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**CHINA'S ENERGY SECURITY:
PROSPECTS, CHALLENGES, AND OPPORTUNITIES**

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Executive Summary

The global financial crisis enhanced and hastened China's rise in the international market. For example, China has increased its imports of energy resources in the wake of the crisis, and half of the oil that China consumes comes from foreign sources – especially from countries in the Middle East, Africa, and Central Asia. China must search continuously for solutions to its problem of rising energy demand.

In addition to importing oil from abroad to meet domestic energy demands for the short term, Chinese enterprises have also been investing directly in foreign firms to assemble long term and more secure energy supplies. These enterprises have engaged in acquisitions and mergers, and portfolio investments such as foreign bonds, stocks, and financial derivatives.

The impact of the recent global financial crisis, as well as turmoil in many parts of the Middle East and North Africa in early 2011, have caused Beijing to further realize the importance of energy source diversification, the linkage of fiscal and monetary policy with energy policy, especially monetary policies that relate to international energy commodity trading, equity markets, and financial markets. Japan's recent nuclear crisis caused China to temporarily halt its nuclear development plans and reconsider nuclear safety issues and future nuclear development strategy. Major changes to the nuclear development strategy would most likely increase China's need for oil.

Energy security is dynamic, uncertain, and full of risk. Moreover, it is no longer one single country's issue, but is a global economic security issue. Global energy prices influence every corner of the world economy. Because of global diversity and the range of complex factors that influence global energy security, it can only be achieved via a relative balance between geopolitical power and soft power on the one hand, and hard power on the other. This implies, among other things, that a solution to China's domestic energy shortage cannot rely just on an energy usage policy in the narrow sense, as China has traditionally employed. Rather, energy security for China will require the integration of energy policy with macroeconomic policy – such as fiscal and monetary policies – and foreign policy, as well as international cooperation.

1. Introduction

The first global oil crisis, in 1973, attracted people's attention to energy supply shocks. This crisis caused huge economic losses for many oil importing economies and generated political instability at a global level. The International Energy Agency (IEA) was formed after the first oil crisis and formally defined the concept of energy security based on oil supply and oil price. Over the past several decades, the world has changed dramatically with respect to social tension, political power, and financial landscape. The rapid rise of emerging markets, growing dependence on energy resources, and dramatically fluctuating energy resource prices have caused renewed concern about energy security and caused some rethinking about previous understandings.

In China, energy security has been categorized as a domestic economic development issue rather than a part of foreign policy for several decades, except for rare strategic issues such as the location of pipelines in Central Asia or border disputes related to energy resources. Coal, which is abundant in China, has been the dominant energy resource in domestic consumption for several decades, and before the 1990s there was weak economic development and relatively lower demand for. Though China's oil self-sufficiency ended in 1993 when it was forced to begin importing oil to meet domestic demand, China did not realize the urgency and importance of energy security until the late 1990s. China's energy consumption reached a record high in recent years due to China's rapid economic development, expanding middle class population, motorization, and urbanization. China became the world's second largest consumer of oil after the United States and the third largest net importer of oil in 2008.¹

Currently China depends on foreign imports for over fifty percent of the oil it consumes, and half of this imported oil is from the Middle East. China has many reasons to worry about its energy security: with 16 billion barrels of domestic proved reserves² - only 1.2 percent of world total reserves - an R/P ratio³ of 11.1 in the domestic market,⁴ lack of a sufficient Strategic Petroleum Reserve (SPR), severe pollution conditions and environmental problems, dramatic fluctuation of global energy prices and rising domestic energy prices, and severe shortages of electricity and water. Facing these immense pressures and challenges, China's national oil companies (NOCs) began to fill short-run gaps in domestic demand from the global energy market in 1997, reaching a peak after 2001 when China acceded to the WTO. As newcomers in the international energy market, the NOCs have had to learn by doing and have had many setbacks in their mergers and acquisitions of foreign energy assets in recent years. Yet there is no consensus on what should be done to reduce the oil dependence. The challenges facing the Chinese government are to better manage its dependence on oil and to define a sustainable energy security path, rather than to simply pursue "oil independence."

¹ "China," Country Analysis Briefs, Energy Information Administration, November 2010, <http://www.eia.doe.gov/emeu/cabs/China/Oil.html>.

² Ibid.

³ Reserves to Production ratio: if the reserves remaining at the end of any year are divided by the production in that year, the result is the length of time that those remaining reserves would last if production were to continue at that rate.

⁴ BP Statistical Review of World Energy, June 2009.

Counter-intuitively, the global financial downturn has increased China's demand for imported energy resources and outward foreign direct investment (OFDI) in the energy sector. With the financial crisis accelerating China's quest for oil and other energy resources in the international market, the IEA has predicted that China's dependence on foreign energy will increase to over 60-70 percent of its total consumption in 2015. Such forecasts raise questions of whether China's growth is economically, socially, and politically sustainable, and whether China's energy demand will crowd out other countries' energy needs and exhaust global energy resources. Such trends demonstrate the urgent need for China to solve its energy security challenge. As a major energy consumer in an integrated world in which domestic policies are inseparable from foreign policies, China's energy security policy will have significant impact at the global level. With a lack of continuous attention and clear strategy to energy policy undercutting China's foreign policy and economic security, integrating energy security issues with other aspects of China's foreign policy remains a challenge for Beijing.

2. Historical Overview of Energy Production, Consumption, and Policy

The changes in China's energy security policy over the past several decades have corresponded with China's development and changes in geopolitical power at the regional and global levels. Strongly influenced by China's general strategy toward the outside world, China's energy security policy has been formed, developed, and transformed through several periods in the past few decades.

China has various and abundant natural endowments, such as minerals, metals, and petroleum among other natural resources; it is not a resource-poor country. Self-reliance and self-sufficiency based on these resources were the basic principles of China's energy policy both before and after the founding of the People's Republic of China in 1949; both the Nationalist government and the PRC government recognized these principles. The principle of self-reliance implies that China's oil industry has to rely on China's own resources which include human capital, physical capital, and natural resources. In other words, the development of the oil industry has to be independent and based on China's own resources rather than foreign resources. Self-sufficiency means meeting domestic demand with the supply of energy resources in China.

Although the Fushun oil field in Liaoning province in northeast China is often regarded as the first 20th century Chinese oil field, it was discovered, developed, and controlled before and during World War II by Japan, until 1945. Japan's annexation and construction of the Fushun oil field made the Chinese people realize the importance of the energy industry to national security and economic development. Ironically, Fushun's development under Japan was a major step toward self-reliance in the Chinese oil industry since development of the oil industry under the Nationalist government-controlled area of China was stirred by Japan's control of the oil industry in Manchuria during the war. A National Resource Commission (NRC) was established to manage and develop China's oil fields and energy resource nationalism served as an ideological format and executive entity for the Chinese government to protect Chinese oil fields during war time. Dominant ideologies in both the Nationalist and Communist regimes considered exploitation and control of their own resources as part of their notion of sovereignty

and symbolic of independence and the importance of self-reliance. It encouraged the Nationalist government's own efforts to discover and develop the first indigenously-managed oil project, Gansu province's Yumen. Though Yumen's legacy is not of total self-reliance since wartime foreign training was received from the U.S., Germany, and others, the development of Yumen oil field made the Nationalist government believe that the Chinese themselves have ability, knowledge and skills and capacity to extract oil and develop their own heavy resource industry sectors.

After War World II, the Nationalist government attempted to destroy oil fields before they retreated to Taiwan. But the oil fields survived and the Chinese Communist Party began to develop a self-reliance plan in the oil industry. The People's Republic of China (PRC) government utilized Fushun, and later Yumen and Daqing, as models for China's oil industry development: a facility developed by the Japanese, restored by the postwar Nationalist government, and upgraded by the PRC government implied an indirect but continuous technology transfer process and was crucial for the institutionalization and shaping of the structure of China's oil industry. The fact that the output of Yumen's liquid oil alone was greater than the total shale oil production in China at the end of the First Five Year Plan (1953-1957) sparked the Chinese government's quest to focus on liquid oil production in Yumen as its alternative path beginning at the end of this Five Year Plan. During this period, with help from the Soviet Union and Eastern European countries, Yumen's crude oil output increased from 0.2 million tons in 1953 to 1.7 million tons in 1960.⁵ As a national heavy industry model of China's ability to extract oil, Yumen's development provided skilled manpower, equipment, technical training, and skills that paved the way for self-reliance in oil for Daqing. The focus on Daqing in 1960 was the starting point of China's quest for energy through domestic sources and a milestone of independence from foreign oil sources for the first time. The development of Daqing, which emerged as an icon of oil industry development in China, was a response of the PRC government to the Soviet withdrawal of personnel and foreign aid from China as a result of tension between Moscow and Beijing. Daqing's crude oil production reached 6 million tons in 1964 compared with 0.64 million tons in 1949.

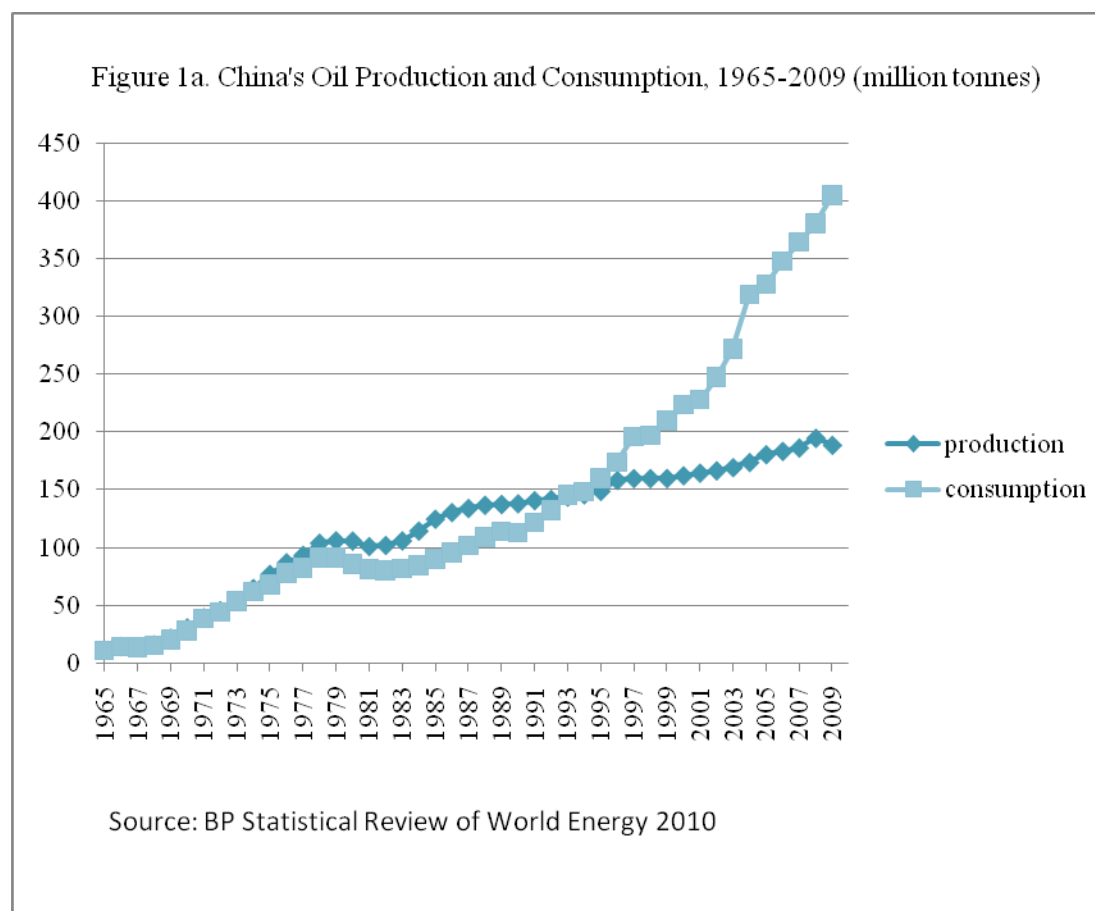
After World War II and the founding of the People's Republic of China in 1949, China was in alliance with the USSR against Western countries during the early period of the Cold War. As a poor developing country, safeguarding prosperity with domestic low-cost energy and resources was perceived as essential to China's national security. Self-sufficient production and consumption without depending on foreign resources dominated foreign policy in PRC leaders' minds for several decades. The ten years of the Cultural Revolution (1966-1976) had jeopardized Chinese economic development and the stability of the PRC government. So, focusing on economic reform became a vehicle to put the country back on the right track. Deng Xiaoping's economic reforms in 1978 began to motivate people according to their own self-interest, such that China's planned economic structure gradually moved to a partial market economy and private small and medium enterprises started to develop in late 1980s and began to gradually beat and replace inefficient state-owned enterprises (SOEs) in late 1990s, although SOEs remained

⁵ Lim, T.W. "China's Quest for Self-Reliance in Oil: The Story of Fushun, Yumen and Daqing" The Edwin Mellen Press, Ltd. United Kingdom, 2008

dominant at that time. Even after economic reform began in 1978, China's market was still quite isolated from the outside world with respect to trade and capital flows, but the “reform and opening” policy attracted foreign direct investment into China and an excess supply of rural labor was absorbed by labor-intensive manufacturing firms in the coastal areas. China's gross domestic product (GDP) started to grow at a very high rate since 1990s. The disintegration of the Soviet bloc in 1989 resulted in the U.S. being the only remaining superpower with China as the largest remaining Communist country in the world. China's accession to the WTO in 2001 allowed China to become one of the major players in the world trading system. Many of these events also spurred the trend of globalization and this, combined with worries about energy shortages, helped cause China to begin importing energy resources in the mid-1990s.

Table 1. The Development History of China’s Oil Industry

Phase 1: 1978 - 1992	Self-reliance and self-sufficiency are the key objectives of energy policy. The National Development and Reform Commission is founded and placed in charge of the energy sector. State-owned enterprises can access limited foreign markets.
Phase 2: 1993 - 1999	Production of oil can no longer meet domestic demand. Government starts to conduct reform to increase competitiveness of the SOEs. Enterprises start to seek oil in foreign markets
Phase 3: 2000 - 2008	“Go global” starts to become the main slogan and government encourages firms to go abroad. China’s accession to WTO further increases domestic business competition. SOEs and private firms expand their business worldwide.
Phase 4: 2008 - present	“Go abroad and buy,” is the response to the financial turmoil that began in 2008, and hastened China’s investment expansion at the global level. China’s investment in resource and energy sectors have increased dramatically.



China has been able to increase its energy production in the past decade, including expanded production of renewable and nuclear energy. The National Bureau of Statistics reported that use of hydro, wind, solar, and nuclear power increased to 9.5 percent of total energy use in 2008. Plans are underway to increase the share of renewable energy to 15 percent by 2020.⁶ Hydropower increased from one percent of China's total energy consumption in 1949 to 7.4 percent in 2008; in that year China's hydropower capacity topped 170 million kw, making China the largest hydropower consuming nation in the world. China's wind energy production has doubled every year in the past three years; current capacity of 12.21 million kw ranks fourth in the world.⁷ In 2008, the solar energy sector produced about 6,000 tons of polycrystalline silicon and 2 million kw of solar photovoltaic cells and nuclear power installed capacity was at 8.85 million kw.⁸

⁶ World Development Report 2010, Development and Climate Change, The World Bank, Washington, DC. pp.192

⁷ Xinhua News Agency, "China's new energy and renewable energy boom in recent years," *China Daily*, October 3, 2009, http://www.chinadaily.com.cn/business/2009-10/03/content_8762482.htm; accessed July 11, 2011.

⁸ "China's new energy and renewable energy boom in recent years" *China Daily*, October 3, 2009. http://www.chinadaily.com.cn/business/2009-10/03/content_8762482.htm; accessed October, 2010)

In non-renewables, coal consumption has been lowered from 96 percent of total primary energy use in 1952 to 68 percent in 2008 (see Figure 2, below). However, despite production growth making China the world's top coal producer, coal imports, fueled by lower coal prices in the international market, reached a record high of 9.43 million tons in May 2009, more than double the imports of May 2008.⁹ As shown in Table 2, after only a 0.4 percent production surplus (43 percent-42.6 percent) in 2008, China became a net coal importer in 2009.¹⁰ China's natural gas consumption grew by 15.8 percent in 2008 over 2007, compared with only a 2.5 percent growth rate globally.

Despite growing diversity in energy sources, China remains dependent on vulnerable oil imports. Although China is the world's fifth largest crude oil producer, since 1993 its production has not been able to keep up with escalating domestic demand. As shown in Figure 1a (above), China's oil production from 1965 to 2008 increased 17 times while oil consumption jumped 37 times. The vulnerability of energy security is not only reflected through energy demand, but also through rising energy price indices over the past decade (Figure 1b, below). This indicates that supply is not the only problem that China faces: stabilizing energy prices is also an immensely challenging task for Chinese policy makers.

Table 2 illustrates how, in 2008, China's oil consumption, 22 percent of its total primary energy use, increased by 3.3 percent over the previous year, claiming a 9.5 percent share of global oil consumption, while global oil consumption dropped by 0.6 percent for the first time since 1993. Even as global consumption was dropping at this time, China's continued to rise. China's oil imports exceeded domestic production for the first time in 2008, and the International Energy Agency (IEA) predicted that oil imports will jump to 75 percent of China's oil consumption by 2030.¹¹ If we compare percentage changes in 2009 over 2008 with percentage changes in 2008 over 2007, Table 2 also shows that R/P ratios of oil, coal, and natural gas drop from 2009 over 2008. Consumption of oil and coal has significantly increased and natural gas has dropped. China's share of global production of oil, coal, and natural gas have increased, and its share of global consumption of oil, coal, natural gas, hydroelectricity and nuclear have also risen in the correspondent period above.

Over 50 percent of China's imported oil comes from the unstable Middle East and over 85 percent of it is transported long distances in strategic shipping lanes such as the Straits of Malacca, Hormuz, and Suez – obviously, any serious disruption could slow or even halt China's economic growth.

⁹ Qiang Xiaoji, "China's coal imports up and exports down," China Daily, June 19, 2009.
http://www.chinadaily.com.cn/bizchina/2009-06/19/content_8302590.htm

¹⁰ Ibid.

¹¹ International Energy Agency, 2008

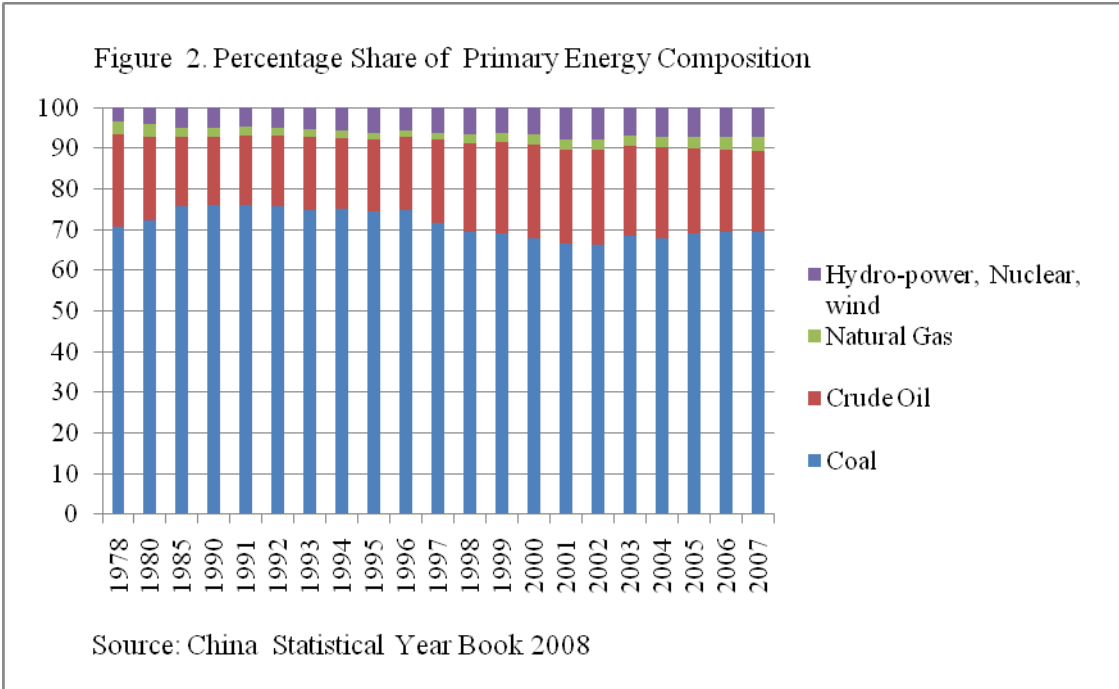
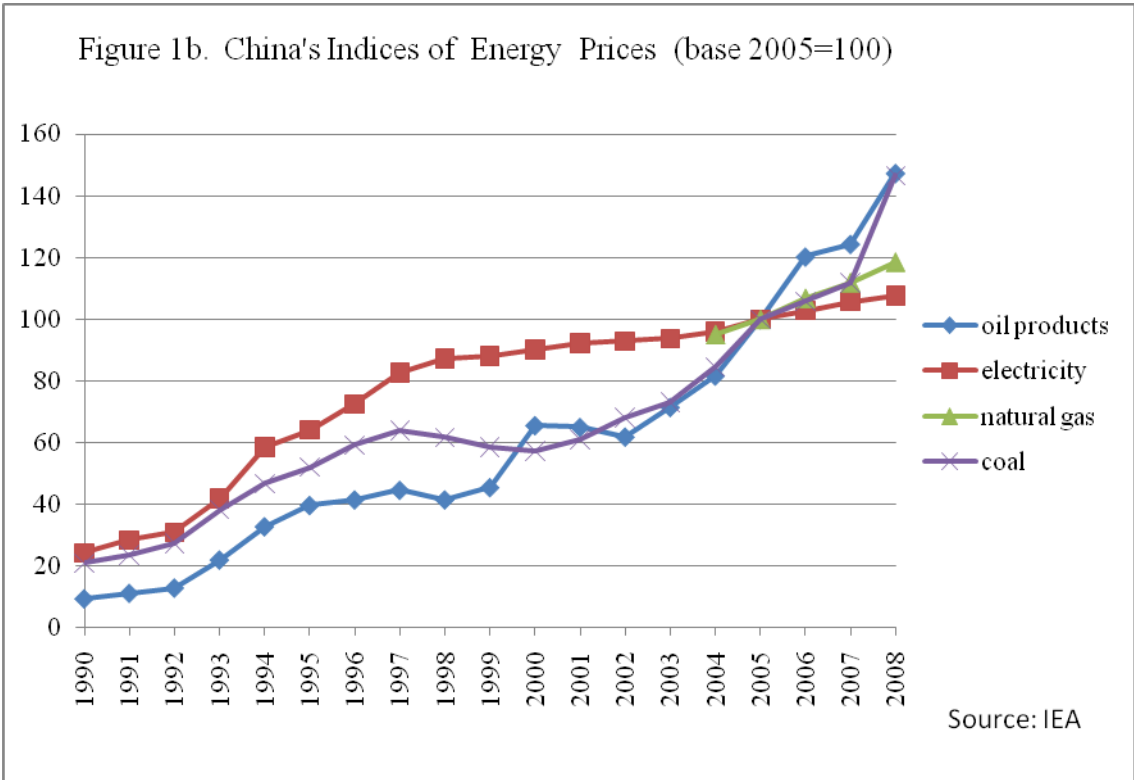


Table 2. China's Primary Energy Reserves, Production, Consumption & Shares of the Global Energy Market

Energy	Oil	Coal	Natural Gas	Hydro electricity	Nuclear Energy
Reserves share in 2008	1.20%	13.90%	1.30%	n/a	n/a
Reserves share in 2009	1.11%	13.9%	1.31%	n/a	n/a
R/P ratio in 2008	11.1%	41%	32%	n/a	n/a
R/P ratio in 2009	10.7%	37.5%	29%	n/a	n/a
Production share change 08 over 07	1.40%	10.00%	9.60%	n/a	n/a
Production share change 09 over 08	-2.8%	9.2%	6.4%	n/a	n/a
Consumption share change 08 over 07	3.30%	6.80%	20.30%	15.80%	9.80%
Consumption share change 09 over 08	6.69%	9.6%	9.4%	5.49%	2.8%
China's production share of global 2008	4.80%	43.00%	2.50%	n/a	n/a
China's production share of global 2009	4.95%	45.6%	2.8%	n/a	n/a
China's consumption share of global 2008	9.50%	42.60%	2.70%	18.50%	2.50%
China's consumption share of global 2009	10.4%	46.90%	3.0%	18.8%	2.6%

Source: Author's calculation based on *BP Statistical Review of World Energy 2009, 2010*

After the financial crisis and especially in 2009, China began to import even more resource-related commodities to take advantage of lower prices or excess supply in global energy market. According to the BP Statistical Review of World Energy in 2009, China's primary energy consumption increased by 7.2 percent in 2008, accounting for nearly three-quarters of global growth in primary energy consumption.¹²

3. China's recent energy security policy

In the current stage of industrialization—especially in China—energy security is essential for economic security. Economic security, in turn, is a critical element of national security and an objective of foreign policy. As noted above, because it had been self-sufficient in terms of energy since 1963, China did not consider energy security as a top priority in its national strategy plan until the late 1990s. In the 21st century, however, China's energy security planning has changed significantly to reflect its vulnerability to the dynamic and unpredictable energy price. In January 2010, China established a National Energy Commission (NEC), directed by Premier Wen Jiabao, aimed at improving the country's energy strategy and planning development. The key function of the NEC is to create national energy development plans, review energy security, and coordinate international cooperation. The NEC is composed of 21 ministers and different

¹² BP Statistical Review of World Energy, June 2009

departments including the National Development and Reform Commission (NDRC) and the People's Bank of China. The establishment of the NEC shows that China understands the urgent needs to integrate energy policy and macroeconomic policy, especially financial market.

Despite the unraveling of China's central planning, the NDRC and NEC still retain a strong leadership function and have focused on urgent energy security issues with energy security policy emphasized and prioritized. These changes were driven by both strong demand for energy resources due to the rapid development of the economy and the concerns of the Hu Jintao-Wen Jiabao administration that increasing dependence on imported oil might threaten national security as well as social and economic stability.

Thus, the 11th Five-Year plan (2006-2010) deviated from previous Five-Year plans by prioritizing expanding and securing domestic energy supplies and, for the first time, by promoting energy conservation through three corresponding objectives: economic efficiency, the reduction of poverty, and environmental preservation. To obtain economic efficiency, the energy sector is expected to transform from the planned economy to the market-oriented economy and thereby improve energy efficiency with a twenty percent reduction of energy intensity based on the 2005 level set as a compulsory target for all provinces and energy-related industries. Additionally, though not mentioned specifically in the 11th Five Year plan, bilateral and multilateral international cooperation in energy fields are viewed by the PRC government as an alternative channel to improve energy efficiency. To reduce poverty and help ameliorate inequality, the 11th Five-Year Plan calls for a focus on social impacts of energy policy. Finally, energy security policy is expected to protect and preserve the environment.

Surprisingly, since China has diversified its oil supply sources and routes since the late 1990s the plan only mentioned expanding and securing the domestic energy supply, and has not focused on foreign energy resources, though the SOEs have explored energy markets abroad since 1980s.

Like the previous Five-Year Plans, the 12th Five-Year Plan also provides quantitative targets in energy sector. For example, a 16 percent reduction in energy intensity is planned by 2015, and there is a target of 17 percent reduction in CO₂ emissions per unit of GDP by 2015.¹³ Though energy security is not highlighted or addressed in detail in this new plan, it is and will be continue at the top of China's list of priorities and policies will be pursued according to previous and updated energy policy.

Like many other countries, China has developed several major strategies that have been applied in the past few years in an attempt to secure energy supply. The strategies can be summarized as follow:

1. diversifying energy resources by increasing production of natural gas and nuclear power, developing clean energy technology to generate gasoline and diesel from coal,

¹³ Deborah Seligsohn and Angel Hsu, "China Releases 12th Five Year Plan," March 8, 2011, <http://www.sustainablebusiness.com/index.cfm/go/news.display/id/22006>, accessed July 6, 2011.

and increasing the use of other renewable energy sources such as wind power and solar energy;

2. enhancing the existing oil and natural gas supply sources and exploring to find more new energy resource locations at the global level; diversifying import routes by reducing import dependence from the Middle East, and increasing imports from Central Asia and Russia in order to reduce transportation risk;

3. strengthening energy exploration and production (E&P) of new oil fields domestically and encouraging international cooperation in offshore oil exploration and production; and

4. increasing the number of Strategic Petroleum Reserve sites and raising mandatory stockpile requirements for major oil firms.

Though securing the supply side of energy resources is viewed as the most effective way to solve energy shortages or alleviate crises for a state-controlled economy like China, this is no easy task.

4. Concepts of energy “security,” “self-reliance,” and dynamic management

Understanding energy security requires understanding not only energy sources, but also markets. Though categories are subject to change with technological breakthroughs, energy sources are currently divided into fossil fuels (crude oil, natural gas, coal), traditional biomass fuels (trees, shrubs, agricultural and animal wastes), renewable energy (wind power, solar, geothermal, tide and wave power, hydropower), and nuclear power. Even though crude oil is only one subcategory of such energy sources and oil security is not necessarily the same as energy security, petroleum has been and will continue for some time to be the world’s largest primary energy source. The process from discovery, exploration, refining, and transportation to final consumption requires various elements of physical capital and such elements of human capital as knowledge, technology, and research and development (R&D). Many of the new energy resources rely on innovative technologies for everything from exploration and initial discovery to bringing them into the final energy consumption. Coupling this complicated production process with uneven distributions of energy resources between regions increases the unpredictability and uncertainty of energy markets on both the supply side and the demand side.

An energy supply and demand model can be used to analyze energy markets. Energy price serves as an invisible hand to adjust both supply and demand. Price volatility induced by unexpected external shocks such as natural disasters, political upheaval, or war could result in economic and social instability. Therefore, stabilizing energy prices and minimizing significant price fluctuations can potentially prevent energy crises and some social unrest. Energy crises caused by shocks on the supply side or demand side can occur when energy prices are too far above or below the long-run price equilibrium level. If price deviates from the equilibrium for a sustained period, governments and inter-governmental organizations may have to intervene in

energy markets to prevent significant price fluctuations.

Equation 1, below, shows the equilibrium of energy supply and demand at the global level. Technically speaking, at time t and at the global level, the total supply of energy products equals to the total demand. Global energy prices are determined by energy commodity supply and demand over the long run.

Equation 1: Equilibrium of Energy Supply and Demand

$$\sum_{i=0}^n S_{it} = \sum_{j=0}^m D_{jt} = F_{it,jt} + Y_{it,jt} (P_t, R_t^d, R_t^{ns})$$

At the global level, for each energy exporting country indexed as i , who is also an energy supplier, the total summation of total global energy supply at time t is $\sum_{i=0}^n S_{it}$, where n represents the total number of energy exporting countries. For each energy importing country j , the total summation of energy demand at time t is $\sum_{j=0}^m D_{jt}$, where m represents the total number energy importing countries. For either an energy exporter (i) or importer (j), $F_{it,jt}$ represents the existing proven energy reserves at time t for energy exporting country (i) or importing country (j)—this can be called the fixed stock.

$Y_{it,jt}$ stands for the output or production of energy for energy exporter (i) or importer (j) at time t . It is a function of other variables such as global energy price (P_t) and domestic or firm specific risk factor (R_t^d) and non-systemic risk (R_t^{ns}). Risk factors include both observed and unobserved factors at the domestic and international levels. In order to prevent energy price shock and keep energy price at the market equilibrium level, the role of energy enterprises is to identify and minimize firm specific risk and the role of government and international cooperation are to identify and reduce non-systemic risk at macro-economic level or global level.

Energy security from the supply side can be viewed across the following four dimensions (4D): (1) quantitative volume, (2) proved reserves, (3) fuel variety, and (4) time span. These imply constraints that equilibrium across each energy sector and region must be achieved in the long run, as imports and exports (energy commodity trading) can solve energy shortages in the short run but not the long run. Dimensions 1, 2, and 3 can be categorized as either supply side or demand side, depending on whether the country in question is energy importer or energy exporter. Quantitative volume, proved reserves, and fuel variety form the fixed stock at any given time. These four dimensions alone cannot determine energy prices in the global spot market even if we relax some of these constraints because of the potentially strong influence of external variables such as political upheaval, natural disasters, and wars. But the 4D generate an equilibrium path of energy prices at the intersection of three dimensions with the energy spot price fluctuating along the equilibrium prices in the short run and in the

long run energy prices would approach the optimal points, which is the equilibrium path. Although each region has a theoretically equal absolute time frame, given the fuel variety, quantity thresholds, and geographic location of each country, the relative time frame for each country's energy supply and demand is different.

The four dimensions change in dynamic fashion corresponding with each country's actions given its location on 4D space. In addition, each of the 4D is influenced by each other. For example, renewable energy and price adjustment can change the quantity demanded and the supply of energy given a certain period of time. The quantity dimension level is lower for energy importing regions than energy exporting regions. Reaching an energy threshold level is the minimum requirement for economic security for an energy importing region, while determining how to encourage higher energy prices and the interaction between time frame and locations with trading partners is crucial for energy exporting regions. From each country's perspective, energy security is defined as having a sufficient amount of energy resources to keep its political, economic, social, and ecological development on a sustainable path such that its energy use and development should not threaten the survival of human and ecological systems. There is no universal key to solving energy security issues at the national or global level given the complex nature of energy security. The possible methods for solving energy security issues should be approached according to four dimensions that can be jointly integrated according to a particular time frame: (1) conserving and increasing energy efficiency; (2) building Strategic Petroleum Reserves (SPRs); (3) diversifying fuel and diversifying imports; (4) managing a hedge trading time frame in which energy commodity futures are bought and sold.

Each country is constrained by these four space dimensions and needs to consider its own strategies given its time dimension (short term or long term), its status as an exporting country or importing country, and its energy quantity thresholds (survival level). Furthermore, and especially for the major exporters and importers, each country's energy security policy influence other countries' decisions in the integrated global energy market such that global energy security issues can not be solved by a single country but can only be changed via international cooperation and multilateral negotiations between countries or regions.

5. China's Energy Security Policy Trends

5.1 The Evolution of China's Energy Security Policy Toward Conservation

China's energy security policy has evolved through four major stages, as indicated in Table 1. The first stage, from 1949-1993, can be called the self-sufficiency, self-reliance period. During this period, China undertook strong measures to establish and safeguard its sovereignty. As foreign interaction would have invited outside interference therefore, energy security policy

mainly depended on domestic production with very little role for foreign policy.

During the second stage, from 1993-2005, the main slogan was “go abroad.” China’s oil self-sufficiency ended in 1993 and it started to import oil from abroad. The national oil companies (NOCs) started to learn how to play in the global energy market via foreign direct investment. China’s accession to the WTO in 2001 accelerated energy resource consumption. One of China’s main energy policies of this period was encouraging energy firms to seek oil and other energy resources. To this end, the government provided more investment knowledge, information and guidelines, and financial support such as tax credits to SOEs especially. Energy security policy and foreign policy became more integrated to better serve national security interests.¹⁴

The third stage, from 2006 to the present, can be called the “outward investment” period. If we regard the previous two stages as the “formation stage” and the “arrival in the global market stage” respectively, the third stage is the “learning the rules of the game stage.” Since 2005, energy security has been prioritized in the 11th Five-Year Plan, with energy conservation, the environment, climate change, and green energy further emphasized. The Corporate Social Responsibility (CSR) law was revised and introduced under the Company Law. CSR policies were first implemented by multinational corporations in the 1960s and 1970s as a way to produce positive impacts and positive publicity. As a newcomer in the international market, China’s enterprises started to learn these rules over the past decade or so. International cooperation in the energy sector is encouraged. In this period, relative to the previous stages, China’s economic and political power has increased. Many firms have selectively invested in foreign countries, getting away from pure profit-seeking strategies and focusing more on CSR, the environment, and host countries’ development issues. With small and medium enterprises also investing overseas, energy investments have become more diversified in terms of firm size and energy sectors. And China’s foreign policy has played a progressively more important role in supporting energy security, especially in big investment contracts.

The fourth stage of China’s energy security policy began with the global financial crisis in 2008, which gave China an opportunity to utilize its large foreign currency reserve and further expand its investments in the global market. Subsequently, China’s economy overtook Japan’s in dollar terms in 2010¹⁵ and as the top goods producer in the world.¹⁶ These achievements have provided China with more confidence and more capacity in pursuing mergers and acquisitions and other financial investment in foreign countries. The recent political unrest in the Middle East and North Africa regions has further strengthened China’s resolve to diversify its energy sources.

¹⁴ For a discussion of energy policy’s place within Chinese foreign policy during this period, see James Tang, “With the Grain or Against the Grain: Energy Security and Chinese Foreign Policy in the Hu Jintao Era,” *CNAPS Visiting Fellows Working Paper Series*, Brookings, October 2006, http://www.brookings.edu/papers/2006/10china_tang.aspx.

¹⁵ Mure Dickie, “China economy overtakes Japan,” *Financial Times*, February 14, 2011, <http://www.ft.com/cms/s/0/3275e03a-37dd-11e0-b91a-00144feabdc0.html#axzz1IaOkUriJ>; accessed July 6, 2011.

¹⁶ Peter Marsh, “China noses ahead as top goods producer,” *Financial Times*, March 13, 2011, <http://www.ft.com/cms/s/0/002fd8f0-4d96-11e0-85e4-00144feab49a.html#axzz1IaOkUriJ>; accessed July 6, 2011.

Japan's nuclear crisis caused by the March 2011 earthquake and tsunami forced China to reconsider some of its plans, and it temporarily suspended the approval of new nuclear plants and began to reconsider its nuclear development plans and nuclear safety standards.¹⁷

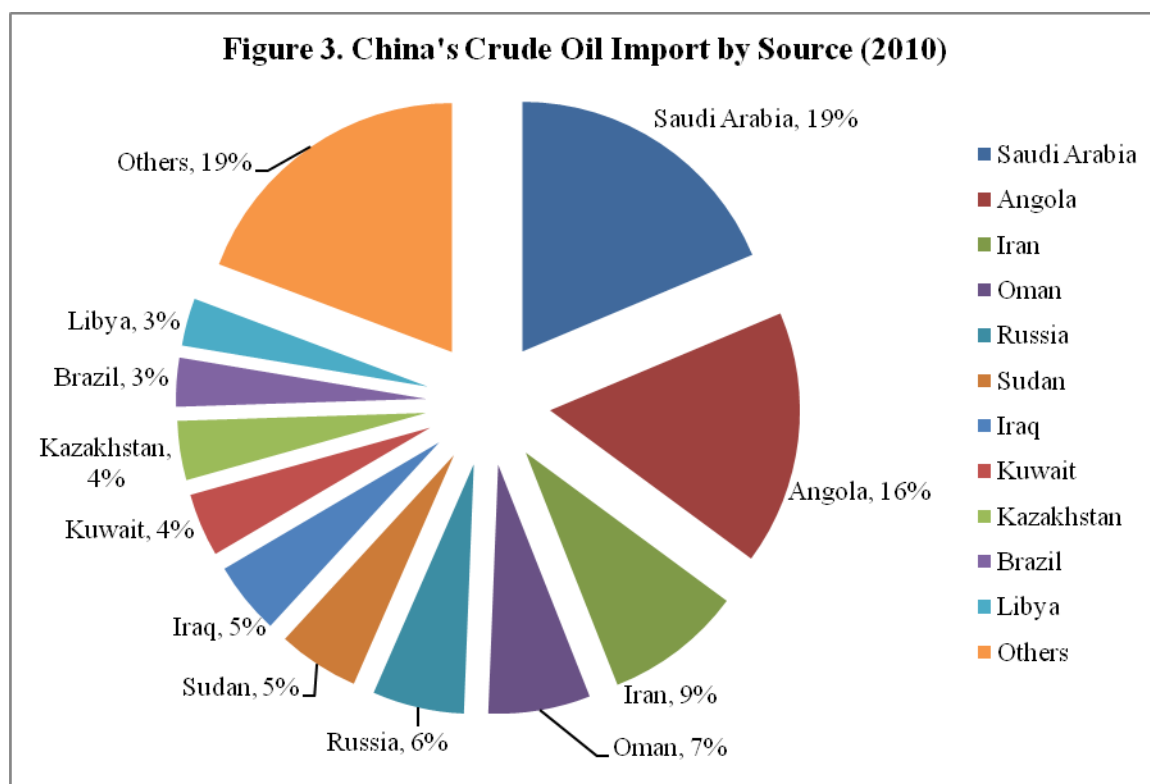
5.2 The Consistency of Primary Energy Use Composition Rates since 1978

Despite increases in the use of renewable and nuclear energy sources, the pattern of China's primary energy usage has remained relatively constant since 1978 as illustrated in Figure 2. Oil accounts for only about 20 percent of China's total energy consumption in the past decade; since more than half of the oil that China consumes is imported, we can estimate that imported oil accounts for roughly ten percent of China's total energy consumption. Coal remains the dominant energy source, making up 70 percent of China's total energy consumption. Unless new clean coal technologies drive up the cost, coal will remain inexpensive relative to other resources in China and therefore, even though it is not an environmentally friendly energy resource, it is likely to remain China's main source of energy in the next few decades.

5.3 The Decreasing Dependence on Oil Imports from the Middle East

China's quest for imported oil has changed with corresponding global and regional geopolitical and economic developments over time in response to geopolitical and transportation risks. Though Middle Eastern countries continue to be the most important suppliers of almost half of China's imported oil (Table 3, Figure 3), China has attempted to decrease its dependence on imports from the volatile Middle East through investments in African countries such as Angola, Sudan, Libya, and the Congo; and Russia and Central Asian countries such as Kazakhstan. Investments in these Central Asian countries can also significantly decrease sea-lane transportation risks. The financial crisis has not changed China's the oil import source. Figure 3 percentage share of China's crude oil import by source is calculated from thousands of barrels per day from EIA data information.

¹⁷ Leslie Hook, "China suspends approval of nuclear plants," *FT Zhongwenwang*, March 17, 2011, <http://www.ftchinese.com/story/001037547/en>; accessed July 6, 2011.



Source: "China Energy Data, Statistics, and Analysis: Oil, Gas, Electricity, Coal," U.S. Energy Information Agency, last updated May 2011, <http://www.eia.gov/cabs/china/Full.html>; accessed July 13, 2011.

Table 3. China's Crude Oil Imports by Origin (% share)

Crude oil imports from	1990	1997	2005	2006	2008	2010
Middle East	39%	48%	46%	44%	46%	46%
Russia/Central Asia	n/a	n/a	11%	11%	10%	10%
Atlantic Basin	n/a	n/a	23%	5%	3%	3%
Asia Pacific	60.0%	26.2%	8.0%	4.0%	n/a	n/a
Africa	0.0%	16.7%	n/a	32.0%	23.0%	22%
Others	0.0%	9.6%	12.0%	4.0%	18.0%	19%
Total	100%	100%	100%	100%	100%	100%

Source: The data are compiled from different sources by the author. China, General Administration of Customs (2005), IEA (2006), IEA (2001), FACTS Global Energy(2008), EIA(2010)

Note: Atlantic Basin source (3%) in 2010 is from Brazil

5.4. *The Expansion of Outward Foreign Direct Investment in Energy Sector*

When China cemented its move from a centrally planned economy to a more market oriented one in the 1990s, this signified more openness in domestic energy sectors and also changes in the structure and approaches to decision-making regarding outward direct investment. The energy sectors have allowed foreign enterprises to invest in China's market but the openness varies from sector to sector. For example, in terms of investors' holding of exploration permits in the oil and gas sectors, state-owned enterprises (SOE) accounted for only 8 percent compared with 92 percent held by non-state-owned enterprises in 2006. By comparison, in the precious metal sector, 57 percent are held by SOEs and only 43 percent are held by non-state-owned enterprises.¹⁸

Furthermore, according to the 2008 Statistical Bulletin of China's Outward Foreign Direct Investment, 43 percent of China's top 40 biggest outward foreign direct investment enterprises in 2008 were firms in energy or resource-related sectors. The China National Petroleum Corp. (CNPC), with assets of 1.8 trillion Renminbi, ranked number one on the list. The scale of outward foreign direct investment has moved from small and medium manufacturing sectors to giant energy resources, electronics, high tech, and telecommunication sectors, and the seat of decision-making was moved from central planner to the individual firm level. However, since most of the biggest energy sectors that "go abroad" are SOEs, the key personnel and CEOs of the enterprises are appointed by the central government.¹⁹

6. Investment & Capacity Building Required to Support Dynamic Management after the Global Financial Crisis

6.1 *The Macroeconomic Environment after the Global Financial Crisis*

Because China was relatively unaffected by the credit crunch, the financial crisis of 2008-2009 helped further solidify China's integrated energy policy by encouraging the diversification of its energy source supply. This was done by making use of a large amount of U.S. bills and taking advantage of lower oil and other energy resource prices (Figure 4). The struggles of other countries made the Chinese government further recognize the importance of monetary policy and financial stability in the integrated global economy. In 2008, China surpassed Japan and become the largest creditor to the United States, holding two-thirds of its \$2 trillion in foreign currency reserves in U.S. treasury bills and bonds. Considering the U.S. is now in the most severe recession since Great Depression, China has embarked on a policy of diversifying its risk of holding large amounts of U.S. bills by buying natural resources and other tangible assets abroad with its cash and foreign reserves. With oil prices having fallen from US\$150 per barrel to US\$40 per barrel in late 2008 and early 2009, China was able to purchase significant amounts of

¹⁸Sun, X. and J. Chen, "Private capital: What impedes its entry into China's minerals industry," *Resources Policy*, 33:23-28 (2008).

¹⁹Morck, Randall, Yeung Bernard and Minyuan Zhao, (2007) "Perspectives on China's Outward Foreign Direct Investment" *Journal of International Business Studies* 39, 337-350 (April/May 2008)

energy and raw materials in a market in which oil exporting countries who were hit deeply by the financial crisis sought buyers to generate revenue to support their economies. In February 2009, China strategically secured long-term energy resource supplies by signing bilateral agreements in the oil and petrochemical sectors with Saudi Arabia, reaching a deal to lend \$25 billion to two Russian energy companies in exchange for an expanded supply of Russian oil for the next twenty years,²⁰ and agreeing to a deal for Brazil to supply up to 100 million barrels of crude oil a day to China for a loan of up to US\$10 billion.²¹ Further strategies include building China's strategic petroleum reserves, looking to resources in new areas, expanding finance and non-finance foreign direct investment, and monetary policies of signing energy trade agreements with non-dollar payments. Although the effectiveness in securing the value of China's foreign exchange reserves or its energy supply is not yet known, such policies seem to have taken advantage of the financial crisis to help further propel China toward improving its energy security.



6.2 Building Strategic Petroleum Reserves

China's thirst for energy resources in recent years is driven not only by the immediacy of economic development but also by the long-term but still urgent need for building strategic petroleum reserves. Electricity outages in many cities in recent years sent an alarm to Chinese leaders to be aware of the impacts and consequences of energy security. China is one of the few

²⁰ Robin Paxton and Vladimir Soldatkin, "China lends Russia \$25 billion to get 20 years of oil," *Reuters.com*, February 17, 2009, <http://uk.reuters.com/article/2009/02/17/uk-russia-china-oil-sb-idUKTRE51G3S620090217>; accessed July 11, 2011.

²¹ Associated Press, "Brazil to supply crude to China - in return for \$US10b loan," *Sydney Morning Herald*, February 20, 2009, <http://www.smh.com.au/business/world-business/brazil-to-supply-crude-to-china--in-return-for-us10b-loan-20090220-8cuv.html>; accessed July 11, 2011.

major oil importers which does not have a strategic petroleum reserve (SPR). Most OECD/IEA countries, such as Japan, South Korea, and Australia, maintain mandatory stocks of oil equivalent to at least 90 days of net oil imports while the U.S. SPR had 688 million barrels in 2006, providing about a 55-day supply of oil imports at 2005 U.S. rates of consumption.

In 2004, China began building SPRs at four sites, located in Zhenhai, Zhoushan, Huangdao, and Dalian. According to a plan released by the National Energy Administration (NEA), by 2011 China will build eight new strategic SPR bases in addition to the current four, and increase China's strategic crude capacity from 103 million barrels to 281 million barrels. Two confirmed venues for SPR tanks are Huanggao and Jinzhou with 14 other potential locations for the remaining six future SPR tanks in Quanzhou, Shantou, Guangzhou, Bao'an, Zhanjiang, Yangpu, Yantai, Binhai, Caofeidian, Tieling, Linyuan, Lanzhou, Wanzhou, and Shanshan. Despite the pressure of the financial crisis, China's decided to reduce some of its financial reserve surplus in order to take advantage of falling global energy prices and increase its oil reserves. Studies have shown that the long-run elasticity of demand is -0.05 and the long-run elasticity of supply is 0.08 for the global oil market.²² Building a strategic reserve is a long-term strategy that helps to mitigate short-term price shocks from the international oil market.

6.3 *Eye on the Arctic Sea?*

The Arctic region may be a promising location of future energy sources for China. Some Chinese researchers have encouraged the Chinese government to make comprehensive strategic plans for the Arctic, which contains about 13 percent of the world's undiscovered oil and 30 percent of its undiscovered gas.²³ In a presentation in 2010, Stockholm International Peace Research Institute (SIPRI) researcher Linda Jakobson argued that China "is at a disadvantage as it is not an Arctic state but is still keen to have the right to access natural resources."²⁴ In addition to possibly providing an abundance of natural resources, a sea route through the Arctic would also shorten the distance, time, and risk associated with the sea lanes around the Horn of Africa and the chokepoints of Southeast Asia.²⁵

6.4 *Financial Outward FDI and Non-Financial Outward FDI*

Since the onset of the financial crisis, the Chinese government has encouraged both private and public investors to go abroad by easing procedures for investment approval, supporting investors with financial services and credit, providing overseas investment guidance, and arranging investment delegations to other countries. China continues to employ two methods to pursue

²² Nouredine Krichene, "World Crude Oil Markets: Monetary Policy and the Recent Oil Shock," International Monetary Fund Working Paper 2006-62, March 2006

²³ Linda Jakobson, "China Prepares for an Ice-free Arctic," *SIPRI Insights on Peace and Security*, no. 2010/2 (March 2010), <http://books.sipri.org/files/insight/SIPRIInsight1002.pdf>.

²⁴ Associated Press, "Group: China preparing for Arctic melt commercial opportunities," *USA Today*, March 1, 2010, http://www.usatoday.com/news/world/environment/2010-03-01-china-arctic-melt_N.htm.

²⁵ Ibid.

energy resource investments in the international energy market: financial outward foreign direct investment (OFDI), which mainly includes banking, insurance, securities, and other financial institutions; and nonfinancial OFDI, which includes manufacturing, mining, education, healthcare, and other areas. Nonfinancial OFDI also includes greenfield investment, merger and acquisition activities, and brownfield investment and others type of investment.

A significant hike in OFDI occurred when China's accumulated OFDI grew from \$75 billion in 2007 to \$245 billion in 2009, an increase of more than 300 percent in only three years. Despite this upward trend, however, China's total OFDI still accounts for only 6 percent of global OFDI stock so far.²⁶

As shown in Table 4, by 2009, China's accumulated OFDI net stock volume was \$245.75 billion, with financial OFDI accounting for 18 percent and non-financial OFDI 82 percent. For non-financial OFDI, Chinese firms have helped China's long-term energy security by increasing their use of mergers and acquisitions of foreign energy or raw material firms to try to gain strategic sustainable competitive advantages as a global player.²⁷ Financial OFDI has become more and more important after 2008. The share of financial OFDI is expected to increase as China's enterprises gain more experience in the international financial market. Financial OFDI accounted for 25 percent of total annual OFDI in 2008 and 15 percent in 2009 (Table 4). In addition, the establishment of the China Investment Corporation (CIC) in 2007, with the issuance of special bonds worth Renminbi 1.55 trillion by the Ministry of Finance, demonstrates the importance of financial OFDI in China's total investment portfolio. The significant drop of financial OFDI in 2009 is mainly due to the financial crisis, as shown in Table 4, Chinese enterprises increased investment in mining sector by 13 percent in 2009 over 2008. While the share of financial OFDI dropped by over 10 percent in the same period.

Table 4 also shows that the share of mining sector OFDI out of total sectors in 2009 is more than twice of that in 2008. The accumulated stock share of mining sector OFDI in 2009 also jumped by 4 percent compared with the share in 2008, which implying that China took advantage of lower prices of resource and increased investment in resource related sector during 2008 and 2009. The opposite trend appears in the share of financial OFDI in 2008 and 2009: both annual flow share of financial OFDI and stock financial OFDI have declined in 2009 compared with those in 2008. This shows that China was cautious about high financial risk and dramatically reduced its financial investments at the global level in 2009 compared with 2008.

²⁶ Nargiza Salidjanova, "Going Out: An Overview of China's Outward Foreign Direct Investment" U.S.-China Economic & Security Review Commission. March 30, 2011

²⁷ Rui Huaichuan and G.S.Yip, (2008) "Foreign acquisitions by Chinese firms: A strategic intent perspective" *Journal of World Business*, Vol. 43 (2008), pp. 213–226.

Table 4. China's Outward FDI Stock and Accumulated Stock in 2002-2009

Annual Flow Volume (Million US\$)								
Year	2002	2003	2004	2005	2006	2007	2008	2009
Mining ¹		1,380	1,800	1,675	8,540	4,063	5,823	13,343
Total Annual OFDI	2700*	2,854	5,497	12,261	17,633	26,506	55,907	56,530
Financial OFDI					3,530	1,668	14,050	8,730
% share of Mining	0.00%	48.35%	32.75%	13.66%	48.43%	15.33%	10.42%	23.60%
% share of Financial OFDI					20.02%	6.29%	25.13%	15.44%
Cumulative stock (Million US\$)								
Year	2002	2003	2004	2005	2006	2007	2008	2009
Mining ¹		5,900	5,951	8,652	17,902	15,014	22,870	40,579
Financial OFDI					15,605	16,720	36,690	45,994
Total Cum. OFDI	29900*	33,222	44,777	57,205	75,025	117,910	183,970	245,750
% share of Mining	0.00%	17.76%	13.29%	15.12%	23.86%	12.73%	12.43%	16.51%
% share of Financial OFDI					20.80%	14.18%	19.94%	18.72%

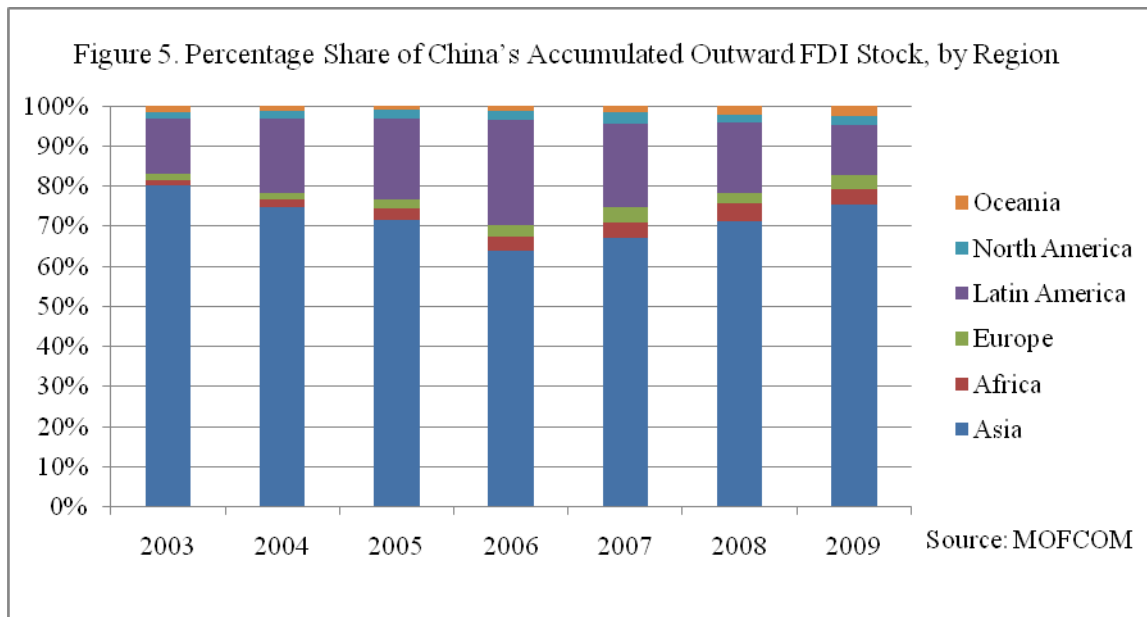
¹ Mainly focuses on extraction of petroleum and natural gas, and mining and processing of ferrous and non-ferrous metal ores.

*excludes financial OFDI.

Note: 2003-2005 data includes only non-financial outward foreign direct investment, 2006-2008 data includes both financial and non-financial data.

Source: Author's calculation based on data collected from 2003-2009 *Statistical Bulletin of China's Outward Foreign Direct Investment*, Ministry of Commerce of PRC, National Bureau of Statistics of PRC, and State Administration of Foreign Exchange (<http://hzs.mofcom.gov.cn/accessory/200909/1253868856016.pdf>).

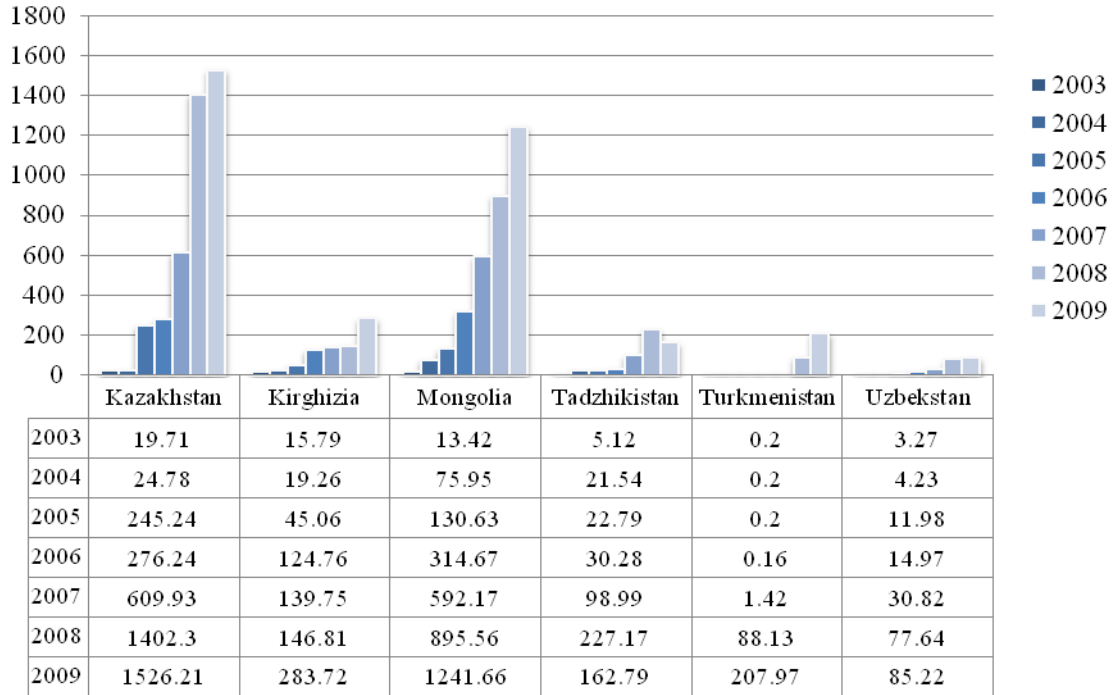
Figure 5, below, depicts the accumulated amounts and destinations of China's OFDI by region from 2003 to 2009. Asia, with a 75 percent share of China's total OFDI, remains to be the major destination. The financial crisis also has influenced the location of Chinese enterprises' OFDI. Shares in Asia, Europe, North America, Oceania increased while shares in Latin America and Africa decreased in 2009 compared with 2008.



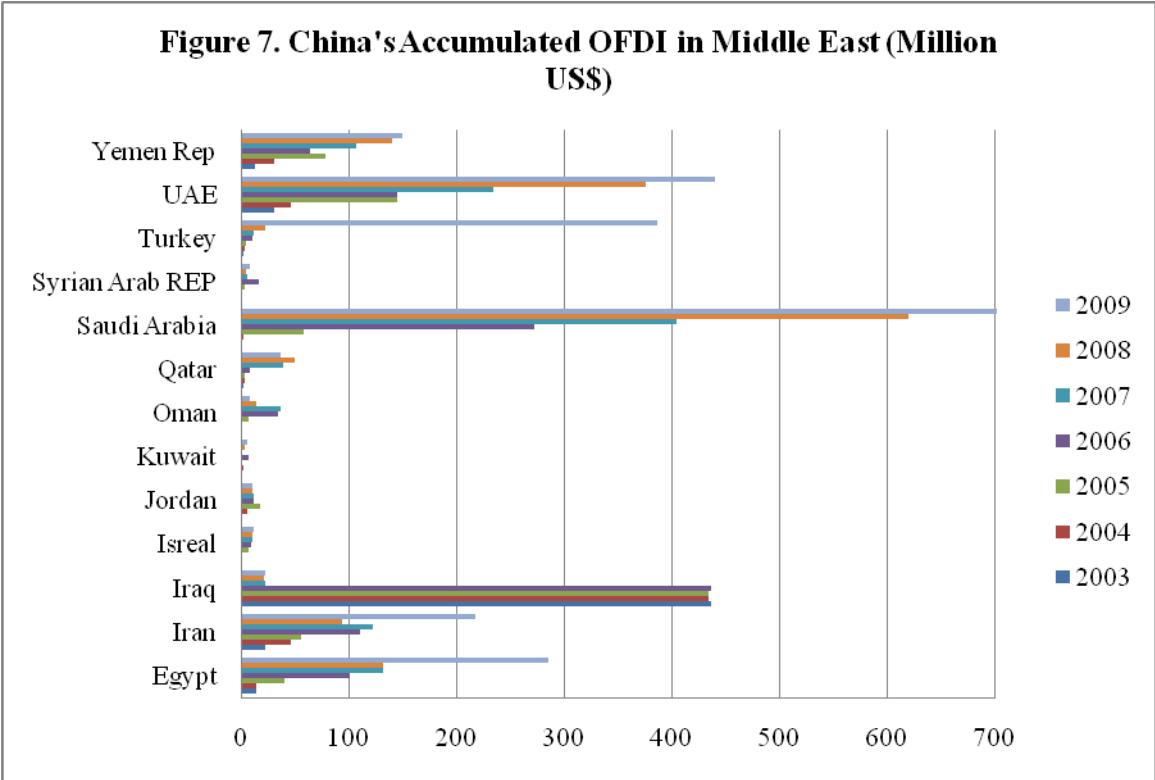
Source: 2009 Statistical Bulletin of China's Outward Foreign Direct Investment Ministry of Finance, PRC.
 Note: Saudi Arabia, Iran, Oman, Kazakhstan, Kuwait, the United Arab Emirates (UAE), and Iraq are categorized as part of Asia

In order to show the changes of China's OFDI in Middle East and Central Asia, which is one of the key energy supply regions, we can further disaggregate the data on these two regions. Figures 6 shows that Kazakhstan and Mongolia received the highest inflow of Chinese OFDI stock from 2003 to 2009, and Figure 7 shows Saudi Arabia, UAE, Yemen, and Egypt having the highest Chinese OFDI in the Middle East. OFDI in Iran remained relatively high in 2009 and OFDI in Iraq dropped significantly in 2009 compared with 2008. According to the 2009 Statistical Bulletin of China's Outward Foreign Direct Investment, China's OFDI investment in the Middle East was around US\$1.497 trillion in 2008 and US\$2.292 trillion in 2009. The Chinese government is calculating the effect on China's energy security and national interests that could result from the sanctions against Iran proposed by Western countries and developing other sources of energy.

Figure 6. China's Accumulated Outward FDI Stock in Central Asian Countries (million US\$)



Source: 2009 Statistical Bulletin of China's Outward Foreign Direct Investment

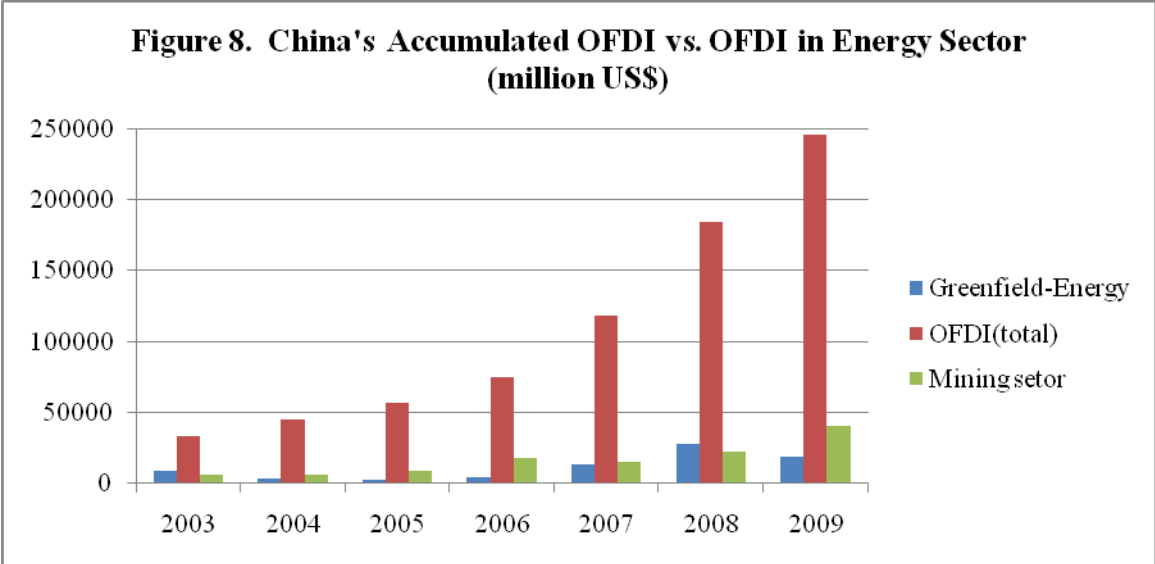


Source: 2009 Statistical Bulletin of China's Outward Foreign Direct Investment

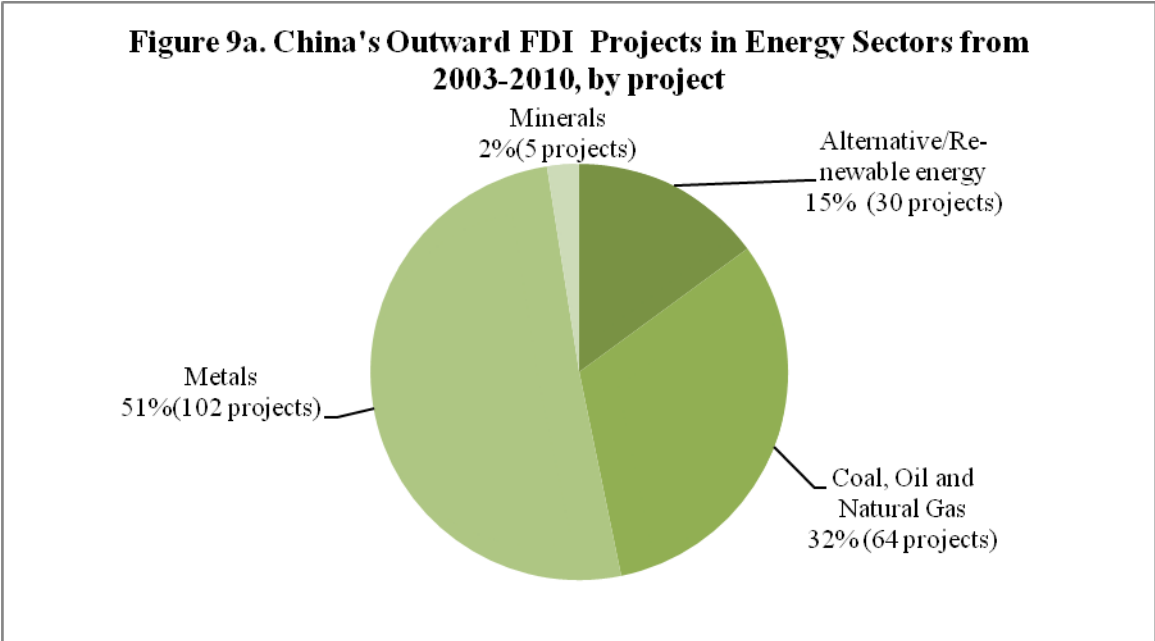
Figure 8 shows the stock value of OFDI, and mining sector stock value and greenfield energy sector OFDI over time. The former two data value are taken from 2009 Statistical Bulletin of China's Outward Foreign Direct Investment (Table 5) and the greenfield energy sector data set is from Financial Times's fDi Intelligence data set. This figure shows that greenfield projects in the energy sector remain relatively small. Because of a lack of merger and acquisition data in the energy sector, it is difficult to calculate the total amount and total share of the energy sector out of total OFDI. Furthermore, we can see the difference of the mining sector from China's official data set and greenfield energy sectors from Financial Times. This is mainly due to project record differences and definition of the variables in the data sets.

Using the Financial Times OFDI data set, figure 9a shows that by number of projects, the metal sector tops the list with 51 percent of total greenfield OFDI projects in 2003-2010. Coal, oil and natural gas retain the second largest share among four energy sectors with 32 percent. Figure 9b demonstrates the share of OFDI by value, in this case, coal, oil and natural gas account for 59 percent of the total value and metals remain second with 28 percent.

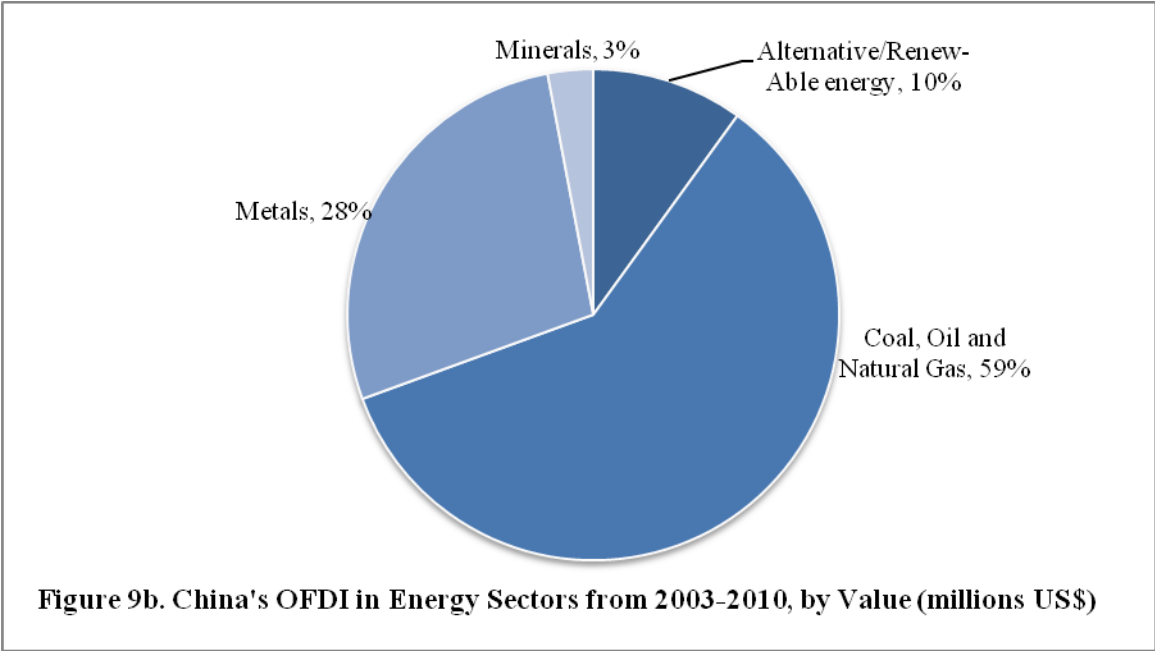
Figure 10 shows that in the greenfield energy sector, Asia absorbs 45 percent of China's total energy OFDI, Africa receives 31 percent, Latin America accounts for 15 percent. North America receives only 1 percent of total greenfield energy OFDI.



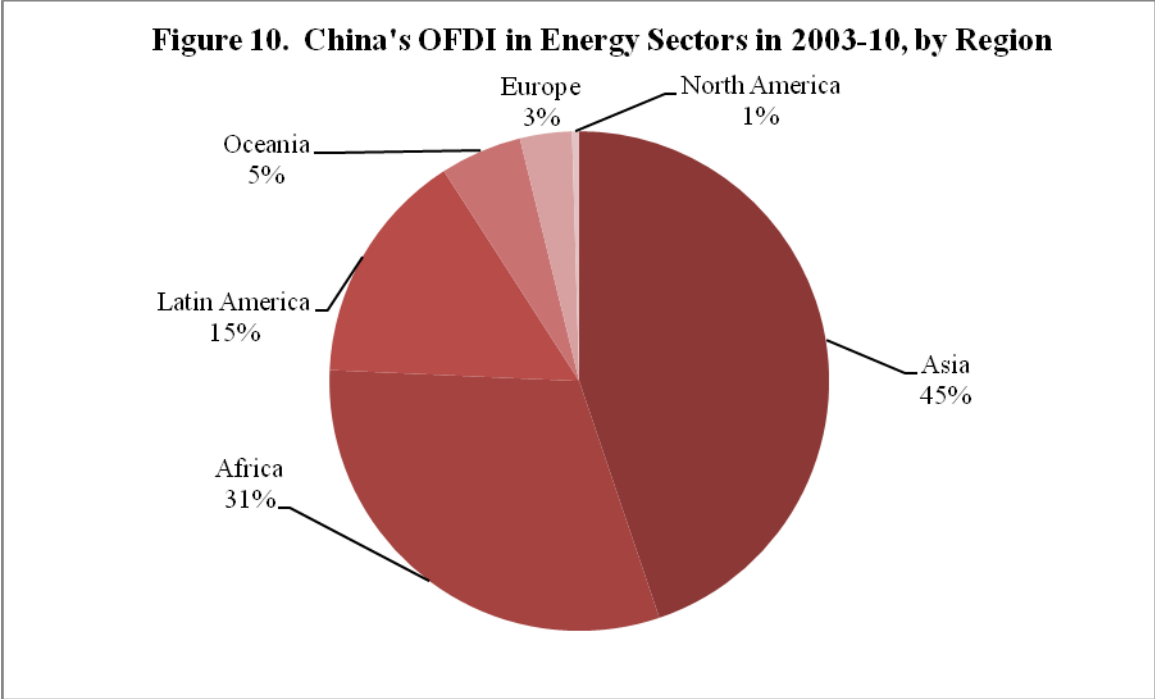
Source: 2009 Statistical Bulletin of China's Outward Foreign Direct Investment and Financial Times fDi Intelligence



Source: 2009 Statistical Bulletin of China's Outward Foreign Direct Investment and Financial Times fDi Intelligence



Source: *Financial Times fDi Intelligence*



Source: *Financial Times fDi Intelligence*

Table 5. Top 20 China's Greenfield OFDI Projects in Energy Sectors

Rank	Country	Year	Sector	OFDI(million US\$)
1	Vietnam	2008	Coal, Oil & Natural Gas	4500
2	Brazil	2009	Metals	4000
3	Iran	2007	Coal, Oil & Natural Gas	3600
4	Afghanistan	2009	Metals	2900
5	Cuba	2010	Coal, Oil & Natural Gas	2900
6	Liberia	2008	Metals	2600
7	Nigeria	2008	Coal, Oil & Natural Gas	2400
8	Australia	2007	Metals	2294
9	Angola	2007	Coal, Oil & Natural Gas	2262
10	Indonesia	2010	Metals	2000
11	Egypt	2010	Coal, Oil & Natural Gas	2000
12	Nigeria	2010	Coal, Oil & Natural Gas	1913
13	Niger	2008	Coal, Oil & Natural Gas	1850
14	Saudi Arabia	2008	Coal, Oil & Natural Gas	1816
15	Iran	2009	Coal, Oil & Natural Gas	1760
16	Sudan	2009	Coal, Oil & Natural Gas	1701
17	Oman	2009	Coal, Oil & Natural Gas	1656
18	Chad	2008	Coal, Oil & Natural Gas	1586
19	Syria	2008	Coal, Oil & Natural Gas	1500
20	Brazil	2003	Metals	1500

Source: Author's calculation based on *Financial Times fDi Intelligence*

Table 5 demonstrates the top 20 biggest OFDI projects in 2003-2010. Most of these are energy-related projects took place in the past few years in developing countries, with coal, oil, and natural gas accounting for 75 percent of them. And more than half took place in or after 2008, implying that China accelerated its hunt for resources after the global financial crunch.

6.5 Energy Sector- Related Macroeconomic Policies: Signing Energy Trade Agreements with Non-dollar Payments

After the global financial crisis in 2008, China, one of the biggest global exporters of merchandise and biggest importers of energy resources, realized the importance of linking macroeconomic policy—especially monetary policy—with foreign policy in an integrated world in which exchange rates, current account balances, and national debts are all connected with trade and investment issues. Therefore, its “going out” policy has been multidimensional and not limited to investments related solely to energy resources. For example, China has accelerated the

internationalization of the Renminbi through a number of measure, creating an offshore market for the Renminbi and encourages the use of the Renminbi in trading transaction. In January 2010, China began to allow trading in yuan in the United States; the New York branch of the Bank of China will become the Renminbi clearing center in the United States. This is the first offshore market for Chinese currency trading after launching one branch in Hong Kong last year. According to this new offshore trading policy, an individual in the U.S. can covert maximum \$4000 per day to Chinese yuan or vice versa, and there is no limit or restriction for enterprises to convert two currencies.²⁸ The immediate goal of this policy is to preventing hot money from flowing into China due to speculator's bet on the yuan's movement. So far, offshore trading of the yuan is only a very small fraction of the market, though the yuan may come to play an important role. The World Bank expects the U.S. dollar to lose its solitary dominance in the global economy by 2025,²⁹ and the Renminbi may be one currency that could take its place, or at least increase its share of the market.

A related step is the signing of bilateral currency swap agreements with the Republic of Korea (ROK), Hong Kong, Malaysia, Belarus, Indonesia, Argentina, Japan, the Philippines, Thailand, Saudi Arabia, Russia, Venezuela, Iceland, and many other trading partners to not use the U.S. dollar for trade deals, which can include oil trading. The impact of the internationalization of the yuan may become important as more and more of China's trading partners adopt bilateral currency swap arrangements. If bilateral currency swap agreements are continuously implemented between China and its trading partners, a large percentage of China's energy trade or investment may be paid for in currencies other than the U.S. dollar. Furthermore, the bilateral currency swap agreement has been expanded to other sectors besides oil sector with even some Japanese manufacturers accepting payment in Renminbi recently. As shown in Table 5, OFDI in mining sector alone is about \$40 billion in stock in 2009, which is about 17 percent of the total OFDI. Globalizing the yuan will have significant impact on outward investment and trade, and the energy sector is one of the most important sectors in both investment and trade.

Table 6 demonstrates the top merchandise trade and services trade of exporting countries and importing countries in 2010. Though China's net exports of \$196 billion in merchandise trade are not very big, China's total import volume and export volume is \$2.2 trillion. In global services trade, China ranked 7th in exports in 2008 with a 3.7 percent share of the market and ranked 5th in imports with a 4.4 percent share of the market. China ranked 5th in export in 2010 with 3.9 percent share of global serves trade and rank 4th in imports with 5.1 percent share of the global market. The financial crisis has accelerated China's rise in the global market. Given the increasing share of energy resource trade and OFDI in the total trade and investment of China, changes in monetary policy that allow for a greater use of the currency and investment strategies involving hedge funds, equities, and derivative related financial markets may further benefit China's integrated energy security policy.

²⁸“New Move to Make Yuan a Global Currency”

(source: <http://online.wsj.com/article/SB10001424052748703791904576076082178393532.html>)

²⁹ “Dollar will lose its dominance by 2025, says World Bank's”

(source: <http://www.blanchardonline.com/investing-news-blog/econ.php?article=2562>)

Table 6. Top 5 Exporters, Importers in Merchandise Trade and Commercial Services Trade

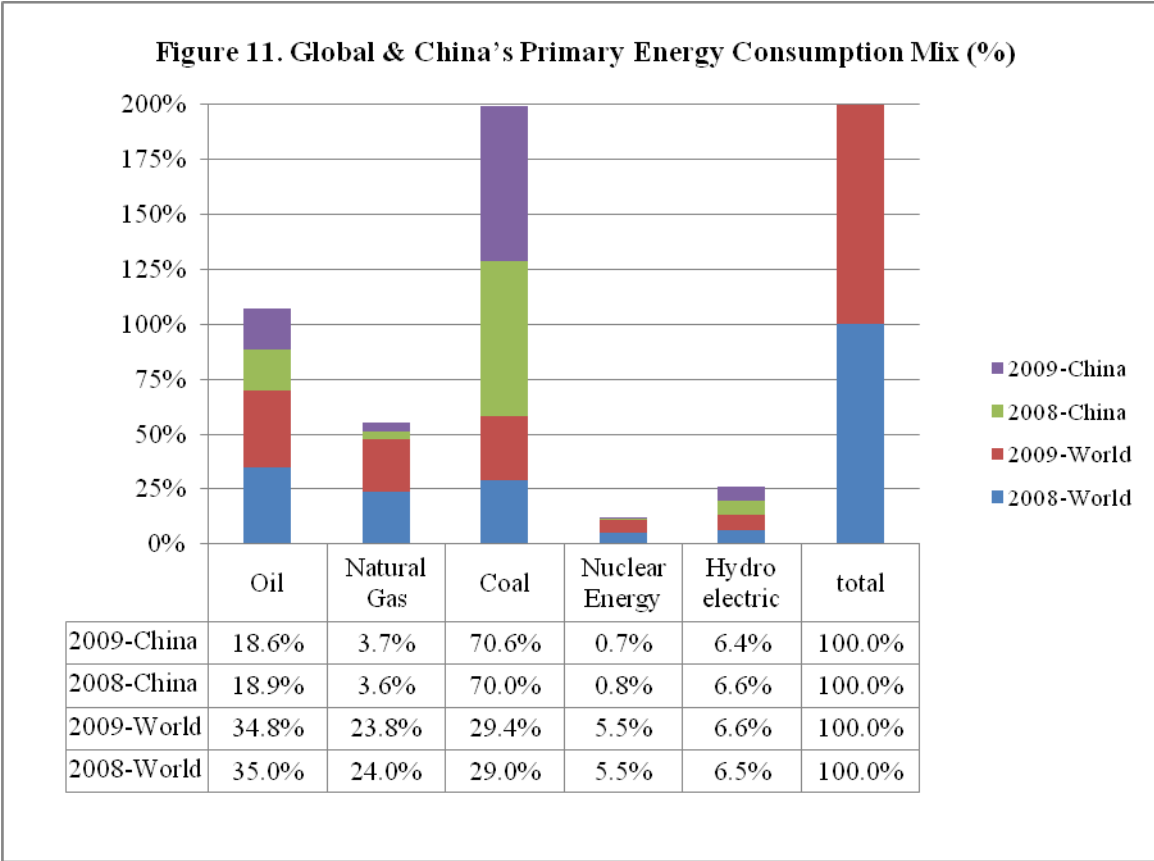
Merchandise trade (billion US\$)							
Rank	Exporters	Value	Share(%)	Rank	Importers	Value	Share(%)
1	Extra-EU(27)	1525	16.2	1	Extra-EU(27)	1672	17.4
2	China	1202	12.8	2	United States	1604	16.7
3	United States	1057	11.2	3	China	1006	10.5
4	Japan	581	6.2	4	Japan	551	5.7
5	S. Korea	364	3.9	5	Hongkong	353	3.7

Commercial services trade (billion US\$)							
Rank	Exporters	Value	Share(%)	Rank	Importers	Value	Share(%)
1	United States	470	14.2	1	United States	331	10.6
2	UK	240	7.2	2	Germany	255	8.2
3	Germany	215	6.5	3	UK	160	5.1
4	France	140	4.2	4	China	158	5.1
5	China	129	3.9	5	Japan	146	4.7

Source: WTO, World Trade Report 2010 , The Trade Situation in 2009-2010. Appendix Table 3. (http://www.wto.org/english/res_e/booksp_e/anrep_e/wtr10-1_e.pdf)

7. Possible Solutions to China's Energy Security

The Western industrialization economic model that relies heavily on high carbon output may not be a good example for China to replicate. China needs to design its own energy security given its natural resource endowments, technological level, and potential growth. Figure 11 compares the global primary energy consumption structure with China's primary energy consumption structure. Though China has strong potential for growth in the hydro-power, nuclear, wind, and natural gas sectors, in the short run it may consider making full use of its coal resources in order to alleviate oil dependence or oil conflicts. In the medium run or long run, China should build a low-carbon economy by conducting R&D in clean coal technology and developing renewable energy.



Source: Author's calculations based on *BP Statistical Review of World Energy 2010, June 2009* and *China Statistical Year Book 2008*.

8. Conclusions and Global Policy Implication

China's energy security policy has transformed from "self-reliance, self-sufficiency" to "resource diplomacy" or "oil diplomacy," and, finally, to a more pragmatic yet more complicated policy as China's economic power and geopolitical power expand. Policies based on a single-minded pursuit of resources or a unilateral approach to energy security will lead to regional or global energy insecurity and damage the credibility of China's diplomacy. Like many countries, China realizes that foreign policy should not be completely subordinated to resource diplomacy.

Given the multi-faceted nature of energy security, multilateral agreements between nations and regions will become more and more important in ensuring the availability of energy resources and possibly to regulating their exploitation and consumption. Though China is the world's largest energy consumer according to a recent estimation from IEA,³⁰ China has not been included in any international or regional energy organizations such as the IEA. A

³⁰ "China overtakes the United States to become world's largest energy consumer," International Energy Agency, July 20, 2010, http://www.iea.org/index_info.asp?id=1479; accessed July 7, 2011.

multilateral institution that includes China and other emerging market players may need to be established to coordinate in times of energy price and supply shocks so that member countries can better prepare for a sudden energy crisis and improve cooperation. A multilateral agency may not be a realistic approach, though, since each country has its own priorities and expectations such that formation and management of an effective agency with such differences is quite difficult.

To meet the urgent demand for energy consumption, in the 11th Five-Year Plan Beijing has emphasized energy conservation and the development of renewable energy resources. But the fact that China's primary energy use composition has not changed since 1978 indicates the difficulty of changing the existing energy supply and demand structure. Recognizing that fossil fuels will continue to be important, China is seeking to diversify the source of some of its oil away from areas of volatility in order to reduce the risk of oil shortage or unavailability. To this end African and Central Asian countries have recently increased their share of China's oil supply, although the Middle East countries remain the major suppliers for China.

After the financial crisis, China's government implemented a series of strategies to obtain oil and other energy resources by taking advantage of low prices on the world market and its own excess cash reserves. Surprisingly, this study shows that China's accumulated outward foreign direct investment (OFDI) in the mining sector has decreased from 17 percent in 2003 to 12 percent in 2008 even though the absolute accumulated OFDI jumped more than 4 times from 2003 to 2008. To lower various risks, the investment portfolio has been gradually changed, with more investment projects shifted from the high risk and high return finance category to the relatively safer non-finance category. With 20 percent of OFDI in finance and 80 percent in non-finance, monetary policy changes such as with the exchange rate regime, interest rates, and appreciation or depreciation of the Renminbi would have strong impacts on capital flows, trade balance, financial markets, and national debt.

Energy security issues will continue to pose challenges to Beijing in both the short run and the long run. Foreign policy and domestic economic policy are inseparably entangled with each other. Energy policy will continue as part of foreign policy as long as China's economy continues to grow well. Nevertheless, China may need to continue to define and search for an energy security path in order to balance energy security with China's accountability and responsibility to the international community.