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Sustaining China's electricity market development

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HIGHLIGHTS

- This paper analyses the electricity market development in China.
- Sustainable electricity market development strategies are identified in the paper.
- A five-goal policy framework is established for sustaining China's EMD.

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ABSTRACT

China's 12th Five-Year Plan addresses new challenges and sets new goals in the country's power sector. The structure of power generation development is to be optimised to properly balance coal transportation and power transmission. The controversy over the direction of grid transmission and distribution is also to be reconciled. The Plan puts forward specific requirements for energy conservation, developing clean energy, optimising the production of coal-fired electricity, rationalising the allocation of peak power, developing distributed energy and constructing a strong smart grid. It also strongly advocates renewable and other forms of clean energy resources. Considering all the above goals and requirements, it is necessary for China to adjust its blueprint for electricity market development by fine-tuning the original market-oriented reform momentum. This paper aims to design a policy framework for this and discusses how China should develop policies and strategies to meet these requirements and achieve these goals. Examples of compatible international experiences illustrate how China can secure a sustainable energy future.

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1. Introduction

The electricity industry in China has gone through three main stages of reform starting with economic reforms which enabled the sector to expand through capital investments, followed by market-oriented institutional reforms of its state-controlled enterprises, and then an unbundling of its generation from the grid to introduce competition (Andrews-Speed and Dow, 2000, p. 335). Worldwide experience indicates that an integrated and effective market regulator is needed for China to install incentives by which investment liberalisation of the electricity industry will support its reforms to meet national objectives such as health and safety, environmental protection, universal service and consumer protection (Ngan et al., 2006, p. 2881). In February 2002, the State Council issued the "Programme for Electricity System Reform", setting forth the basic elements of the plan which remains in effect today (Fu and Wang, 2008). The early significant reforms included the separation of generation assets from grid companies, the dismantling of state-owned assets into diverse generation companies, and the establishment of an independent regulatory authority known as the State Electricity Regulatory Commission (Ngan, 2010, p. 2142).

China's ambitious 12th Five Year Plan (FYP) builds on decades of unprecedented economic growth (China, 2011). Ambitious climate and energy goals are set through which China has laid out a strategic roadmap for pursuing a sustainable energy supply and use framework with targets to reduce fossil energy consumption, promote low-carbon energy sources and energy efficiency. It seeks to transform the economy from an investment-led powerhouse focused exclusively on GDP growth to a sustainable model that balances growth with social harmony, and innovation with environmental protection. China must cope with these challenges by reducing the overall energy intensity and coming up with plans to close inefficient power and industrial facilities, setting targets to increase renewable

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energy sources, implementing carbon trade markets and developing industrial polices to support clean energy industries and related technologies. The new phase of energy market reforms reflect a wave of strategic measures for accessing private capital and with a strong emphasis on devising new energy and climate programs committed to increased environmental protection. However, liberalised energy markets of the types adopted in the western world will not spontaneously deliver the required investments in China as their returns are not judged solely on economic grounds alone, but also social harmony and expectations (Wu and Fu, 2005).

Moreover, the power sector in China must overcome two basic challenges: building up the national grid connections among the interprovincial and inter-regional networks and improving the power dispatch capabilities within the built national grid. In the long run, the mature power sector serves to provide opportunities to reduce costs and emissions. It appears that both the regulatory environment and typical competitive electricity market cannot resolve these issues. Thus, the question for China is what policies and what trade-offs between market forces and competition will deliver the desired outcomes at the lowest cost?

This article analyses the various power sector issues relating to sustainable energy development in China. The findings indicate that China is in need of new measures to further promote its Electricity Market Development (EMD). The following Section 2.1, briefly describes the deliverables pertaining to its power sector. Findings on the multi-dimensional aspects of the reforms are provided in the next section. This is followed by an investigation into how a new strong smart grid needs to be developed in China. The article concludes by discussing the formation of the integrated policy framework supported with prospective electricity market reform strategies for its implementation.

2. Electricity market development

2.1. New phase of EMD in respect to China's 12th Five-Year Plan

The Five-Year Plans are China's most significant government policy documents. They describe various economic development initiatives, map strategies for economic development, set growth targets and launch reforms. During the 11th FYP period, the rapid growth in the power industry met the needs of economic and social development, but this growth was a bit disorganised. The 12th FYP established many social and economic goals, including significant expansion of the country's power generation industry in many new directions (Lewis, 2011). For instance, the structure of power generation development will be optimised, including the proper balance of coal transportation and power transmission. The controversy over the direction of grid transmission and distribution is to be reconciled. In addition, the plan also puts forward specific requirements for energy conservation. When formulating these requirements, the Chinese central government and major power companies agreed on certain specifics with respect to clean energy, optimising the production of coal-fired electricity, rationalising the allocation of peaking power, developing distributed energy and constructing a strong smart power grid. With these goals and requirements in mind, the fourth phase of China's EMD (Ngan, 2010, p. 2142) is defined and its main characteristics are identified as follows:

- Focusing on optimising the structure of power generation at the micro-level for better economic and sustainable development.
- Setting out systematic reform strategies for developing clean energies, optimising production of coal-fired electricity, rationally allocating peaking power, developing distributed energy and constructing a strong and smart grid.

Apart from generic options, such as introducing competitive incentives, increasing efficiency, reducing cost, improving pricing mechanisms, optimising resource allocation and advancing nationwide grid construction, the plan also ensures that further development of the power sector can contribute to achieving the nation's broader economic and environmental goals (Yang, 2006). China's strategic challenge in the EMD is to find a more sustainable development path, while retaining the social expectations for better living quality and environmental standards. The success of achieving greener growth and greater social stability depends on whether implementation of the ambitious targets set in the 12th FYP can rebalance the social economic interests of the community at large.

Implementation of the EMD has slowed down in recent years due to uncertainty following the crises in California and elsewhere. Power plant financing is no longer a significant objective, and electricity prices do not depart significantly from marginal costs. The above observation provides an opportunity for China to pause, reflect and adjust its plans for the industry.

2.2. Factors for sustaining the 12th Five-Year Plan

Over the next five years, China's new energy industries, such as wind power, solar power, biomass energy and nuclear power will continue to develop rapidly. The *New Energy Industry Development Guidelines* submitted to the State Council in 2010 point out how the new trend supersedes the original design in the 11th FYP. That is, the new energy industry has expanded from merely utilising new resources like wind, solar, biomass and nuclear to incorporating new resources and technologies, such as clean coal technologies, smart grids and non-conventional gas resources like coalbed methane and natural gas hydrocarbons.

2.3. Renewable energy and clean energy technology

Based on China's pledge to reduce greenhouse gas emissions, as contained in the 12th FYP, the government has communicated the emission reduction targets at both provincial and sector levels. Prominent changes will take place in reforming the power generation structure in which new and renewable energy resources will account for more than 10 per cent of total primary energy consumption by 2015, and renewable energy resources will account for 20 per cent by 2020, respectively. From the list of installed generation capacity in Table 1, it can be seen that hydropower will play the most important role in the development of new and renewable energy and contribute considerably to energy savings and emission reduction targets over the next 10 years.

Table 1
Total installed electricity capacity in 2010 and target in 2020 of China.
Source: SETC, 2003; CERS, 2002.

Technology	2010		2020	
	GW	%	GW	%
Coal	646.60	66.77	1030.00	57.68
Gas	26.42	2.73	58.90	3.30
Nuclear	10.82	1.12	80.83	4.53
Hydro	198.21	20.47	340.00	19.04
Pumped storage	17.84	1.84	50.00	2.80
Wind	29.57	3.05	150.00	8.40
Solar	0.26	0.03	24.00	1.34
Biomass	1.70	0.18	15.00	0.84
Other	36.92	3.81	36.92	2.07
Total	968.34	100	1785.65	100

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