Energy Security in Times of Economic Transition

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Energy Security in Times of Economic Transition: Lessons from China

BY

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Contents

Abbreviations

Acceptability by society	**AC**
Affordability of energy prices	**AF**
Analytic hierarchical process	**AHP**
Applicability of technology	**AP**
Asia Pacific Energy Research Centre	**APERC**
Availability of resource	**AV**
Barrels per day	**bpd**
Belt and Road Initiative	**BRI**
Billion cubic metres	**bcm**
British Petroleum	**BP**
Carbon capture and storage	**CCS**
Carbon dioxide	**CO_2**
China Energy Conservation Investment Corporation	**CECIC**
China National Offshore Oil Corporation	**CNOOC**
China National Petroleum Corporation	**CNPC**
China Petrochemical Corporation	**Sinopec**
China Statistical Yearbook	**CSY**
China's National Development and Reform Commission	**NDRC**
China-Pakistan Economic Corridor	**CPEC**
Chinese Academy of Social Sciences	**CASS**
Chinese Communist Party	**CCP**
Coal-bed methane	**CBM**
Coal-mine methane	**CMM**
Contract Responsibility System	**CRS**
Department for Business, Enterprise and Regulatory Reform	**DBERR**
Diversification of primary energy demand	**DoPED**
Driving force–state–response	**DSR**
Energy indicators for sustainable development	**EISD**
Energy Information Administration	**EIA**
European Union	**EU**
Five-Year Plan of economic and social development	**FYP**
Frontier Works Organisation	**FWO**
Global Terrorism Index	**GTI**
Greenhouse gas	**GHG**
Gross domestic product	**GDP**
Gross national product	**GNP**

Group company system	**GCS**
Gulf Cooperation Council	**GCC**
Household Responsibility system	**HRS**
Hydro, Eolien, Light, Insulation, Organomasse	**HELIO**
Independent power producer	**IPP**
Indicators for sustainable energy development	**ISED**
Initial public offering	**IPO**
International Atomic Energy Agency	**IAEA**
International Energy Agency	**IEA**
Kilowatt-hour	**kWh**
Kuomintang	**KMT**
Large and medium-sized enterprise	**LME**
Liquefied natural gas	**LNG**
Lawrence Berkeley National Laboratory	**LBNL**
Megawatt-hour	**MWh**
Memorandum of understanding	**MOU**
Middle East Oil Import Dependency	**MEOID**
Million tons	**Mt**
Modern enterprise system	**MES**
National Bureau of Statistics of China	**NBS**
National Energy Administration	**NEA**
National Environmental Protection Agency	**NEPA**
National Oil Company	**NOC**
National People's Congress	**NPC**
National Renewable Energy Laboratory	**NREL**
Net energy import dependency	**NEID**
Net oil import dependency	**NOID**
Non-carbon based fuel portfolio	**NCFP**
Non-governmental organisation	**NGO**
Not in my backyard	**NIMBY**
Oil vulnerability index	**OVI**
Organisation for Economic Co-operation and Development	**OECD**
Particulate matter-10	**PM_{10}**
People's Republic of China	**PRC**
Renminbi	**RMB**
Research and Development	**R&D**
Reserve-to-production	**R/P**
State Electricity Regulatory Commission	**SERC**
Small and medium-sized enterprise	**SME**
State Development and Planning Commission	**SDPC**
State Economic and Trade Commission	**SETC**
State Electricity Regulatory Commission	**SERC**
State Environmental Protection Administration	**SEPA**
State Petrochemical Industry Bureau	**SPIB**
State Planning Commission	**SPC**
State Power Corporation of China	**SPCC**

State Power Investment Corporation	**SPIC**
State-owned enterprise	**SOE**
Sulfur dioxide	**SO_2**
Sustainable Energy Watch	**SEW**
Sustainability indicator	**SI**
Tons of coal equivalent	**tce**
Total primary energy supply	**TPES**
Township and village coal mine	**TVCM**
Township and village enterprise	**TVE**
United Nations	**UN**
United Nations Development Programme	**UNDP**
United States	**U.S.**
United States Dollar	**USD**
Work programme on indicators of sustainable development	**WPISD**
World Energy Council	**WEC**

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Introduction

Despite unprecedented energy consumption rates and environmental sustainability threats, China has seen fast economic growth and its energy policy and energy security have gone through decades of transformation. As China's economy shifts from a planned to a market mechanism, it is valuable to find the root reason behind the transformation of the energy policy and energy security situation.

International political economy and security studies on China have yet to explore the interaction among three important factors: its energy policy, its energy security, and macroeconomic reform. This book aims to fill this gap in the literature with a new methodological approach to the study of China's energy security. It applies both quantitative and qualitative analyses to the energy security situation in China during the reform period. With this said, two primary objectives are achieved in this book. The first objective is to examine how the energy security situation in China has evolved during the economic reform period. This book establishes a quantitative framework based on a comprehensive concept of energy security which covers availability of resources, applicability of technologies, acceptability by society, and affordability of prices. The framework analysis shows that China's energy security situation has not improved during the reform period.

The second objective of the book is to explore qualitatively why the energy security situation has not improved. To answer the 'why' question, the book opens up a new perspective by analysing the relationship between energy policies and the macroeconomic reform. It is found that China's macroeconomic reform has restricted the formation of China's energy policies and determined its energy security situation. In essence, China's energy policies are only a reaction to the macroeconomic measures. In other words, China's energy policies are not originally intended to improve energy security, but passive reactions to China's macroeconomic reform. This explains why China did not improve its energy security situation despite 40 years of reform.

In addition, with a separate chapter, it also includes an international perspective by studying the impact of China's Belt and Road Initiative on its energy security situation. This book is not only meaningful for the case of China but also useful to explain energy security in other countries, especially those countries in economic transition.

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I would like to thank my parents from the bottom of my heart for their dedication and support. They always stand by me whenever I am in difficulty. They are the nicest people in my world.

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Chapter 1

Into the Landscape

A country's energy policy and energy security status are closely related and influence each other. Having sound energy policies will improve energy security, whereas less prudent energy policies may worsen its energy security situation. Thus, ensuring energy security is fundamental for domestic prosperity and national security because 'the advent of globalization, the growing gap between rich and poor, the war on terrorism, and the need to safeguard the earth's environment are all intertwined with energy concerns' (Wirth, Gray, & Podesta, 2003, pp. 132–133). China's huge appetite for energy consumption and its massive degradation of the environment have increasingly fostered international concerns. Therefore, analysing the interaction between energy policy and energy security in China is an urgent task and will help address these concerns. This chapter gives a general background, introduces research questions, and explains the research framework and methodology of the book.

1.1. Background

1.1.1. Energy Security and Energy Policy

What makes energy policy and energy security so critical an issue is that the energy sector has specific features. For example, a reliable energy supply is crucial to economies, energy projects involve high capital investment and large risks, and energy production and consumption may result in environmental degradation. These distinctive characteristics of the energy sector require every government to have its own energy policy (Andrews-Speed, 2001). This policy, in turn, has a significant impact on both energy production and consumption. Hence, the security of energy supply has even been deemed as the 'key element for the functionality of the modern societies' (Purhonen, 2005, p. 1).

Energy is an economic commodity, but it has also become a political commodity whereby economics and politics influence the energy sector. Since energy is essential for fuelling the economy, energy resources – especially fossil fuels – have often been a fuse for conflicts and wars. Fossil fuels are the most important source of energy. Therefore, competition for seeking fossil fuels is fierce and prone to tension and conflicts. The historical record shows examples of oil-importing countries that sought to eliminate their oil dependence through military expansion. A case

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in point is the Japanese invasion and expansion in East Asia during World War II (Yergin, 1991). There is a close relationship between a country's national interests and energy supply security. Energy *per se* is not a security issue, but any shortage of energy will become a security issue as states get involved in conflicts and resort to military action.

The underlying implication of the close relationship between energy security and energy policy is also reflected in geopolitical thinking. Geopolitics is an instrument of political warfare and helps explain the structure of security problems (Sloan & Gray, 1999, p. 10). In particular, geopolitics is a useful tool to analyse energy politics. Although there is no common definition of geopolitics, it is widely viewed as a driving force for world politics/conflicts. Geopolitical ideology was used by Hitler, Mussolini, and Japanese militarists to justify their expansion into neighbouring countries. Their actions threatened the geopolitical interests of opposing powers, such as their sphere of influence on Eastern Europe and Southeast Asia, leading to World War II (Klare, 2003, p. 52). When Japan found that China and Southeast Asia had dependable sources of energy, it realised that it could rely on these resources to grow its economy. It was Japan's decision to control these resources that further aggravated World War II.

Traditional geopolitics, as defined by Klare (2003), is:

> the contention between great powers and aspiring great powers for control over territory, resources, and important geographical positions, such as ports and harbors, canals, river systems, oases, and other sources of wealth and influence. (p. 51)

Although traditional geopolitics offers convincing arguments and supporting evidence for the main drivers causing conflict and war, it has been criticised for being trapped in state-centrism and acting as a mere narrative about resource wars. In response to this criticism and along with the process of globalisation, a much broader notion of geopolitics, namely critical geopolitics, emerged in the late twentieth century, when the more integrated world dwarfed the role of nation-states and enhanced the roles of non-state actors, such as transnational corporations and environmental organisations. Critical geopolitics defines space in a more socio-economic way such that different regions can be connected to best serve national interests (Amineh, 2003). In sum, geopolitics, traditional or critical, justifies the importance of a country's energy policy and its implications for security. In the energy sector in particular, big oil companies may play a key role in a state's energy policy decision-making process. Globalisation makes a country's energy policy not just a national issue but a transnational issue; and 'spill over' effects in other countries may cause an international security problem. This raises the issue of energy security as well.

1.1.2. Definitions of Energy Security and Energy Policy

Energy security is defined in the literature in both a broad sense and a narrow sense. In the broad sense, energy security is a condition in which a country has

access to adequate and reliable energy supplies at reasonable prices (Chang & Lee, 2008; Clingendael International Energy Programme, 2004; IEA, 2007a; Lin, 2009a; Yergin, 1988). In the narrow sense, energy security refers mainly to concerns with the security of primary energy resources, particularly with oil; it also focuses on the economic or national welfare aspect (European Commission, 2001; Jansen & Seebregts, 2010; Loschel, Moslener, & Rubbelke, 2010; Nautilus Institute for Security and Sustainable Development, 1998).[1]

The narrow definition of energy security implicitly assumes that oil supply serves as the focus of energy supply security. Some argue that clarifying the risks related to other types of fuels constitutes the concept of energy security equally or even more critically than oil supply does (Nautilus Institute for Security and Sustainable Development, 1998, p. 15), and energy security should not only focus on the economic/welfare aspect. With this said, several dimensions have been identified to make the concept of energy security more comprehensive. These dimensions include the economic dimension, environmental dimension, social dimension, foreign policy dimension, technical dimension, security dimension, strategic dimension, political dimension, and systemic dimension (Alhajji, 2007; Purhonen, 2005). These dimensions constitute a new, comprehensive energy security concept.

The definition of energy security employed in this study is a comprehensive one, covering the dimensions of economy, environment, technology, and society, so that energy security guarantees that a country, industries, and citizens have access to an adequate and reliable supply of energy resources (including primary and renewable resources) at reasonable prices.[2] What underlies this definition is that energy insecurity may arise when any of the above-mentioned dimensions are not met. Whether they are met or not is directly affected by the promulgation and implementation of energy policy. For example, severe fluctuation of energy prices affects the economic dimension of energy security, and a deteriorated environment in relation to fossil fuel utilisation affects the environmental dimension. Hence, this definition underlines the integrated character of energy policy and national security, which forms a bridge between international political economy and security studies.

Winston Churchill's decision to switch ship fuelling from coal to oil is an early example of an energy policy derived from the concept of energy security. This policy was 'bold, creative, and farsighted' (Wirth et al., 2003). Churchill's decision initiated the analysis of energy policy. Similarly, Deng Xiaoping's decision that China's oil companies should 'go out' to seek a diversified energy supply initiated

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[1]For details of the literature on energy security definitions, see Chapter 2.

[2]The term 'reasonable price' has been criticised by scholars. It is argued that 'reasonable' is sometimes difficult to understand. First, it is not clear whether 'reasonable' is from the producer or consumer's point of view. Second, the terms 'affordable' and 'reasonable' are themselves vague. If 'reasonable price' means 'competitive price', it is unlikely to exist in all energy sub-markets, which are not perfect markets. Furthermore, the concept of 'competitive price' is also diffuse (Loschel et al., 2010, p. 1666). This study defines 'reasonable price' as a price that is devoid of excessive market power (Chang & Lee, 2008).

the study of energy security and energy policy in China. Unlike the definition of energy security, there is a little variation in the literature on the definition of energy policy. Energy policy is a policy made by the government, industries, or non-governmental organisations to address issues in the energy sector, officially or unofficially (McGowan, 1996). These issues may cover the whole energy sector or deal with a specific subsector, such as coal, oil, renewable energy, energy research and development, and energy conservation.[3] Historical analysis of trends in energy policy shows the change in government thinking about policies on energy, from concentration purely on security of energy supply to greater emphasis on efficient and sustainable energy utilisation (Finon, 1994). This change in policy priority exists in China as well.

1.1.3. The Importance of Analysing China's Energy Policy

The energy industry in China has a number of characteristics that are distinct from other sectors of the economy. First, the ownership of energy resources in China is largely in the hands of the state/government. The government has the right and responsibility to manage these resources. Second, exploration and development of energy resources involve large capital investments, long payback periods, and high risks. It cannot be easily tackled by the private sector. Third, energy production and consumption normally have negative consequences, such as environmental damages at the local, regional, and global levels. These issues need to be addressed by the government, either individually or collectively (Andrews-Speed, 2004). Therefore, these characteristics make energy policy deserving of intensive research.

China's energy industry has gone through 70 years of transformation from the founding of the People's Republic of China (PRC), the Great Leap Forward period, the Cultural Revolution, till the reform era. The energy policy of China, an ultra-large economy and energy consumer, has critical implications not only for its own security situation, but also for the world's. China's energy security situation has increasingly drawn international concerns. One reason for this is the current huge gap between its stagnating domestic energy production and its fast-growing consumption. The combination of China's rising energy demand and its limited indigenous energy resources has prompted its oil companies to acquire stakes in exploration and production projects abroad. Indeed, securing energy supply sources has become the key aim of China's energy and foreign policies. China's rising demand for energy has also raised serious concerns regarding global pollution and other environmental issues. Therefore, it is valuable to identify the way China's energy policy has evolved and its relevant impact on the security situation. It is even more valuable to find the root reason behind the evolution of the energy security situation.

Energy policy stipulates objectives and the means to achieve these objectives, which may change to match a country's economic, political, and social conditions. The means to achieve the objectives are categorised into three groups: command,

[3]For details of the literature on energy policy definitions, see Chapter 2.

market, and persuasion. In a planned economy, command dominates the energy sector. Command, in the form of plans, regulations, and laws, regulates the flow of energy and players' actions. In a liberalised economy, a market mechanism dominates the energy sector. The market determines energy flow and prices. Persuasion, such as education and publicity for policy implementation, is required in both planned and liberalised economies (Andrews-Speed, 2001). As China's economy shifts from planned to market mechanism, it must adjust its energy policy accordingly. Facing the challenges of energy security problems amid rapid economic and social development, China's energy policy objectives have been amended to address emerging issues. The necessary means have been modified to realise these objectives and China's energy policy has evolved correspondingly. Therefore, research on the energy policy of China has both academic and practical significance.

1.2. Research Questions and Key Findings

This book finds solutions for four policy-oriented questions. First, how has China's energy security situation evolved? The answer to this question is a quantitative study based on a framework (the 4-As framework) using indicators to quantify the energy security situation in China, with the conclusion that China's energy security has deteriorated over more than three decades of economic reform. Second, what impact do the energy policies have on China's energy security status? The answer involves a whole chapter that analyses the direct impact of China's energy policies on its security situation. Third, why has China's energy security deteriorated? The answer explores the nature of the evolution of energy policies and their impact on the energy security situation in China. Fourth, whether does China's Belt and Road Initiative (BRI) contribute to improving China's energy security? The answer addresses the impact of BRI on China's energy security.

To put it briefly, this book evaluates the impact made by *past* and *current* energy policies and activities on the energy security status of China. Upon evaluation, it is found that China's energy security situation has not improved over three decades of economic reform. This book gives reasons for the evolution of China's energy security status: China's macroeconomic reform has restricted the formation of China's energy policies. In essence, it is the macroeconomic reform that limits the improvement of China's energy security situation. China's energy policies are only responses to the evolution of macroeconomic measures. In other words, China's energy policies were not originally intended to improve energy security, but only passive responses to macroeconomic reform. This book does not deny or disregard other factors that affect China's energy security situation such as international relations, institutions, interest conflicts, etc., while it finds that the macroeconomic reform is the key driver of China's energy security evolution.

1.3. Existing Discussions on China's Energy Policy and Energy Security

The existing qualitative studies on China's energy security are mostly from the perspective of international relations. They discuss international or geopolitical

advantages and challenges for energy security in China and offer suggestions (Wang, 2001; Zhang, 1998 & 2003a; Zweig & Bi, 2005). In the context of international relations theory, the current literature addresses China's energy security and its geopolitical implications through either a realist perspective or a neo-liberal perspective, thus taking an energy perspective of China's foreign relations, which entails either competition or cooperation. Realists take the international system as an anarchical one. Competition and a zero-sum game lead to conflicts. Realists believe peace is achieved through the balance of power between states, whereas neo-liberals believe that peace is achieved through cooperation.

From a realist perspective, China's oil dependence and increased demand for foreign energy resources result in strategic competition between major powers such as the United States (U.S.) and China. The U.S. hegemonic oil strategy in the Middle East had been the root cause of political instability in the region. This strategy has also severely constrained China's ability to secure a stable oil supply in the Middle East (Moran & Russell, 2009; Shu, 2010). Russia too faces fierce competition in its search for energy reserves in the Middle East and Central Asia, which could provoke power warfare on a grand scale. The United States, Russia, and China are trying to bolster their strategic positions and curb the influence of each other, hence a 'three-way geopolitical struggle' has emerged (Klare, 2004, p. 162). Energy reserves in Central Asia provide motives for the United States to secure a position in the region, albeit in competition with the interests of Russia. The latter will undoubtedly try to offset the deepening U.S. penetration in Central Asia. The motive behind Russian–Chinese rapprochement can be traced to China's desires for Central Asia to meet its future oil requirements (Naughten, 2007; Noreng, 2006).

From a neo-liberalist perspective, energy can be a platform for dialogue. Domestically produced coal still dominates China's usage of energy. Therefore, China is less vulnerable to supply shortages than countries that lack domestic energy resources. As major coal producers and exporters, China and the United States share an interest in the development of coal-related technologies. Furthermore, China would prefer investment in expensive oil pipeline projects to conflicts with the United States and its neighbours over sea lanes to ship its oil supplies from the Middle East. China's oil imports from the Middle East offer China an interest in regional stability. It is China's investments in Iran's oil and gas sector that makes China interested in preventing a nuclear Iran (Shaffer, 2009). Since political instability in the Middle East poses high risks for the oil and gas supply from the region, China should work towards a long-term Sino-U.S. energy cooperation rather than risk confrontation in the Middle East (Sun & Pan, 2009). The more China feels threatened by the United States and its allies, the more China will enhance its energy security by seeking alternative options, such as maximising the use of its domestically abundant coal resources, developing expensive oil and gas pipelines, and cultivating relationships with oil-producing states such as Iran (Downs, 2000). As an oil-importing country, China is interested not only in collaborating with Middle-Eastern countries, but also in finding common ground with other oil importers. The oil-importing countries should seek to acknowledge cooperation rather than competition in their search for energy (Jakobson & Zha, 2006).

Neither the realist nor the liberalist perspective gives an assertive evaluation of the evolution of China's energy security situation. Compared to qualitative studies on the energy security situation in China, energy security quantification makes it more operational to evaluate the evolution of China's energy security. Zhang (2007) and Chang (2010) apply the methodology of Analytic Hierarchical Process (AHP) in establishing evaluation frameworks that incorporate indicators to assess China's energy security evolution. Also using the AHP methodology, Shi (2011) makes the same conclusion that China is energy-secure. He analyses general factors that affect the country's energy security and recommends policies. The AHP methodology has also been used to construct a framework to calculate the oil security index and evaluate China's oil security. It concludes that China's oil security has been worsening since 1991 (Zhang & Liu, 2005).

Besides the AHP methodology, other assessment systems can evaluate energy security in China with a more historical view. He, Sheng, and Wang (2011) use 10 key indicators to assess the evolution of energy security in China and conclude that China's energy security situation generally improved from 1988 until 2004, after which it deteriorated. Liu, Shen, Gao, and Liu (2012) review several energy security indices and models and build an assessment model to evaluate China's energy security situation from 1990 to 2008. They conclude that China's energy security situation was the best in 2001 and then began to decrease. Since 2004, the deterioration has accelerated and the energy security situation reached its worst in 2008. However, none of these studies identify the key reason behind the evolution of energy security in China. They only superficially analyse factors that have an impact on energy security in China, such as international relations, domestic energy reserves, economic growth, industry structure, technology, and environment. They fail to identify the key or the most critical reason behind the energy policies and energy security status evolution.[4]

From the qualitative research perspective, study on China's energy policies has gained momentum since economic reform was initiated in 1979. From then on, China's energy policies have been extensively discussed. However, the discussion is either short of a comprehensive overview or lacks combination of energy policies with the country's energy security situation. In 2002, the Strategic Planning Department of the State Power Corporation published *China's Energy in Fifty Years*. This book comprehensively reviewed the achievements in China's energy industry since 1949, summarising the impact of China's energy policies on the energy industry and developments and changes in China's energy structure. It also mentioned China's energy policies, especially the energy policies in the individual energy sectors during the reform era. However, it only covered energy policies in general and omitted details on their evolution.

China's energy situation in the early 1980s is well documented in the *Research Report on China's Energy Policy*. The report extensively reviews past implementation of energy policy and proposes a number of energy policy recommendations. It also points out the major energy challenges China faced in the early 1980s, such

[4]For details for energy security measurements, see Chapter 2.

as rural energy shortages and coal transportation difficulties (China's Energy Research Institute, 1982). The report shows the background of China's energy policy formulation in the early 1980s and its dilemma in energy and economic development, but it does not evaluate the effects of China's main energy policies and specific measures on its security situation.

Some works have briefly discussed the evolution of China's energy policy. The evolution is generally categorised into three periods: before the economic reform, from the beginning of the reform to the Tenth Five-Year Plan (FYP) period, and from the Tenth FYP period onwards. The first period is a period of energy self-sufficiency. The second is a period of energy sector reform amid increasing international cooperation. The third is regarded as a period with more 'mature' energy policies where priority is given to energy conservation and sustainable development (Wang, Wang, & Fan, 2012). However, this kind of categorisation only takes a simple view of the change in priority documented by the Chinese government. The actual motivation behind the evolution is ignored. Shi (2005) finds that market reform and an open energy market are 'objective requirements' of energy security in China. She maintains that market liberalisation is directly related to energy security. Perhaps she has some sense of the relationship between market reform and energy security, but she fails to explain how the relationship works. In a later work, she tries to find the motivation behind the energy policy evolution, and she almost gets there with the argument that energy industry reform is a component of Chinese economic system reform. But she argues that the purpose and steps of energy system reform reflect the stepwise process and characteristics of the energy industry, rather than going further to analyse the relationship between energy industry reform and reform of the Chinese economic system. She reviews the processes and contents of the reform in the energy sector from only three aspects – energy pricing mechanism reform, opening of the energy sector to foreign and private investors, and administrative institution reform in the energy sector – and evaluates the effectiveness of the reform (Shi, 2008). The failure to identify the essence of energy policy evolution makes it less possible for her to comprehensively discuss energy policies and the energy security situation with a firm stand.

Traditionally, China's energy policy has a concrete target for each energy sector, such as coal, oil, gas, and power. However, the energy policy lacks coherence (Andrews-Speed, 2004; Smil, 1981). Therefore, most literature tends to address China's energy policy by targeting a specific sector. In this way, China's energy policies can be divided into coal policy, electricity policy, oil policy, renewable energy policy, environmental policy, and energy conservation policy.[5] These works address the policies and their effects in detail, with an analysis of the background of energy policy formulation. They serve as an important reference for this study of China's energy policy, but they are lacking in research on policies throughout the whole energy sector. They also do not relate the policies to the overall energy security situation in China. The gap is filled by this book, which

[5]See Wang (1999), Ma and He (2008), Yeh and Lewis (2004), Li (1984), and Shen (1988).