish a nationwide coal market as railway freight capacity has not been liberalised. This means that if rail wagons are not included in any liberalisation, purchased coal cannot reach the load centres. Thus, future reform has to be undertaken considering the entire coal value chain, targeting reform at those parts that need to be liberalised but which are, to a large extent, still controlled by the government. However, even if such reform is undertaken, coal prices will not fully reflect the

cost of production because of officially controlled costs and the distorted prices of other production factors. Coal prices also do not include negative externalities. Clearly, the imposition of market-based environmental instruments can internalise externality costs in market prices. Indeed, implementing carbon trading not only creates a new impetus for power pricing reforms to allow the pass-through of carbon costs in the electricity sector, but can also help internalise externality costs in market prices.

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