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Green Evidence for Energy Security Transformation in China: Re-conceptualization of Energy Security and Its Implication to China's Renewable Energy Policy Change

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Abstract: China has grown to a global large energy consumer since 1993, and surpassed the U.S. to become the top energy consumption country in 2010. Energy security is indispensable to the rapid and sustained development of China's economy. Different from the realist geopolitics and liberalist analyzing approach, the author constructs a dynamic constructivist theoretical framework of energy security and tends to explore the unique re-conceptualization trajectory of Chinese energy security: from self-sufficiency security with emphasis on the internal supply (first stage) to "go abroad" supply-oriented energy security highlighting the external expansion of sufficient energy at reasonable price (second stage), then to comprehensive energy security concept focusing on international cooperation, energy diversification, energy conservation and low-carbon economy(third stage). Especially the transition from "decreasing energy intensity" to "reducing the carbon intensity" in the third stage has shown the conceptual shifting from the static energy security to dynamic resilience energy security. Based on the discourse and institutional analysis, the author further illustrates the profound constraints of climate change scenario to energy security in China as well as their interacting relations. Finally the author points out that the green evidence for energy security concept transformation has exerted significant impact on renewable energy policy-making, which opening "the window of opportunity" for rapid renewable energy development in China.

Key words: energy security, renewable energy, climate change, policy change

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I Introduction

To certain degree, energy can be compared to the “blood” for the well-balanced cooperation of one country, and energy security is indispensable to the rapid and sustained development of national economy system, especially for the large energy consumers such as China, U.S., Japan and so on. Since 2003, China has exceeded Japan to be the second largest energy consumer. Along with average annual 8-10% economy growth rate, China has surpassed Japan to become the second largest economic entity in 2010, and meanwhile overridden U.S. to rank the top one energy consumer in the world. The energy security issue of China has drawn/ attracted more seriously academic concerns, because with increasing economic globalization and the acceleration of China’s modernization, China’s energy development issue has spilled over the national boundary to exert an influential impact on international policy arena and China’s soaring demand for energy has complicated its foreign relations on many fronts(Kennedy 2010: 137), such as oil diplomacy, climate change negotiation, international investment as well as human right, etc.

There are mainly three approaches to study the Chinese energy security: **this first approach** is based on the **realist geopolitics**, to treat the rapid growth of oil import and abroad energy investment of China as a threat to the stability of current international pattern, such as aggressive “going out” strategy which involves overseas oil and gas asset purchases by its state oil companies.^① Furthermore, China’s growing energy-related interests abroad have raised concerns that Beijing will build a powerful navy that could challenge the power control of U.S. in significant maritime space (Downs 2004: 22). Moreover, the go-abroad strategy of Chinese energy companies supported by the government is regarded as “aggressive” mercantilism, which short of international responsibility and human right concerns, such as Darfur issue in Sudan.

The second approach is from the **liberal institutional perspective of global energy governance** to study the China’s behavior in the international energy organizations as well as multilateral energy cooperation. The oil crisis is not aroused by “oil peak” or “supply falls short of demand” nowadays, but due to regional turbulence, political instability and the international oil speculation. Moreover, the interest of oversea Chinese energy enterprises is not always aligning with government, and they also sell much oil to international market due to the cost consideration.^② The global energy governance needs to involve China as key actor to guarantee the international energy cooperation, and China gradually realizes that to maintain the positive and benign regional relations is a fundamental way for energy security, such as enhancing energy diplomacy with the Middle East, Russia and Central Asia, Africa countries, developing transnational oil pipe cooperation and trusting more for international oil market, etc. From this perspective, China’s reliance on foreign oil and efforts to maintain good international relations with other regional countries could facilitate its deeper integration into the international system(Downs 2004: 22) and moderate the conflictual aspects of Chinese foreign policy (Li and Clark 2010: 9).

The third approach will go beyond the comparatively static research of realist and liberalist, tending to study **the dynamic evolution of energy security and constructivist cognitive learning of China**, especially in the changing scenario of climate change. Since around 70% energy consumption in China relies heavily on coal as well as roaring energy-consumption-based economic growth (energy growth rate faster than GDP growth rate), China has surpassed U.S. to become the world’s top emitter of greenhouse gases since 2007 and undergone more normative pressure from the international community. Many scholars point out that the strategic energy demand for economy growth is the core interest of China, and even the climate change policy is an accessory of energy policy(in other words, the intention of taking energy efficiency measures or developing clean energy is to improve

^① These include China National Offshore Oil Company (CNOOC), China National Petroleum Corporation (CNPC) and Sinopec (China National Petrochemical Corporation).

^② Transportation and logistical costs may well prevent most of the oil produced in China’s overseas oil fields from entering China. This oil will most likely be sold on the international market or swapped for other oil that would enter the Chinese market. See Zha, D. (2006). “China’s Energy Security: Domestic and International Issues.” *Survival*, Vol. 48, No. 1, pp. 179-190.

the energy security rather than reducing the GHG emission or mitigating climate change). However, this logic treats the national interest and cognition preference of China as static one and ignores the connotation evolution itself of energy security concept in China. And it is also hard to explain the China's green miracle of rapid renewable energy development and carbon-intensity reduction turning in national plan if China only takes a cynical or half-measure attitude to climate change. From the constructivist perspective, the energy security and climate change are not totally separated concepts with different interests, and it is meaningful to explore the internal interaction of these two concepts in a changing dynamic scenario.

On the whole, along with the discourse change of Chinese leaders, from "energy sufficiency" to "go abroad for energy", then to "conservation society", "scientific development" (Constantin 2007: 17), and "low-carbon economy", the energy security, as core concept for national development, has evolved with the external changing context, especially in the climate change scenario. This kind of cognitive transformation has led to the domestic intuitional change as well as national resources reallocation, which opening a window of opportunity for the new industrial sectors, such as renewable energy development and low-carbon technology innovation. And the "green miracle" of rapid renewable energy development as well as carbon-intensity reduction turning in national plan has proved this tendency. Based on the dynamic constructivist theoretical framework of energy security concept, this paper aims to explore how and why the re-conceptualization process of energy security taking place in China, and how the "conceptual revolution" of energy security imposing significant influence on the renewable energy policy change, which resulting in the burgeoning of low-carbon societal-economy construction.

II The Dynamic Concept Evolution of Energy Security in the Global Energy Governance

1. From external supply- biased energy security to also take the internal-oriented energy use security into consideration

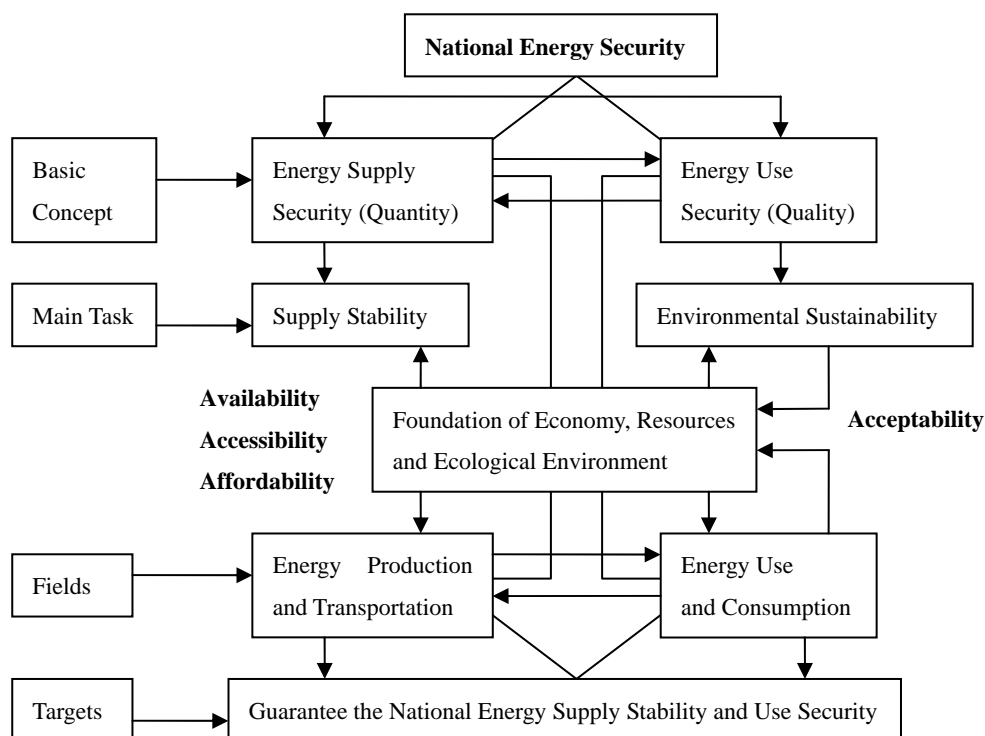
The definition of energy security originated from the oil crisis in the early 1970s, and since then a military metaphor of the 'oil weapon' was quickly coined (Cherp and Jewell 2011: 2). In order to guarantee the national energy interest and the availability of natural resources for energy consumption, the major OECD countries, led by the U.S., to establish the International Energy Agency (IEA) in 1974^①, and formally put forwards the concept of national energy security which particularly focusing on the stability of oil supply and oil price. Against this backdrop, most studies conceptualize energy security in terms of security of oil supplies and tend to use the theoretical framework of geopolitics as well as energy mercantilism to analyze the energy as a foreign policy tool to gain national power (Vivoda 2010). The Chairman of the IHS Cambridge Energy Research Associates, Daniel Yergin, proposes that since the uneven distribution of energy supplies among countries has led to significant vulnerability, "the objective of energy security is to assure adequate, reliable supplies of energy at reasonable prices and in ways that do not jeopardize major national values and objectives" (Yergin 1988: 111-112). This traditional energy security concept usually include three dimensions: the first one is **availability** (geological existence), which refers to the stable existence of sufficient energy resources (include self-sufficiency), and the import interruption and temporary shortage could affect one country's economic development and political stability seriously; secondly is **affordability** (economical elements), which means the imported energy maintains at a reasonable price; thirdly is **accessibility and durative** (geopolitical elements), which refers to the reliable and continuous access to adequate energy and the transportation routes free from threatening, such as hostile navy force or pirates attack (Szyliowicz and O'Neill 1975: 29). In a word, the core connotation of traditional energy security is to ensure the sufficient and continuous energy supply at a reasonable price. Based on this definition, the main energy strategies for nation-states are to establish the emergency mechanisms for oil and gas strategic

^① The IEA was initially dedicated to responding to physical disruptions in the supply of oil, as well as serving as an information source on statistics about the international oil market and other energy sectors.

reserve; guarantee the reliable international transportation network and diversify the energy transportation routes, such as setting up new pipelines; promote cooperation with the oil and gas producing countries through energy diplomacy and entering into international agreements to underpin international energy trading relationships; enhance the dialogues and cooperation with major oil-importing countries, etc.

However, the largest drawback of this supply-biased energy security definition is to ignore the internal dimension of energy use. Since the 1980s, the energy security definition has undergone a re-conceptualization process, from external supply- biased energy security to also take the internal-oriented energy use security into consideration. Besides the availability, accessibility and affordability, the fourth dimension of energy security is **acceptability** (environmental and societal elements)(Kruyt et al. 2009: 2167),which highlights how new energy sources can both serve environmental security purposes and ensure supplies (Constantin 2007: 13). Energy consumption of fossil fuels is one of the main sources for environmental pollution and green house gases emission, furthermore, the “growth limitation” theory proposed by the club of Rome also set a restriction for extravagant energy consumption style. The short term interest for energy security is to guarantee the energy supply for economic growth, and we can see the external supply energy security mainly emphasize the “energy supply quantity”; while the acceptability dimension of energy security puts emphasis on the long term interest of energy security and sustainable development, and this internal use energy security highlighting the “energy use quality”. The main energy strategies of energy use security aim on the improvement of energy efficiency, unification of d internal energy market, innovation of energy-saving and environmental friendly products and promoting the energy diversification and strategic independence , especially to enhance renewable energy development (as alternative energy sources).

Graph 1 The Graph of National Energy Security Concept (Energy Supply and Use Dimension)



Sources: The graph compiled by the author based on the data from Zhang Lei (2001), On the Energy Security of China, *International Oil Economy*, Vol. 8, No.3.

2. Shifting from the static energy security to dynamic energy security (resilience)

The definition of energy security mentioned above mainly points that the supply and use of energy should not

pose a threat to national economic development and environmental sustainability, and this concept dimension could be understood as a kind of "safe state" or "static situation of security". However, there is another deeper-level connotation should be included into the definition of energy security, that is "dynamic state", which emphasizing that owning the "security capabilities" to withstand ever changing insecurity situation. If a subject is currently in a danger-free /without threatening condition but lack of resilience to resist the potential danger in the nearby future, from a strict sense, this situation can only be titled as "quasi-security".

The maintenance of security state relies on certain internal and external context. Once the environmental condition has undergone changes, the external disturbances or internal potential threat factors will be activated or stimulated. As a result, the original security status will be replaced by the "at risk" or "threatened" state. Security does not only refer to an actor free from danger or threat, but also means that it has the ability to explore/discover the potential threat and to avoid from the damage. This "**safety capacity**" could be understood as a dynamic flexibility mechanism, which including the institutional resilience to respond to external threats (such as energy crisis, climate change and so on) as well as overcome internal hindrance through innovative mechanism.

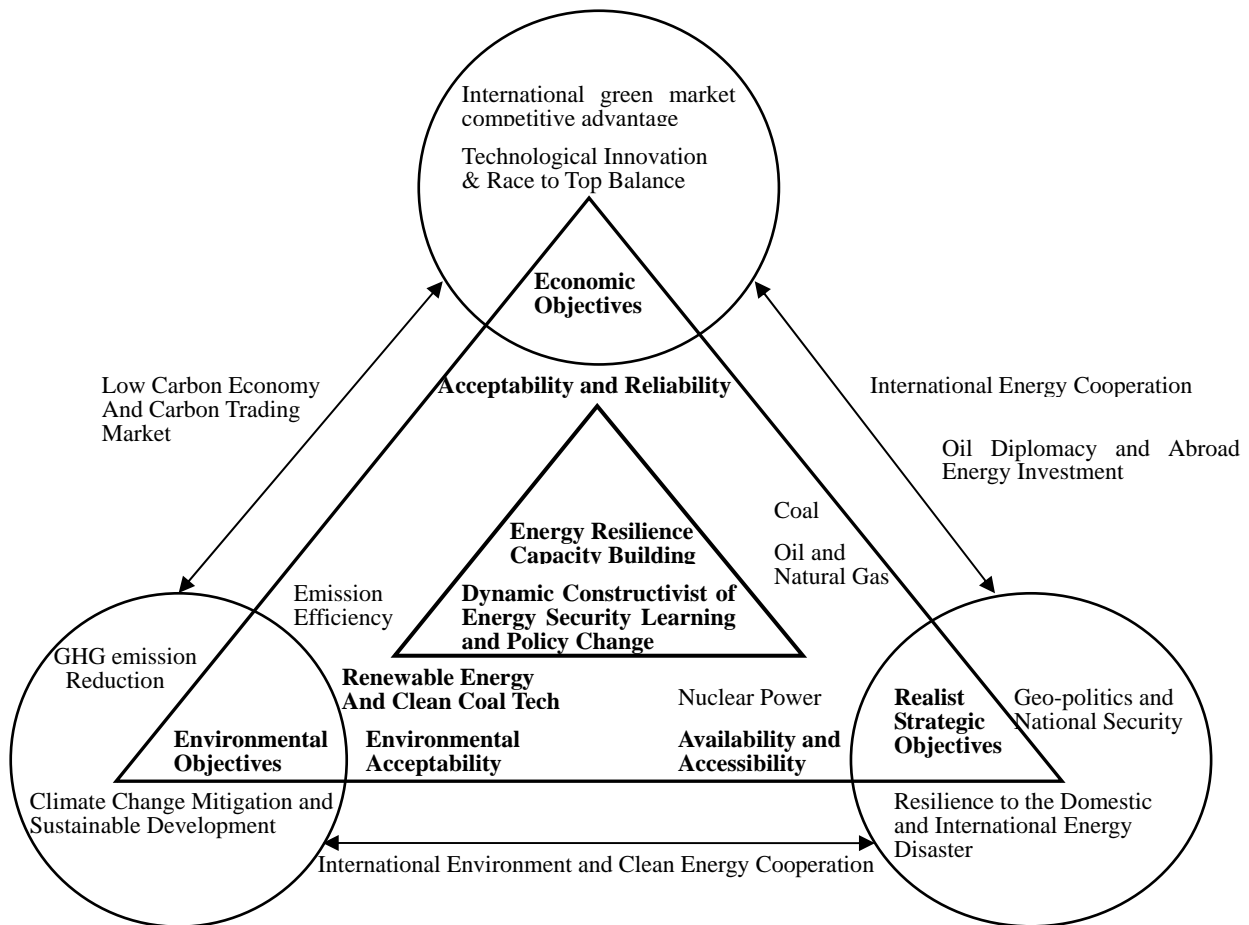
The key word in the dynamic perspective is resilience, which means the capacity of a system to respond to a perturbation or disturbance by resisting damage and recovering quickly. During the emergencies, the resilience capacity promotes the system from an acceptable low operating level back to the initial state of normal operation, through mechanisms of institutional flexibility, risk management and adaptive governance.

When we talk about resilience of energy security, such vulnerability was most visibly manifested by nuclear power plants accidents of the Three Mile Island accident in U.S. (1979), Chernobyl catastrophe in Ukraine (1986) and more recently Fukushima nuclear crisis in Japan (2011) (Cherp and Jewell 2011: 4). Take Fukushima nuclear spill for example, the accident was caused by the tsunami after great earthquake, which shows that the construction of nuclear facilities lacking of resilience mechanism to deal with the sudden natural disasters. Since then, confronted with strong domestic anti-nuclear power voices, governments are more cautious and conservative to the nuclear power development, and it can be anticipated that the nuclear power could be difficult to achieve substantial growth in short to medium term. In the short run, the main effective alternative for nuclear power are still fossil fuels (oil, gas and coal), meanwhile, it will also promote the rapid development of renewable energy in the long run. Along with the worsen climate change scenario as well as more frequency of extreme climate events, the security of energy mining, transportation and use will be confronted with more challenges, which requires every nation to reconsider the energy security in a changing context and construct the relevant resilience mechanisms for early warning system operation, conflict resolution and variability management.

As a result, besides the four dimensions of energy security we have mentioned above (availability, accessibility, affordability and acceptability), Sovacool, B. K., and Mukherjee, I. (2011) add two more dimensions to the energy security concept relating with the "safety capacity building" : the first one is **technology development and resilience**, which refers to capacity to adapt and respond to the challenges from disruption ,by the means of developing new and innovative energy technologies, realizing energy efficiency and promoting low-carbon energy alternatives, making proper investments in clean energy infrastructure and delivering high quality and reliable energy services; the second one is **regulation and governance**, which means having stable, transparent, and participatory modes of energy policy making, promoting the competitive capability of green energy and enhancing social and community knowledge and access to energy information(Sovacool and Mukherjee 2011). Even though markets are excellent at managing quantifiable risk but must rely on governments to provide insurance for non- quantifiable uncertain risk(Cherp and Jewell 2011: 5). The dynamic dimension of energy security capability actually puts emphasis on the national adaptability, resilience and innovative learning competence to respond to the potential energy crisis and co-evolve with the ever-changing global energy scenarios. From the perspective of dynamic energy security. Based on the triangle energy security graph drawn by

Verrastro, F., and Ladislaw, S. (2007), the author has made a graph of resilient energy security governance to illustrate the dynamic perspective of comprehensive energy security concept.

Graph 2 The Graph of Resilient Energy Security Governance (Static and Dynamic Dimension)



Sources: the main part of graph compiled by the author, and partly referring to Verrastro, F., and Ladislaw, S. (2007). "Providing Energy Security in an Interdependent World" ,*Washington Quarterly*, Vol. 30, No. 4, pp. 95-104. 102

III The Re-Conceptualization Process of Energy Security in China

In the evolution of energy security concept, China has its own unique trajectory: from self-sufficiency security with emphasis on the internal supply to “go abroad” supply-oriented energy security highlighting the expansion of external supply, then to comprehensive energy security concept focusing on international cooperation, energy diversification, energy saving and sustainable development (concerning both external supply and internal use),^① furthermore the third stage could be divided into two periods: the first one emphasizing on the energy conservation which aiming to improve energy efficiency, the second one showing a transition from “decreasing energy intensity” to “reducing the carbon intensity” , which clearly attaching the importance to the low-carbon economy.

1. The first phase from 1949 to 1993: energy self-sufficiency with focus on internal supply

Due to the blockade of external forces, newly founded China mainly relied on the imported oil from the Soviet Union. However after the Sino-Soviet relations split in the early 1960s which lead to the end of oil supplies(Leung 2011: 1332), and considering the embargo imposed by Western nations on China during the Cold War, then

^① This kind of subsection partly refer to Yang Zewei (2008), “The Issue of China Energy Security : Challenges and Responses”(in Chinese), *World Economy and Politics*, No. 8, pp. 52-61.

“independence, self-reliance” had become the core thought in Maoist era to guide China's internal and foreign affairs.^① During the period of 1959 to 1962, the exploration of the Daqing oilfield and Shengli oilfield has greatly enhanced the oil self-sufficiency capability of China(Zha 2005: 39). In 1963, China ended its century of dependence on imported oil and oil products and basically achieved the target of oil self-sufficiency.^② Later, a large number of oilfields, such as Dagang, Jiangnan and Liaohe, Changqing, Henan, Huabei, Zhongyuan oil fields, have also been explored, and since 1973 China has gradually begun to export the petroleum products to Japan, the Philippines, Thailand, Romania and other countries in order to construct hard currency reserves and import the necessary equipment and technology to develop an export-oriented economy(Zha 2006: 180).

With the deepening of reform and opening up since the end of 1970s as well as rapid economic development in Dengist era, the growth rate of oil production has been unable to meet domestic energy demand growth(Jiang 2008: 258). In 1983, China began to import crude oil from Oman and since 1988, Chinese imports of crude and processed fuels began to rise rapidly due to increase demand (in 1985 China's crude oil exports peaked, reaching 30m tones) (Zha 2006: 180). In 1993, China has turned from a net exporter of oil products to a net importer, which symbolizing the end of energy self-sufficiency era (and in 1996, has become a net importer of crude oil), and from that day on, its dependence on oil imports grew dramatically. Chinese leaders have begun to realize that effective energy support for economic development need to rely on the international energy cooperation. The former president Jiang Zemin once pointed out “Given limited domestic energy resources, China has to make use of two markets and two sources, both international and domestic, to secure its energy supply, especially oil and natural gas supplies” (Jiang 2008: 259).

2. The second phase from 1993 to 2003: supply-oriented energy security and going abroad strategy

Based on the supply-oriented energy security concept, the core connotation of China energy security is to ensure the sufficient and continuous supply of energy (especially oil) at a reasonable price. In July 1993, the China National Petroleum Corporation (CNPC) obtained part of the shares of North Twining oil field in Alberta, Canada and produced the first bucket of overseas crude oil. Then, Chinese energy corporations began “going abroad” strategy and invested some comparatively smaller projects in order to adapt to international investment environment, acquire the skills of bidding overseas energy projects and accumulate valuable experience. Since 1997, the overseas energy investment business of Chinese energy corporations has entered a stable stage and signed oil and gas exploration agreements with Sudan, Kazakhstan and Venezuela and other countries.^③ China tries to establish long-term energy supply agreements with the energy-producing countries, to ensure the stable supply of energy. By the end of 2002, Chinese businesses had combined contractual investments of over US\$ 16 billion, with over US\$ 1 billion in cross border mergers and acquisitions(Bambawale and Sovacool 2011: 1951).

Since 2000, oil import figures almost doubled from 36.6m to 70.2m tonnes (Zha 2006: 180)^④ and due to the low energy efficiency of China(the amount of energy used in the production of one unit of GDP in China is roughly three times that in the United States, five times that in Germany and almost six times that in Japan(Cheng 2008: 301)), China's total energy consumption growth rate has exceeded its GDP growth rate by as much as five

^① See Zha 2006: 179-180. With the termination of the Soviet aid programme in July 1960, Beijing found itself devoting much of its energy resources to preparing for war with a major power. In addition, a US-led embargo lasted from 1950 to the Sino-American rapprochement in 1971. For two decades China thus had energy self-sufficiency under strained international circumstances.

^② See Leung 2011: 1332 and Zha 2006: 179-180. In 1949, China's domestic oil output is only 0.12 Mt, and since 1963 the Daqing oil field in Northeast China produced 4.3 Mt of crude, making up the bulk of the 6.48 Mt of nationally produced oil.

^③ Generally speaking, China imports oil and gas from more than 30 countries. In recent years, the larger oil and gas suppliers to China are Saudi Arabia, Iran, Angola, Russia, Oman, Sudan, Yemen, Indonesia, Australia, Thailand, Malaysia, Congo, Kazakhstan, Venezuela and Libya.

^④ See Zha 2006: 180. The dramatic rise had several causes. Domestic crude production was insufficient for consumption. China's refining capacity had significantly improved, making it possible to import more types of oil for refining. In June 2000 China began to reform its pricing system for processed fuel by pegging the domestic sale price to the Singapore commodity futures market, leading to four separate increases in domestic oil prices within six months, and encouraging Chinese refineries to increase imports amidst concerns about supply interruptions worldwide. Finally, official statistics more accurately reflected the true volume of imports, thanks to a campaign between 1998 and 2001 against oil smuggling into the country

percentage points (Zha 2006: 185). Another factor responsible for the rapid growth of oil dependence is the national oil production remained stagnant from 1993 to 2003, only growing by an average of 1.7% during these years; while by contrast, oil consumption has grown an average of 7% per year during the same period, especially due to the rapid growth of automobile civilization in the transportation sector (Constantin 2007: 9). As a result, China surpassed Japan as the world's second largest oil consumer in 2003 and China has been the source of almost 40% of the world's oil-demand growth(Cheng 2008: 297). To deal with the pressing energy issue, China puts the preservation of supply security at the top agenda of its energy strategy in the 10th Five-Year Plan (2001-2005) (Constantin 2007: 10) and officially introduced the concept of "energy security" to national plan. It is noteworthy that Chinese leadership released a policy document entitled "Twenty-First Century Oil Strategy" in 2003, allocating US\$100 billion for a 'futuristic strategic oil system' in China(Cheng 2008: 301-302).

3. The first period of the third stage from 2003 to 2010: concerning both external supply and internal use with focus on decreasing energy intensity/energy efficiency

Against the backdrop that China's energy consumption growth rate has far exceeded its GDP growth rate and undergone sudden increase in energy intensity after 2003, China tends to make a transition to take energy internal use and sustainable development into account. Many efforts to promote the formation of comprehensive energy security concept, which mainly highlighting in two aspects: first of all, tending to gradually break the traditional dominant energy pattern of fossil fuels (such as coal and oil) and paying attention to energy diversification to enhance the proportion of renewable energy in the energy structure; ^①secondly, putting emphasis on energy efficiency, to guarantee the supply quantity is only one dimension to ensure the energy security, the other dimension is to improve the energy use quality through raising the energy exploitation/ use efficiency and reducing fossil-fuel pollution of the environment.

Since 2003, the new administration of President Hu Jintao and prime minister Wen Jiabao has showed the political commitment to optimize the national development approach. In October 2003, the third plenary session of the 16th Central Committee of Communist Party of China, Hu-Wen administration formally put forwards the "Scientific Development" concept, which highlighting to a people-oriented, coordinated and sustainable society construction, furthermore, energy and resource saving should become important targets in economic restructuring (坚持以人为本, 树立全面、协调、可持续的发展观, 促进经济社会和人的全面发展). In the executive meeting of State Council in June 2004, Chinese leaders discusses and approves "China's Energy and Long-Term Development Plan (2004 - 2020)", in order to determine the long-term energy saving goal of annual average 3% during 2003-2020. Since then, energy conservation has been attached top priority.

The NDRC (the National Development and Reform Commission) initiated ten major energy-conservation projects to implement the 'Medium and Long Term Energy Conservation Plan for China' since May 2005(Cheng 2008: 302). Meanwhile, the Premier Wen puts forwards the concept of "recycling economy", which strengthening of the exploitation and management of national mineral resources, and the promotion of energy-conserving production and consumption modes(Cheng 2008: 302).In 2006, Hu-Wen administration has set medium-term compulsory energy intensity targets in the "11th Five-Year Plan" (2006-2010) (The Eleventh Five-Year Programme on National Economy and Social Development), to reduce energy intensity by 20 per cent in per capita commercial energy consumption (a specific target was set to reduce the energy consumed for each unit of GDP by 20% at the end of 2010 when compared with the end of 2005.) and pollution intensity by 10 per cent based on the 2005 level(Hallding et al. 2009: 125-126).

In 2008, the former president Jiang Zemin has published an influential paper titled "Reflections on Energy Issues in China" (Jiang 2008) to point out the government should attach great importance to new energy development road with Chinese characteristics, that is to adhere to energy-saving and high-efficiency, diversified development, environment protection, technology guidance and international cooperation (Jiang 2008: 257). In

^① See Lin Boqiang(2008), "Energy Security is More Than Oil Reserves", August 9th , <http://www.chinareform.org.cn/cirdbbs/dispbbs.asp?BoardID=9&ID=175257&skin=0> (Accessed on April 16, 2012).

other words, China is striving to build a reliable energy production, circulation and consumption system that is efficient, technologically advanced, low polluting and ecologically friendly(Jiang 2008: 257).

4. The second period of the third stage since 2010: the transition from “decreasing energy intensity” to “reducing the carbon intensity”

Based on the emphasis on reducing energy intensity, China has further explicitly shown its political commitment on reducing the carbon intensity and constructing low-carbon economy. From the perspective of sustainable development, fossil fuels are the main culprit of global greenhouse gas emissions. As a result, reducing the dependence on fossil fuels such as coal and oil is not only the need for energy supply security, but also a key factor for societal and environmental acceptability, which as green constraints for energy use security. In the 2009 Copenhagen conference, Chinese government has first time made a voluntary commitment for decreasing 40% - 45% unit of GDP carbon dioxide emissions by 2020 based on the 2005 level. What is noteworthy that in 2010 Cancun Conference, all developed and developing countries are asked to take measurable, reportable and verifiable greenhouse gas emission reduction actions, which symbolizing the rising international binding level of carbon intensity control.

In the thirteenth meeting of the 11th NPC Standing Committee in February 2010, the NDRC has issued a report to officially involve the per unit GDP carbon dioxide emissions as significant compulsory binding indicator into the 12th Five-Year Plan. This indicates that the carbon intensity has been formally absorbed into the Chinese energy security concept. In the 12th Five-Year Plan, it mentions that China will strive to establish a competitive renewable energy industry system, to make a reduction of 16% energy intensity and 17% carbon intensity by 2015 compared with the 2010 level. Meanwhile on December 1st 2011, the 41st file from State Council is issued to formally decompose the whole targets and assign them to different provinces and municipalities(Wang 2012).

At the same time, China has accelerated the renewable energy development (especially wind, solar, biomass energy), actively engaged in clean coal and CCS carbon capture technology, in order to realize the following binding targets: the ration of non-fossil fuels in primary energy accounting for 11.4% by 2015 and 15% by 2020.^① These targets have been embodied in the local climate initiatives and low-carbon city campaigns, for instance, the NDRC launched “Low-Carbon Pilot Cities and Provinces Project ” in August 2010, five provinces (Guangdong, Liaoning, Hubei, Shaanxi, Yunnan) and eight cities(Tianjin, Chongqing, Shenzhen, Xiamen, Hangzhou, Nanchang, Guiyang, Baoding) will act as low-carbon pilots to promote the low-carbon development planning and accelerate the establishment of low carbon emissions industrial system, so as to put low-carbon energy security concept into practice . Since then, the low carbon discourse has become an important component of China's energy security concept, which signposting the green turning of carbon intensity reduction in China's energy security strategy.

IV China’s Green Turning of Energy Security in the Climate Change Context: Hidden Constructivist Dynamics and Policy Interaction

1. The climate change as positively natural constraint to the national energy security

Many scholars have mentioned that understanding the core interest in terms of economic growth and social stability of China is the jumping-off place to analyze the climate change policy in China (Moore 2011: 147). China’s climate policy highlights the delicate balance between economic growth, energy security, environment, and climate change mitigation(Anderson 2008).Especially the GDP-oriented thought and economy-growth stress in China has lead to some contradictory characteristics of climate policy: On the one hand, the Chinese government has acted aggressively to reduce carbon intensity and improve energy efficiency, and even publicly mooted the adoption of a carbon tax; while on the other hand, it has rejected calls to cap its greenhouse gas emissions, brokered a series of deals to secure oil and coal reserves(Moore 2011: 147). From this realist and

^① Huaneng Group (2012), The Emission Reduction Targets of Twelfth Five-Year Plan -“Boots Landing”, Jan 29th 2012, <http://www.chng.com.cn/n31531/n507564/n789602/n789613/c795097/content.html> (Accessed on May 12, 2012).

strategic perspective, some scholars propose that the climate change policy in China is not more than an “appendant” of its energy policy (not aim to reduce the GHG emission), which tending to guarantee the interests of economy development and merely improve the competitive capability for green market(Moore 2011: 148). Hallding proposes China’s current climate and energy policy is a “repackaging” of existing energy and environmental strategies with co-benefits for the mitigation of climate change(Hallding et al. 2009: 119), which calculated to pursue core economy and political interests.

However, the discussion above fails to make further dynamic analysis of energy policy and energy security concept evolution in China. In other words, scholars make more emphasis on how energy policy influences the climate change policy, not how climate change policy, as external context, affect energy policy. Even though we admit that the energy policy dimension is the main part of Chinese climate change policy, we can not deny that the energy security concept in China itself has undergone gradual changes from self-sufficiency to supply-biased, then to a comprehensive energy view focusing on energy intensity reduction as well as carbon intensity reduction. If treating climate change as external context actor, what are the hidden constructivist dynamics to promote Chinese leaders to make transition of carbon intensity reduction in energy security as well as absorb the green dimension to energy policy framework? The author tends to explore this question in two aspects as follows:

(1) Domestic level: reconsidering the external energy supply dependency and realizing the energy use constraints

Although China is the third largest country rich in coal resources (coal accounts for about 70% of China's total energy consumption),^① the significant place of oil could not be replaced in the economy structure. Whereas domestic oil production has increased slowly climbing from 138.3 Mt in 1990 to 198.8Mt in 2009, China’s oil consumption has grown rapidly from 114.9 Mt in 1990 to 408.3 Mt in 2009, yielding an average annual growth rate of 7.0%(Leung 2011: 1330).^② According to the forecast of the International Energy Agency, China’s dependence on imported oil will reach 60.5%, 76.9% and 82% by 2010, 2020 and 2030, respectively(Cheng 2008: 301), as a result, the rapid growing reliance on imported oil has increased concern about energy security in China(Kennedy 2010: 139).

Besides, along with the remarkable development of automobile market in China, which treated as main approach to expand domestic demand and stimulate economic growth, (nearly 10%-15% growth rate between 2007-2012), the transport sector has gradually become the actual driver of China’s oil demand since 2007(Leung 2011: 1333).^③

It is predictable that heavy dependency on oil importation will not decrease in the long run and concerns about increasing external dependence remain prevalent(Aden and Sinton 2006: 253). As a result, China has attached much importance to establishing the national oil reserves, setting up more oil pipes to mitigate the “Malacca Dilemma”,^④ promoting energy diplomacy and so on(Kennedy 2010: 139). The leaders in China have a cautious attitude to the rate of energy supply dependence, and great support for “go-out” strategy of national-owned energy enterprises reflects a belief that oil produced by Chinese companies abroad is a more secure source than that purchased on international markets.

^① Although China has abundant coal reserve, China still need to import 0.2 billion tonnes coal annually (the total consumption is 4 billion tonnes annually) , which due to following two reasons: first of all, the external economic factors, the coal abroad is relatively cheap; secondly, the uneven distribution of China’s coal production, most mining area are in western provinces like Inner Mongolia, Shanxi and Shaanxi and need long-rail transportation to the east part of China, the strong economic region. It is much closer and cheaper to import the coal from Indonesia or Australia by ship.

^② See Downs 2006: 10. The stagnation in oil supplies stems from the aging of China’s oil fields, particularly those in the northeast. Daqing oil field, for instance, discovered almost half a century ago in the northeastern province of Heilongjiang, remains the starting to fall in 2021.

^③ The share of the industrial sector in total oil consumption declined from 59.2% in 1990 to 42.1% in 2007 whereas that of the transport sector increased from 17.6% to 35.9%, meaning that transport’ s oil demand has grown faster than that of industry. See Leung, G. C. K. (2011). "China's Energy Security: Perception and Reality." *Energy Policy*, Vol. 39, pp. 1330-1337.

^④ Over 80% of these imports are likely to come from Africa and the Middle East, crossing the Indian Ocean and passing through the narrow Malacca Strait. At the same time, renewed tension with the United States over Taiwan from the mid-1990s highlighted the possibility of conflict with a state that seemed well positioned to exploit China’s growing reliance on oil imports.

However, even though China could guarantee the external energy supply at reasonable price, there still remains greater challenge from energy demand and use. Since 2001, China's energy consumption began to grow more quickly than GDP as a result of low energy efficiency and macroeconomic shifts to more heavy industry(Aden and Sinton 2006: 253). From 2000 to 2005, China's energy consumption has risen by 60%, accounting for almost half of the growth in world energy consumption (Downs, 2006:1). This phenomena has released that the economic growth in China is heavily energy-consumption-based, which constructing the real predicament for long-term development. The high energy intensity usually has an implication of heavy environmental pollution and high green house gas emission. In this view, Chinese leaders have begun to reconsidered the issue priority of external energy dependence, and realized that country's biggest energy-security challenge lies not in growing imports, but in internal disarray(Kennedy 2010: 138). Kennedy(2010: 138) proposes that China should worry less about external dependence and more about reforming its domestic energy sector, making it more reliable, more efficient and less polluting.

No one could deny that even if there is no oil peak or oil supply interruption in the short or medium term, climate change has already set the serious constraints to uncontrolled and extensive energy use. In other words, the climate change has set an alert for us to reconsider the growth limits and attach the importance to the necessity of energy efficiency improvement and green alternative energy development. The climate change knowledge diffusion, such as four IPCC reports, has helped the decision makers to raise much clearer causal chains between energy consumption-climate change-natural disaster-social and economic stability. Chinese leaders have realized that climate change threatens the core interests of food security, water security and rural livelihoods through decreased crop yields or increased drought and flooding (Moore 2011: 150-152), which relating closely with CCP's core interests of social stability and economy growth sustainability(Moore 2011: 150-152). That is why there are more green factors appearing in the energy security concept since 2003 and the change in Chinese leaders' discourse will be discussed later in this section.

Some scholars would like to analyze energy security and climate change separately to further point out that "energy security takes precedence over other objectives, including reducing greenhouse gas emissions" (Moore 2011: 152), while ignoring to explore the detailed connotation as well as diachronic evolution of energy security concept, which influenced by climate change recognition in the last decade. The appearance of carbon intensity reduction emphasis in China's energy security concept, which being embodied in 12th five-year plan, has shown the "carbon concerns" in the energy strategy. In order to inhibit the excessive growth of energy-consuming industries, the government has been studying the establishment of total energy consumption control system, in order to promote the formation of effective anti-driving mechanism for total energy amount control. In 12th five-year plan, it emphasizes that total energy consumption by 2015 will be controlled at around 4.1 billion tonnes of coal, and the proportion of non-fossil fuels in primary energy will reach 11.4%. Besides, in 2012, the National Energy Bureau has issued the first general technology energy plan since its establishment-" National Energy Technology Twelfth Five-Year Plan " (《国家能源科技"十二五"规划》). This plan will actively promote energy technology initiatives and institutional innovations, accelerate the construction of the four-in-one energy technology innovation system, including significant technical study, important technical equipment, major demonstration projects and technology innovation platform.

(2) International level: constructing external structural pressure for interlinking the international energy cooperation and international responsibility building

China, as a rising power, actively joining in the international community and being a responsible big country is a significant dimension coupled with energy security. Along with the salient position and normative power of climate change issue in international community, reducing the green house gas emission has imposed more international pressure for national energy structure reformation. Since the largest GHG emitter (since 2007) and top energy consumer (since 2011), China has realized that merely adhering to the "common but differentiated responsibility" does no good to its national reputation and international image. According to World bank report,

since China surpassing Japan to become the world's second largest economy in 2010, the per capita carbon emissions in major Chinese cities has been already higher than in many of the world's large cities, especially the carbon intensity and energy intensity of large Chinese cities, like Beijing, Tianjin and Shanghai are six times more than New York, London, Tokyo.^① If carbon output continues unrestrained, China's carbon-dioxide emissions will account for 25% to 30% of the global total by 2020.

Furthermore, in the process of climate negotiations, the EU's efforts to turn two-track negotiation system into a substantial single-track system has achieved some progress in 2011 Durban conference, for instance, launching of the Ad hoc Working Group on the Durban Platform for Enhanced Action, which will form a legal instrument in 2015. In this new platform, EU strongly advocates all the big developing countries such as China, India, Brazil, South Africa to participate the international binding commitment, which signposting the approaching huge pressure for global "single-track system" reformation, and emphasizing more on "shared responsibility" rather than "differentiated developing stage".

In order to change the comparatively passive position in the climate change negotiation and get more discursive power, China has learned to add more green factors to energy security to improve the energy efficiency as well as promote the renewable energy development. It is noteworthy that the Chinese government's 12th Five-Year Plan includes targets for energy-intensity and carbon-intensity cuts of 16% and 17% respectively between 2010 and 2015, and the State Council formally set reduction targets for provincial-level governments(Wang 2012). In 2011, the National Energy Administration also started looking at capping total energy consumption. (Currently, the total primary energy consumption cap for 2015 has been set between 4 billion and 4.2 billion tonnes of coal equivalent, while there is also a total electricity consumption target of 6.4 trillion kilowatt hours.)And it's a short step from energy consumption to carbon emissions(Wang 2012). Besides the normative pressure, the international climate regime has provided some interest initiatives to help China change the attitude to renewable energy development at the early stage, such as encouraging China to join the CDM since late 1990s. Meanwhile, the China Renewable Energy Scale-up Programme (CRESP) has been developed by the Government of China (GOC) in cooperation with the World Bank (WB) and the Global Environment Facility (GEF) to provide assistance with the implementation of a renewable energy policy development and investment programme.^② CRESP is a 10 to 12 year program, implemented in three phases. For Phase 1, the GEF Council approved a GEF grant of \$ 40.22 million to finance assistance to create an enabling environment for scaling-up renewable energy investments and to support the provincial demonstration projects.

Furthermore, the limitations of traditional strategic energy security measures also need China to interlink the international energy cooperation with the international responsibility building, so as to enhance the international reputation as well as construct benign development context. Taking the transnational pipelines construction for example, the contribution of two main transnational pipelines in north China (China-Russia/Kazakhstan oil pipeline) and southwest China (Myanmar-China oil and gas pipeline) to energy security, which aiming to avoid the "Malacca Dilemma", is still under question.^③ First of all, the pipelines are

^① According to the World Bank report, in 2010, Beijing, Tianjin, Shanghai's per capita carbon dioxide emissions are 10.1,11.1,11.7 tons, close to or more than the New York level of 10.5 tons per capita, the London level of 9.6 tons per capita, the Singapore level of 7.9 tons per capita, and the Tokyo level of 4.9 tons per capita. From the perspective of carbon dioxide intensity and energy intensity, the Chinese large cities are higher. For instance, the carbon dioxide intensity of Beijing, Tianjin and Shanghai in 2010 are 1063,2316,1107 tons / million U.S. dollars respectively, six times more than that in New York, London and Tokyo. <http://money.163.com/12050401/80KHND800253BOH.html> (Accessed March 21, 2012) .

^② CRESP Website: <http://www.cresp.org.cn/english/about.asp> It aims to: 1) study the current renewable energy resources status; 2) learn from the experiences of developed countries in the development of renewable energy; 3) study and formulate renewable energy development policy in China; 4) implement renewable energy scale-up development 5) provide cost-effective and commercial renewable energy electricity to the electric power market; and 6) replace coal-fired generation and reduce the local and global negative environmental impacts.

^③ The positive opinion: The deals with Russia Kazakhstan and Myanmar are noteworthy because they promise to reduce China's reliance on seaborne oil imports while deepening its cooperation with overland suppliers. If the pipelines from Russia, Kazakhstan and Myanmar are all completed and operate at full capacity, they would carry 1.1 million barrels of oil per day, about 14% of China's projected imports in 2015. See Kennedy, A. B. (2010). "China's New Energy-Security Debate." *Survival*, Vol. 52, No. 3, pp. 137-158.

more expensive than the oil tanker as well as comparatively fragile (long and fixed objects) to the bomb attack or sabotage if regional armed conflicts occur. Furthermore, considering the politically unstable situation of Myanmar, the security of energy investment with built-in political risks do not reduce China's oil dependency on the Middle East (Leung 2011: 1334). In summary, actively joining the international community and maintain good regional relations is the fundamental measure to ensure energy security. Moreover, some of the overseas oil investment areas of China are politically unstable regions where the U.S. and European countries enter less, such as Sudan with Darfur issue. In order to ensure the China's foreign assets safety and avoid international normative critique, China should take more international responsibility such as active participation in UN peacekeeping and humanitarian aid.

2. The policy interaction between climate change and energy security: The general discourse change during the interaction of climate change and energy security

(1) Two main greening themes for development and society stability: scientific development concept and harmonious society/ harmonious world

Keeping rapid economy development and maintaining social stability are two top goals of CCP. The new discourses of scientific development concept and harmonious society mainly put forwards by Hu-Wen administration have shown the CCP's reconsideration for innovative approaches of development and society. These two grand thoughts have constructed a strategic framework for national development and embodied much more sustainable development elements for green turning. This part mainly discusses the governmental discourse change since 2002 through analyzing the key official documents, such as five-year plan and annual government report, as well as the significant speeches of Chinese leaders.

(1.1) Scientific Development Concept

When the Hu-Wen administration came to power in late 2002, they were confronted with an "increasingly divided society with devastating environmental conditions, mounting resource scarcities, alarming social and regional disparities resulted from China's market economic reforms, and increasing international fears about the global implications of China's rise" (Hallding et al. 2009: 123). In order to reverse the adverse situation, they reconsider the developing pattern seriously and put forwards the new rhetoric of "**scientific development Concept**" in July 2003, and formally endorsed by the National Peoples Congress in March 2004 to become current official guiding socio-economic ideology of CCP, which aiming to fill the ideological vacuum left by China's leadership since Deng's economic growth-oriented policies. This thought adheres to establish a people-oriented comprehensive, coordinated and sustainable development pattern, in order to promote the comprehensive economic, social and human development. The main features of this ideology is to incorporate sustainable development, social welfare, a humanistic society, increased democracy to a comprehensive development approach, so as to reduce the social inequities, prove the environment protection and improve the national innovation capability (Constantin 2007: 7).

The word of "**Green GDP**" has shown the governmental willingness to evaluate the environmental impact of economic decisions and subtract environmental costs from the traditional GDP equation. In October 2007 the Seventeenth National Congress of the Communist Party of China, this concept was enshrined into the Constitution of CCP, and has become one of the significant CCP's guiding ideologies, and as a successor and extension ideology in parallel with Marxism-Leninism, Mao Zedong Thought, Deng Xiaoping Theory and Three Represents Theory.^① Since the opening of the Eleventh National People's Congress in March 2008, the Scientific Development Concept is used as a guiding principal for China's socioeconomic development.

It is noteworthy that Scientific Development Concept has introduced a new environmental dimension to the debate of climate change as well as energy security. China's climate policy highlights the delicate balance

^① Three Represents Theory put forwards by former president Jiang Zemin, and the main content including to represent the requirements of the development of China's advanced productive forces; to represent the orientation of the development of China's advanced culture; to represent the fundamental interest of the overwhelming majority of people in China.

between economic growth, energy security, environment, and climate change mitigation (Anderson 2008). It is not until 2005/06 that climate change mitigation appearing as a serious issue on the Chinese leadership's agenda. International IPCC report as well as the domestic research about the severe climate events on China, such as food crisis, water crisis, has drawn leaders' attention to China's role in climate change. The climate change issue is upgraded rapidly to the top agenda, and by June 2007 China has published its *National Climate Change Programme* (Hallding et al. 2009: 125-126). And in March 2008, climate change has become one of the key issues during the Eleventh National People's Congress in response to energy security and ecological concerns. On the whole, the climate change strategy that has emerged also fits very well under the Scientific Development Concept, which reflecting the leaders' ambition to build a "resource-saving and environmentally friendly society" (Hallding et al. 2009: 129). This kind of discourse as well as agenda setting change has contributed greatly to the reformation in the energy sector.

(1.2) Harmonious Society

The final target of Scientific Development Concept is to realize a harmonious socio-economic vision, that is, harmonious society, which could be traced back to the traditional Confucianism thought. It serves as the ultimate goal for the ruling Communist Party of China along with Xiaokang society, which aims for a "basically well-off" middle-class oriented society.^① The Harmonious Society has been described by Hu Jintao as "democracy, the rule of law, justice, sincerity, amity and vitality" as well as a better relationship between the people and the government and between man and nature (民主法治、公平正义、诚信友爱、充满活力、安定有序、人与自然和谐相处) (Hallding et al. 2009: 124). On September 19, 2004, the fourth plenary session of the 16th Central Committee of the Communist Party of China, the concept of "building a socialist harmonious society" is formally proposed. Since 2005, "harmonious society" has shown officially in the National People's Congress, and the idea changes China's focus from economic growth to overall societal balance and harmony, in order to fight against social injustice and inequality. Harmonious society concept has represented a new direction of China's social and political transition, and regarded as the value orientation for building "socialism with Chinese characteristics".

The idea of scientific development stresses on scientific discovery and technological advance, engines for sustainable growth in the long run. As a target of scientific development approach, the harmonious society also has strong implication for green turning of energy use as well as sharing more responsibility to fight against climate change. For example, president Hu proposes a "**new energy security concept**" at the G8 Summit in St Petersburg, to stress the need to control domestic demand and for sustainable development of human society and call for greater international cooperation to increase oil and gas supplies. Premier Wen Jiabao, has echoed his call for a "resource-conserving and environmentally friendly society" (Kennedy 2010: 146), which reflecting the pursue for harmonious status of human and environment.

The Harmonious Society is also extended to international level, titled as Harmonious World Concept, which aiming to show China's positive attitude to join the international community and cooperate peacefully with other countries, rather than challenge the current world order as a rising power. When President Hu's visit to the U.S. in 2011, he represents a focus on the international dimensions of peace and cooperation, which could also be well incorporated into the concept of a harmonious society, or a harmonious world. President Hu further points out that the harmonious world requires the establishment of a sustainable development international community, in order to promote the harmonious coexistence of humanity and the Earth. Only through the international cooperation can we use and exploit the global resources rationally, protect the natural ecological environment in a better way. When Premier Wen attends the Fifth World Future Energy Summit in January 2012, he delivers an important speech that China will invest more money for renewable energy development and promote the clean technology innovation. China should show its positive attitude to join the construction of new energy supply system (clean, safe and reliable) through the renewable energy great leap. This speech, which embodying the harmonious world thought, has caused a strong international repercussion.

^① http://en.wikipedia.org/wiki/Harmonious_Society

(2) The evolving process of energy security: from conservation society to low carbon economy

As mentioned above, scientific development concept and harmonious society have provided the guiding ideology and strategic framework for the sustainable and harmonious development. Specifically speaking to the field of climate change and energy security, conservation society and low carbon economy are the two main discourses, which reflecting the internal-use-oriented change of energy security. Furthermore, from the discourse analysis, we can also see the transition of “decreasing the energy intensity” to “reducing the carbon intensity”.

(2.1) Conservation society -circular economy

The concept of “conservation society” has two connotations: first of all, to reduce the waste of resources consumption in the economic operation; secondly, to improve the energy efficiency, to create more wealth by consuming less resources and energy. It aims at putting an end to the bottlenecks hindering development and to support the transformation of the current conception of economic development toward a more sustainable concept of development (Kai 2003; Tiemao 2004). Later, this concept is further enriched by the concept of circular economy. It refers to change the traditional linear growth economy which heavily depending on the resources consumption, to the resource recycling economy which relying on eco-development.

Conservation society is first appeared in the Tenth Five Year Plan (2001-2006), but was only recently exposed in greater details by Ma Kai, the head of the NDRC (Constantin 2007: 14). In 2004, the issue of “Short and Long Term Strategy of Energy Development, 2004-2020” has offered a general framework for energy strategic development. The most important part is to make reduction in energy consumption the core of the energy policy, to adjust and optimize the energy structure and base energy development on technological innovation, to strengthen energy security by diversifying the sources of supply and improve environment protection (Constantin 2007: 15). To execute this plan, NDRC calls for an improvement in the diffusion of resource conservation techniques, for more technological innovation (Constantin 2007: 15). In 2005 the Sixteenth Plenary Session of the Fifth CPC Central Committee, the leaders make it clear to accelerate the construction of resource-saving and environment-friendly society, to promote the coordination of economic development with population, resources and environment. Conservation society and circular economy both put emphasis on the reduction of energy intensity and improve the energy efficiency, which closely with the green turning of energy security as well as climate change mitigation. On August 29, 2008, Circular Economy Promotion Law is approved by the Fourth session of the Eleventh National People's Congress Standing Committee and comes into force on January 1, 2009. This means the energy conservation as well as circular economic pattern has received its legal position in national strategy.

(2.2) Low-carbon economy

The systematic discussion of “low-carbon economy” could be traced back to the 1992 United Nations Framework Convention on Climate Change and the 1997 Kyoto Protocol. It refers to an economy that has a minimal output of greenhouse gas (GHG) emissions into the environment biosphere through applying the clean technology innovation as well as promoting the green integration of different sectors (manufacturing, agriculture, transportation, and power-generation, etc). In order to promote the transition to low carbon economy and urge the internalization of external environmental cost, some political supports are necessary, such as emissions trading and/or a carbon tax. Different from the conservation society -circular economy which mainly focusing on the energy intensity reduction, low carbon economy put much more emphasis on decreasing the carbon intensity/ carbon dioxide emission and has closer implication to climate change mitigation.

On September 8, 2007 at the 15th APEC Summit, President Hu Jintao raised four proposals to explicitly advocate the development of low-carbon economy. In this important speech, he has mentioned the word of "carbon" for four times: developing low-carbon economy, promoting the research and diffusion of low-carbon energy technologies, increasing carbon sinks and promoting the development of carbon absorption technology/ carbon capture and storage technology (CCS). In December 2007, the State Council Information Office has published a White Paper on China's Energy Conditions and Policies, which highlighting the development of energy

diversification and listing the renewable energy development as important part of the national energy development strategy, rather than insisting the dominant place of coal any more. In 2008 in the annual sessions of the National People's Congress and the Chinese People's Political Consultative Conference, the member of the national committee of CPPCC, Wu Xiaoqing clearly raises the issue of low-carbon economy to the conference agenda. He puts forwards that whether China could come to the forefront of world development in the coming decades and take actions actively to respond to serious challenges such as climate change largely depends on China's ability to cope with low-carbon economy adjustment. He suggests that China should speed up the low-carbon economy development and embark on the technology research and pilot study of renewable energy. In September 2009, President Hu pledges at the UN Climate Change Summit, "China will further integrate climate change concern into its economic and social development plan and continue to take effective measures to implement: firstly, enhance the work of energy conservation and improve energy efficiency, aiming to significantly decrease the carbon dioxide emissions of per unit GDP by 2020 based on the 2005 level. Secondly to develop renewable energy and nuclear energy, tending to realize the non-fossil energy share of total primary energy consumption reaching around 15% by 2020; thirdly, to increase forest carbon sinks through enlarging the 40 million hectares forest by 2020 compared with 2005, and increase forest stock volume by 1.3 billion cubic meters compared with 2005; fourthly, to develop low-carbon economy and circular economy, promoting the research and diffusion of climate-friendly technologies." In 2009 State Council meeting shortly before the Copenhagen negotiations, Premier Wen Jiabao puts forwards that the low-carbon economy as a key characteristic of a new, sustainable economic growth model (Moore 2011: 153). Furthermore, rapid growth and strong momentum in renewable energy sectors such as wind and solar as well as green technologies clearly indicate that China's political ambition and determination is strongly in favour of alternative and more sustainable development paths (McKinsey and Company 2009).

3. The policy interaction between climate change and energy security: the institutional change of energy sector in the climate change context

In the political realities, the green turning process of energy security concept in China is rather complex, since energy policy making is entangled with many actors with different interests. Some scholars have pointed out that the policymaking of China is under the model of 'fragmented authoritarianism' (Moore 2011: 148), in which the elite interests do not always align and one certain policy is shaped by a multiplicity of actors.^① Behind the policy outcome on certain issue, the actors' interaction and institutional change have shown the resources re-allocation and power shifting in the policy making process. In this part, the author tends to focus on the institutional change of energy as well as climate change sectors in central government, and explores how the climate change issue become salient in the agenda setting and what's relationship between the institutional enhancement of climate change and energy institution reform (Moore 2011: 148).

The high energy intensity, carbon intensity and environmental pollution of energy consumption could be attributed to the lax regulation of the energy sector in the past decade, such as the pale performance in the remediation of illegal small coal mines. Since the energy sector evolves more key stakeholders as well as organizational interests, especially including those concerned with trade, fiscal, electricity and other policy areas, the establishment of the Ministry of Energy is confronted with more difficulties and the reform process is rather challenging. From the historical perspective, there were co-existing separate ministries for coal, electricity and oil in the 1950s. In 1970, a new Ministry of Fuel and Chemical Industries combined the functions of those three ministries, but it had to be dissolved five years later. Due to the acute energy shortage in the early 1980s, China once created the State Energy Commission (SEC) (1980-1982) and subsequently developed to Ministry of Energy

^① In their study of Chinese energy policy-making, Kenneth Lieberthal and Michel Oksenberg concluded that authority below the apex of Chinese political system is fragmented. This "fragmented authoritarianism" results in a decision-making process in which issues tend to rise to higher levels in the system, consensus-building among central bureaucratic actors is necessary to maintain momentum, and the enthusiastic support of at least one senior leader is required for a major project to be approved. See Downs, E. S. (2004). "The Chinese Energy Security Debate." *The China Quarterly*, Vol. 177, No. 1, pp. 21-41.

(MOE) in 1988. However, the jurisdiction of MOE had overlapping authority with the State Development and Planning Committee (now is the NDRC)(Tsang and Kolk 2010: 6), and during the same period, the management and production functions of the previous industrial ministries were taken over by state-owned energy companies, which further weakened the position of MOE. MOE failed to carry out its mandate and was abolished in 1993(Tsang and Kolk 2010: 6). As a result, China has been short of a ministerial-level agency devoted to the country's energy-development policies since then, and this absence greatly reduces the central government's power to formulate as well as implement the strategic energy plans (Zha 2006: 186).

With the rapid growth of economy as well as increasing energy demand, **the National Energy Bureau (NEB)** was formed in 2003. In the hierarchical-focused governance of China, ranks are significant because governmental unit with the same ranks cannot issue binding orders to each other. NEB was trapped in an embarrassing position because it was lower than state owned enterprises (ministry or vice-ministry-level agencies). Along with the upgrading importance of energy issue, in May 2005, the State Council established **a State Energy Leadership Group** headed by Premier Wen Jiabao, with Vice-Premiers Huang Ju and Zeng Peiyuan as deputy heads. Membership of the Leadership Group included leaders from 13 central ministries and commissions. In early June 2005, a State Energy Leadership Office was set up as the executive organ of the Leadership Group (Cheng 2008: 302).

The establishment of this institution indicates that the central government began to attach strategic importance to energy sector management. The main tasks of this team, as high-level coordinated agency, are to research on national energy development strategy and major energy policy planning, to explore the energy development and energy conservation, to discuss energy security and emergency response, and to promote the international energy cooperation. Meanwhile, on 27 June 2005, the CPC Political Bureau held its twenty-third collective study session on the theme of study to resolve the energy resources question, and President Hu puts emphasis on encouraging the development of new energy and renewable energy, optimizing energy structure, promote the development of recycling economy. These measures above demonstrated the high priority attached to the energy scientific development by the Chinese leadership. It was the first time that **energy conservation** ranking as top agenda setting in the central government against the background that climate change issue has attracted much official attention in China since 2005.

2007 was a significant year for institutional innovation and organizational change in climate change and energy sectors, to certain degree, the rapid institutional development of climate change cognition in central government has promoted the adjustment of energy sector, since more green factors been involved into the energy strategy. In January 2007, China's National Climate Change Assessment Report is released and emphasizes the devastating impacts of climate change on China. Immediately following the release of the report, **the National Expert Group on Climate Change** is established to advise the government on climate change issues. In June 2007, along with the announcement of **China's National Climate Change Programme**, which symbolizing the first official position of Chinese government on climate change, **the Climate Change Coordination Group** under the NDRC is elevated to **National Leading Group on Climate Change (NLGCC)** directly under the State Council and led by Premier Wen Jiabao(Hallding et al. 2009: 125-126).^① At the same time, **State Council Energy Conservation and Emissions Reduction Leading Group** has also been established to set the national guide lines and strategy for energy saving, energy intensity reduction, climate change mitigation and renewable energy. Meanwhile, the advisory committee including 40 experts and consultants under the State Energy Leadership Group was also established, which is aiming to improve the level of scientific policy-making. Energy conservation committee and renewable energy development committee are two important one among the six specialized committees.^②

^① The "Leading Group" is a super-ministerial mechanism created to largely coordinate the complex decision-making process in some policy fields where there are probably more than 10 ministries involved.

^② Under the Advisory Committee, there are consisting of six specialized committees. They are the Specialized Committee of Coal, Electricity and Nuclear Energy committee, Oil and Gas Committee, Renewable Energy Committee, Energy Conservation Committees and Energy Economics Commission.

In September 2007, a special mechanism for external relations on climate change is established under the Ministry of Foreign Affairs and a **designated top climate change representative** is appointed. The activity continued through 2008, with climate change being one of the key issues during the Eleventh National People's Congress in March and the China Development Forum in April. In October **the White Paper on Climate Change** was published and China announced its initiatives for international climate talks (Hallding et al. 2009: 125-126). Against this backdrop, the former State Environmental Protection Administration (SEPA-formed in 1998) was upgraded to the ministerial level as **the Ministry of Environmental Protection (MEP)** in 2008. This institutional change sets a milestone for the environmental sector to gain the equal jurisdiction and power as other ministries, such of the Ministry of Agriculture and Ministry of Construction. It is remarkable that NEB was upgraded to **the National Energy Administration** (NEA- vice-ministry-level agency) in 2008.

However, since it is still difficult for NEA to regulate and coordinate the SOE actions without enough authority, for example, it is hard for NEB to impose the two national grid enterprises(the State Grid and the China Southern Power Grid) to purchase all the renewable energy power according to the feed-in tariffs system. As a transition solution instead of establishing the Ministry of Energy, China sets up **National Energy Commission** headed by Premier Wen Jiabao in 2010 (as a coexisting organization with NEA). NEC is a high-level discussion body or think-tank with ministerial rank, which be responsible for drafting national energy development plan, reviewing energy security and major energy issues as well as monitoring implementation. ^①

Generally speaking, the NDRC plays the most important role in the energy policy formulation as well as implementation, and its research institution -**Energy Research Institute (ERI)** provides the strategic vision of China's energy problems as well as knowledge support. As early as 2001, **the Center for Renewable Energy Development (CRED)** was established under the ERI, which symbolizing the green concern of energy security. Based on the international experience of renewable energy legislation, CRED began to explore the feasibility of Renewable Energy Law formulation in China, study the innovative ways and measures of developing the renewable energy industry and aim to offer annual report and policy advice for NDRC. It is noteworthy that the voluntary carbon intensity target issued by China's State Council before 2009 Copenhagen Conference (reduce the amount of greenhouse gases emitted per unit GDP -its carbon intensity- by 40-45% by 2020, compared with 2005) has put greater pressure for energy sector to accelerate the structural adjustment of low-carbon development. As a result, in February 2012, NDRC decides to upgrade the CRED to **China National Renewable Energy Center (CNREC)**, which directly assist the State Council as well as the main energy sectors to promote the renewable energy policy research, coordinate the management in the renewable energy industry, assist the establishment of renewable energy industry system, and carry out national demonstration projects as well as renewable energy international cooperation. ^②

Besides the changes in governmental institutions, some energy research centers or academic organizations or private sectors also promote the green turning of energy sector under the framework of climate change, such as **EU-China Institute for Clean and Renewable Energy (ICARE)** built in 2010 between Turin Polytechnic University(Italy) and Tsinghua University (China) under the cooperation framework of "Sino-EU Clean Energy Center Joint Declaration" which signed in the eleventh EU - China summit in May 2009.The ICARE aims to fill up the gap between the China's priority in battling against climate change by adopting clean and renewable energy and the lack of a critical mass of Chinese engineers in these new technologies. ^③ Other academic organizations

^① Instead of re-establishing a Ministry of Energy,China's leaders have icrosofted two inadequate entities: the National Energy Commission and the National Energy Administration. The former is tasked with overall policy guidance and coordination, while the latter provides the manpower and expertise for day-to-day work. See Kennedy, A. B. (2010). "China's New Energy-Security Debate." *Survival*, Vol. 52, No. 3, pp. 137-158.The NEC committee was composed of 21 members from various government agencies. It is said that NEC will have a strong voice on the price-setting power for electricity which as important authority of NDRC.

^②The inaugural ceremony of China National Renewable Energy Centre held in Beijing,

<http://www.cnrec.org.cn/zxdt/2012-02-24-159.html>

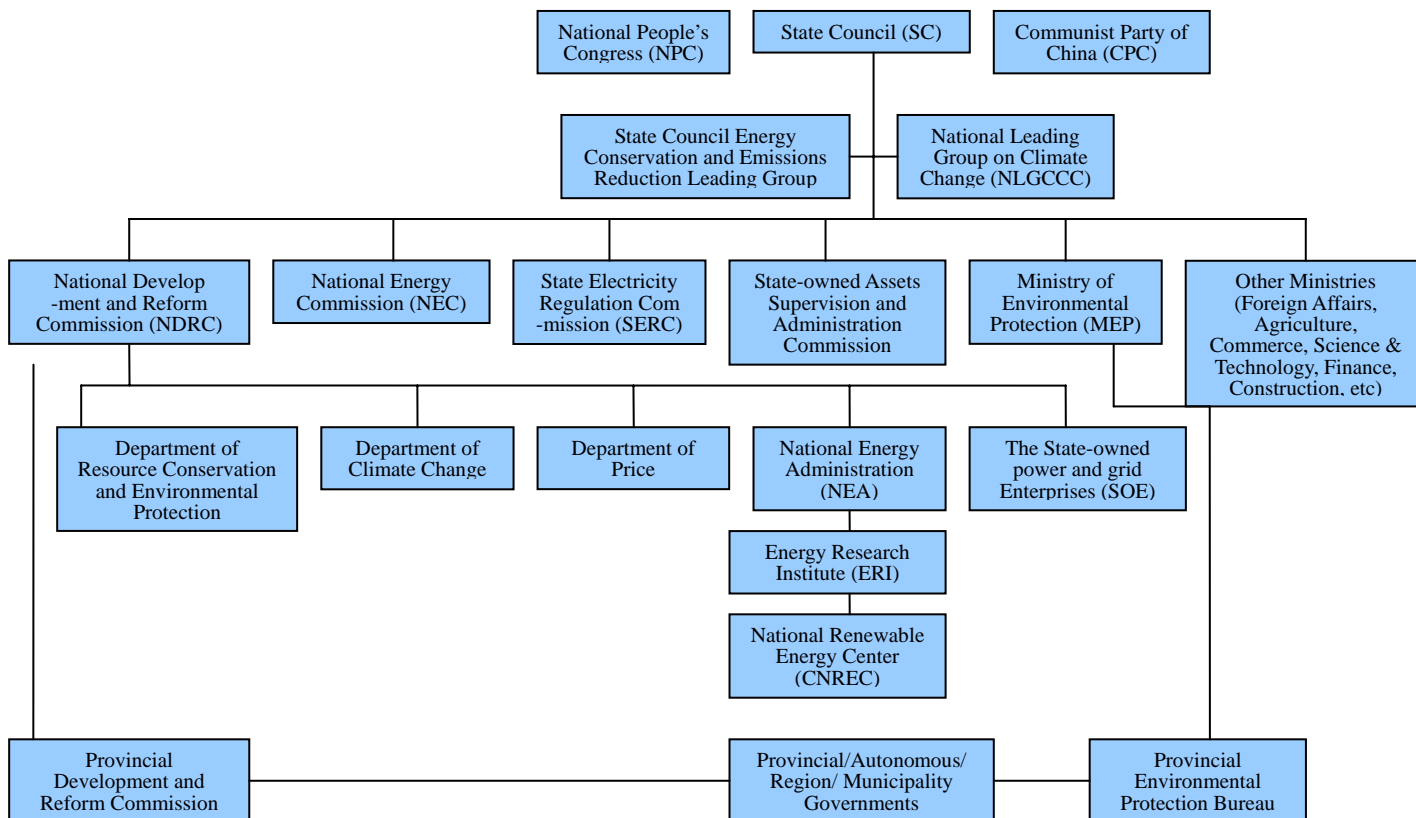
The introduction of CNREC <http://www.cnrec.org.cn/zxjs/zxjs/> (Accessed on April 3, 2012)

^③ The website of ICARE, http://eeas.europa.eu/delegations/china/projects/list_of_projects/20141_en.htm

such as Chinese Academy of Social Science (CASS) , Development Research Center (DRC) (an influential research institution directly under the State Council), Joint Research Center for China Studies of Chinese Academy of Sciences and Tsinghua University, the Research Center for Contemporary China in Peking University and so on all have contributed to the climate change mitigation as well as energy security research and take efforts to provide more and more policy recommendations for different political leaders.

On the whole, there is quite close relationship between climate change issue and energy issue in China and the deepening institutionalization of climate change policy has played a positive role to promote the green turning of energy sector, such as developing renewable energy and involving the carbon intensity reduction into energy security concept.

Graph 3 The Structural Graph for Key Chinese Government Units in Energy Sector



Sources: the graph is drawn by the author

V The Influence of Energy Security Green Turning on Renewable Energy Policy Change in China

Along with the energy security re-conceptualization process, especially the salient transition in the third stage of comprehensive energy security concept, focusing from the energy intensity reduction to carbon intensity reduction, renewable energy has achieved rapid development from 2003 till now and constructed a “green miracle” in this field. As the following graph shows, China has ranked top in the new renewable capacity investment as well as renewable power capacity and become global leader in wind power capacity as well as solar hot water/heating capacity. In order to explore what is the exactly detailed influence of energy security re-conceptualization on the renewable development in China, the author tends to analyze this question in two dimensions: domestic concrete policy dimension as well as international strategic policy dimension.

Table 1 Top Five Countries: Total Capacity as of End-2011

	Renewable power capacity (incl. hydro)	Renewable power capacity (not incl. hydro)	Renewable power capacity per capita (not incl. hydro) ²	Biomass power capacity	Geothermal power capacity	Hydropower capacity
1	China	China	Germany	United States	United States	China
2	United States	United States	Spain	Brazil	Philippines	Brazil
3	Brazil	Germany	Italy	Germany	Indonesia	United States
4	Canada	Spain	United States	China	Mexico	Canada
5	Germany	Italy	Japan	Sweden	Italy	Russia

	Solar PV capacity	Solar PV capacity per capita	Wind power capacity	Solar hot water/heat capacity ¹	Solar hot water/heat capacity per capita ¹	Geothermal heat installed capacity	Geothermal direct heat use ³
1	Germany	Germany	China	China	Cyprus	United States	China
2	Italy	Italy	United States	Turkey	Israel	China	United States
3	Japan	Czech Rep.	Germany	Germany	Austria	Sweden	Sweden
4	Spain	Belgium	Spain	Japan	Barbados	Germany	Turkey
5	United States	Spain	India	Brazil	Greece	Japan	Japan

Sources: REN21. (2012). *2012 Renewables Global Status Report*, p.19, Report of Renewable Energy Network for the 21st Century.

Available HTTP: <<http://www.map.ren21.net/GSR/GSR2012.pdf>>(accessed on 7 July 2012).

1. The green turning of energy security and the domestic concrete renewable energy policy evolution

Although the Law on Environmental Protection in China was issued in 1979(Liao, Jochem et al. 2010: 1885), the renewable energy development did not get enough attention until the late 1990s. Compared with the renewable energy pioneering countries, such as Netherlands, Germany and so on, the development of Chinese renewable energy is ten years later than those countries. Different from other environmental policies, such as water pollution, forest protection, waste management, renewable energy development need the sufficient support from energy sector not only from environmental sector. Besides, since the production cost of renewable energy (mainly wind power, solar power and biomass) is much higher than traditional fossil fuels (coal, oil and natural gas) especially at the burgeoning stage, this competitive disadvantage need to be made up by the favorable policy context. Thanks to the cognitive evolution of energy security concept in China, the renewable energy has gained much importance in the national energy strategy. Generally speaking, the concrete renewable energy policy in China has undergone three stages as follows:

(1) First stage: the tendering policy since 2003

The tendering policy is “using competitive bidding to select projects that offer the best price. Through the competitive bidding process, renewable developers submit proposals to build new renewable generation facilities and indicate the price they would accept for their output. The lowest priced renewable energy projects are then selected with a guarantee to purchase all the output from these projects” (Wiser, Hamrin et al. 2002: 7). ^①The U.K. Non-Fossil Fuel Obligation (NFFO) is the most widely cited example of a tendering policy. Through the NFFO, the U.K. government placed five successive competitive orders for renewable energy between 1990 and 1999

^① See Mitchell 2000. The U.K. Non-Fossil Fuel Obligation (NFFO) is the most widely cited example of a tendering policy. Through the NFFO, the U.K. government placed five successive competitive orders for renewable energy between 1990 and 1999.

(Mitchell 2000)^①. The main function of this policy is to find out the proper supporting price and profitable space for developing RES.

The advent of the leadership of President Hu Jintao and Premier Wen Jiabao in 2003 has brought a significant change in the thinking of the Chinese government on broad questions of economic development, energy and environmental impacts, including climate change(Freeman and Holslag 2009: 13). The concepts of scientific development and a harmonious society with “people-centered” development put forwards by Hu and Wen have shown that the sustainable development and environmental concern has upgraded to the core agenda of central government(Freeman and Holslag 2009: 13).In 2003, Chinese government first time issues the Wind Power Concession Programme (NPRC 2003)to follow the former U.K. tendering policy model, in order to create further incentives for international and domestic investors to develop large-scale wind farms and to encourage a reduction in the price of wind power within China’s reformed electricity industry (Changliang and Zhanfeng 2009)through government-overseen competitive processes. Domestic and international companies are all invited to bid for relatively large-scale potential projects (100-200MW). Successful bidders are selected according to the price per kWh of wind electricity proposed and the share of domestic components utilized in the wind farm. The wind concession lasts for 25 years and the bid price is guaranteed as a feed-in tariff for the first 30,000 full load hours achieved (NPRC 2003).

From 2003 to 2008, NDRC has continuously organized five rounds of wind concession projects, giving more emphasis on the domestic manufacturing (Changliang and Zhanfeng 2009). In 2009, a major concession project with 5.25 million kilowatts was held in Inner Mongolia. Although the concession projects aims to draw up a reasonable price for the FIT or RPS system in the previous rounds, the actual bidding price is far below the reasonable range, even appears the price as low as 0.382 yuan/ kWh. Furthermore, the state-owned energy company with much stronger strength usually wins the bidding with low price even there is not enough profitable space, and the small and middle sized private companies are gradually marginalized in this green market(see table 3). As a result, the tendering policy has gradually substituted by feed-in-tariff, only applied to off-shore wind park construction after 2009.

(2) Second stage: the feed-in tariff policy since 2005 (paralleled with tendering system)

The feed-in tariff policy refers to “a price-based policy which offering renewable energy developers a guaranteed power sales price, coupled with a purchase obligation (a guaranteed market) by electric utilities in relatively long time (such as 20 years). The feed-in price depends on the types of renewable energy resources available in a particular region and their production cost”. (Wiser, Hamrin et al. 2002: 2).In addition, feed-in tariff often include "tariff degression", a mechanism according to which the price (or tariff) ratchets down over time. This is done in order to track and encourage technological cost reductions(Couture and Gagnon 2010). Germany is the well-known example to successfully carry out feed-in tariff since 1990^②.Then the feed-in tariff is officially enshrined in the “Renewable Energy Sources Act ”(EEG) which came into effect by April 2000. In 2004 the EEG was amended improving the incentives and recently updated version in 2009 with changed promotion rules for various technologies(Wiser et al. 2002: 2).

In order to launch sizable renewable energy market like Germany, the Feed-in Tariff system is officially introduced in the People's Republic of China Renewable Energy Law in 2005. This milestone law has set a principal framework to promote the RES develop: setting the goal to realize 15% of China’s energy from renewable sources by 2020 and offering financial incentives with guaranteed price. More importantly, this law requires that power grid operators purchase full amount of wind power generated by registered producers. This kind of mandatory guaranteed price and grid connection are enshrined in articles 13, 14 and 19(NPC 2005): “The government encourages and supports various types of grid-connected renewable power generation..... grid

^① Through issuing the Renewable Obligation in 1999, the UK has taken the RPS to replace the tendering model since 2002.

^② In 1990 the “Act on the Sale of Electricity to the Grid” (Stromeinspeisegesetz- StrEG) represented the first legal basis to promote the production of “green electricity” and its distribution over the grid.

enterprises shall enter into grid connection agreements with renewable power generations enterprises that have legally obtained administrative license, and buy all the grid-connected power produced with renewable energy within the coverage of their power grid, and provide grid-connection service for the generation of power with renewable energy.... (NPC 2005)".

Different from Germany that a series of matching detailed rules and regulations were embodied in the EEG, the renewable energy law in China only simply mentioned the introduction of Feed-in Tariff, later another four important governmental regulations further complement and enrich the general rules of renewable energy law: The Interim Management Measures for Renewable Power Tariff and Cost Allocation issued by NDRC in 2006, the Regulatory Measures on Off-take Purchase of Electricity from Renewable Energy Sources by Grid Companies issued by the State Electricity Regulation Commission (SERC) (REN21 2009b: 14), the Interim Measures on Renewable Power Surcharge Collection and Allocation issued by NDRC in 2007. Based on these regulations which setting concrete favorable conditions to promote renewable energy development, the NDRC has officially set the feed-in price for wind energy issued through Notice on Policy to Improve Grid-Connected Power Pricing for Wind Power issued by NDRC in 2009 (0.51 yuan/Kwh, 0.54 yuan/Kwh, 0.58 yuan/Kwh, 0.61 yuan/Kwh for four different wind-resources regions respectively), feed-in price for biomass (0.75 yuan/ Kwh) issued through Standards for Feed-in Policy of National Unified Agricultural and Forestry Biomass in 2010 by NDRC, and feed-in price solar energy issued through Notice and Notice on Feed-in Policy of Solar Photovoltaic in 2011 by NDRC in 2011 (1 yuan/Kwh, 1.15yuan/ Kwh). The constant improvement of FIT has constructed great dynamics for the green industry in China, especially for the "upstream" industry such as wind turbine production as well as wind and solar park construction. However, the "downstream" support for renewable energy is still immature: the green electricity utilization is faced with financing shortage, for the national grid enterprises are unwilling to buy the "unstable and low-quality" renewable energies. Although in 2005 Renewable Energy Law has regulated that the grid enterprises should purchase all the renewable energy electricity within their grid coverage, the statistics illustrates that it plays only a limited due to the weak supervision: till 2009, the installed capacity of wind power has accounted for 1.85% of the total installed capacity of electric power, while the on-grid wind power only accounts for 0.75% of total electricity consumption.

(3)Third Stage: the further consideration for RPS since 2009

The Renewable Portfolio Standards (RPS) is defined as a market -based mechanism that "generally places an obligation on electricity supply companies to produce a specified fraction of their electricity from renewable energy sources. Certified renewable energy generators earn certificates for every unit of electricity they produce and can sell these along with their electricity to supply companies. Supply companies then pass the certificates to some form of regulatory body to demonstrate their compliance with their regulatory obligations. Unlike FIT which guarantee the purchase price, RPS mechanism relies almost entirely on the private market for its implementation and claim that market implementation will result in competition, efficiency and innovation that will deliver renewable energy at the lowest possible cost"(Chen et al. 2007; Cory and Swezey 2007).U.K. and 30 of 50 U.S. States, as well-known examples, adopted the RPS to promote the green market.

In order to overcome the grid-connection problem, some Chinese scholars and officials have begun to consider introducing the RPS to renewable energy policy system, and further combining the RPS with FIT. They have pointed out there are three main advantages to adopt the RPS: first of all, to force the grid enterprises to purchase the renewable energy at fixed quota index; secondly, to make the green market in China more mature, compared with FIT, RPS has a higher requirement for market mechanism, and the RES production should turn from quantity-oriented to quality-oriented; thirdly, to share the benefits and responsibilities of energy production between the western and eastern regions of China (Langniss and Wiser 2003)^①, and Eastern electricity companies

^① Western China has rich renewable resources, especially having strong wind power resources and more space for solar PV, however, the economic development of western part has fallen far behind the eastern coastal areas, which has high demand for large amount of energy supply.

can achieve their quota by buying Tradable Renewable Energy Certificates (TRCs or Green Certificates) or by exploiting renewable energy resources in Western part(Langniss and Wiser 2003).

The Medium- and Long-term Plan for Renewable Energy issued in 2007 by NDRC is the first time to put forward that in areas covered by large power grids, non-hydro renewable power generation’s share of total power generation will reach 1 percent by 2010 and over 3 percent by 2020 (REN21 2009b: 15). It is required that the power plants with equity installed capacity of over 5 GW shall have an equity installed capacity of non-hydro renewable energy accounting for 3 percent of their total capacity by 2010, and over 8 percent by 2020 (REN21 2009b: 15). This plan has showed the RPS turning hints for the renewable energy policy system. However, the quota target aiming at national grid enterprises has been shown in the 2009 Amendment Draft for Renewable Energy Law, especially the Article 14 has been amended to require the promulgation of an annual regulation that will govern grid purchases of renewable power. Under the mandatory quota requirements, the grid companies will be pressed to accelerate the construction of smart power grids and energy storage. As a result, the author marks 2009 as a symbolic year of substantial change for RPS consideration. In 2010, the central government issued the Management Measures on RPS Index of Renewable Electricity (The Proposal Version) to operationalize the quota allocation on the national level. China’s power enterprises, including the power companies as well as the grid companies will be forced to obey the quota allocation. In the draft of 12th Five-Year Plan for National Economic and Social Development of the People's Republic of China (2011-2015), the central government has announced the RPS mechanism will be officially involved in the five-year development strategy. However, the combination of RPS and FIT in China still stays in a trial stage and the compatibility should be re-checked in the practice.

Table 2 The Renewable Policies Evolution in China

	Tendering	FIT	RPS
Basic functional mechanism	Governmental Project-led Based on the lowest bid price	Price-based Make a guaranteed price for a long time (such as 20 years)	Market-based Requiring quite mature market for green certificate trading
General advantages	Transition policy to provide relatively high degree of certainty and stability for RES in the early stage	Guarantee the profitable space; Ensure resource diversity and local industry infrastructure development	Realize price minimization; and realize the inter-regional complement of capital and resources through green certificate trading system
The main purposes to learn	Establish a price-base for the FIT or RPS through bidding competition	Secure the profit space for RES producers; promote the RES development in a short time	Solve the grid-connected problem ; promote the on-grid renewable electricity growth
The main structural problems in China	Vicious competition, the bid price lower than the cost price ; the monopoly of state-owned power enterprises	The grid-connection problem; the monopoly of stated owned grid enterprises	The immature market system hard to apply Green Certificate System; only complement for FIT in current stage

Source: the table compiled by the author based on the website of REN 21.

2. The green turning of energy security and renewable policy change in the international strategic perspective

Yu(2008) points out that from the historical perspective, the rise of emerging powers is often accompanied by the rise of a new generation of the energy chain, for instance, the hegemony of the U.S. is inseparable from its long-term monopoly of the oil resources and control of “oil dollars”. From the national long-term strategic perspective, low-carbon economy is the main embodiment of national innovative capacity building and national overwhelming “knowledge power” which put forwards by Susan Strange(1994). Furthermore, the core of this economic growth approach is including the innovation of energy technology, innovation of industrial structure as well as industrial institution, and the fundamental change of human survival and development notion. This means that original carbon-intensive, high energy consumption and high pollution economy development model will be

replaced by low-carbon economy notion and production patterns. As a critical energy support for low-carbon economy, the development of renewable energy is essential for international system power shift. The Chinese leaders have recognized that only realizing the great-leap-forward development of energy structure adjustment/reformation as soon as possible, can China play a dominant role to lead the global clean energy chains(Yu 2008), in order to truly ensure the long-term energy security and sustainable development from the strategic height/perspective.

What can not be ignored is the influence of Japan Fukushima nuclear crisis on the energy security reconsideration. Developing nuclear power has been once regarded as a significant clean energy approach to guarantee the energy supply as well as reduce green house gas emission. ^①Compared with renewable energy, nuclear power can provide stable power output and relatively large installed capacity, especially when solar and wind power markets have not had the decisive ability to satisfy the energy supplies(He 2011) . However, the sudden-happened Japan Fukushima nuclear crisis in March 2011 has caused a big blow to the Asian booming nuclear industry and forced China to recognize the seriousness of security problems existing in nuclear power plants. In March 2011 State Council executive meeting, Premier Wen Jiabao put forwards that “We will suspend the approval of the nuclear power project...We must understand thoroughly the importance and urgency of the nuclear security and put safety on the first place for nuclear power development ”. This thought is also embodied in the 12th Five-Year Plan and the 2020 Vision of Nuclear Safety and Radioactive Pollution Prevention (《核安全与放射性污染防治“十二五”规划及2020年远景目标》) .The slowdown in nuclear power development, to some extent, will cause the world's fossil energy demand rising as well as prices ascending. However, it will also continue to strengthen the strategic orientation of the national renewable energy development. In the long run, this strategic conversion will help to construct a clean and reliable world energy supply system, and achieve the global low-carbon transition more quickly.

According to REN 2012 global report, the renewable sources proportion has increased to 16.7 % of global final energy consumption in 2011 and investment in renewables increased 17% to a record \$257 billion, despite a widening sovereign debt crisis in Europe. Moreover, the rapidly falling prices for renewable power equipment(Photovoltaic module prices dropped by 50% and onshore wind turbines by close to 10%) and leading renewable technology innovation have greatly improved the competitive advantages of renewable energy compared with fossil fuels such as coal and gas (REN21 2012). From the international low-carbon strategic vision, CCP leaders have reached a consensus that developing renewable energy could enhance economic competitiveness through adoption of newer, greener technology(Moore 2011: 154). In the 12th Five-year Plan, energy-saving environmental protection as well as renewable energy development have been attached much importance, which being treated as key green measures to “develop a modern industrial system and improve industrial core competitiveness” (Moore 2011: 154).

Along with the green turning of energy security and strategic focus on carbon intensity in China we have mentioned above, renewable energy sector has gained great opportunity to develop rapidly. Specifically speaking, renewable energy is ranking the national priority development project and gotten more structural resources allocation. The American clean energy research institute- The Pew Charitable Trusts- has mentioned in its report “Who is Winning the Clean Energy Race? Growth, Competition and Opportunity in the World’s Largest Economies” that, China has already overtaken the U.S. to be the global largest clean energy investment country. As an “clean energy investment champion”, China’s green investment total amount has reached \$ 34.6 billion in 2009 with 50% growth rate, which has first time surpassed the total investment of G20. ^② Furthermore, China

^① Pro-nuclear Group insist developing nuclear power plants seems to be considered as the easiest and the best way to solve the energy problem when Chinese solar and wind power markets have not had the decisive ability to satisfy the energy supplies. Nuclear power can provide stable power output and relatively large installed capacity.

^② The Pew Charitable Trusts, Who is Winning the Clean Energy Race? Growth, Competition and Opportunity in the World’s Largest Economies,
http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Global_warming/G-20%20Report.pdf.

has greatly promoted the international renewable energy cooperation with other countries and aimed to build some renewable energy demonstration industry bases. Meanwhile, the energy efficiency standards, emission reduction target, energy-saving performance and other low-carbon indicators are involved into the evaluation system for local officials, so as to ensure the evidence-based assessment of local clean energy development.

It is noteworthy to point out the development of carbon trading market in China since 2011, which corresponding to the low-carbon economy strategy, has provided another strong dynamics to promote the renewable energy development. The World Bank estimates that carbon trading globally could be worth US\$3.5 trillion by 2020, meaning it would overtake oil to become the world's largest market. Stimulated by this promising prospect, China had 100 carbon exchanges in operation or under preparation by late 2011(Wang 2012). However, speaking on the global scale, the carbon trading market has undergone a slump, especially the EU's Emissions Trading System (EU-ETS) is still struggling to recover from a crash a year previously, which had seen the price of carbon allowance plummet from 30 euros to just a few cents(Wang 2012). Even though confronted with this adverse context, China has decided to learn these lessons and first launch a group of city and provincial-level carbon-trading trials, which are widely considered to be preparation for an absolute cap on emissions (Wang 2012). In May 2012, the NDRC has issued " Notice on Carbon Trading Trials Scheme" (《关于开展碳排放权交易试点工作的通知》), in which five cities and two provinces are fixed as carbon trading pilots" : the cities of Beijing, Tianjin, Shanghai, Chongqing and Shenzhen and the provinces of Hubei and Guangdong. Beijing, Tianjin, Shanghai have more experience which gaining from the operation of earlier environmental exchanges in these cities (Lin and Yang 2012).^① Currently, the carbon trading implementation plan of Beijing has been approved by NDRC and it is expected the carbon emissions trading system will be basically formed by 2015. Developing renewable energy has gained much priority in the local carbon trading strategy.

Furthermore, the improvement of renewable energy strategic position and the development of carbon trade have also promoted the formation of "clean energy diplomacy/ low-carbon energy diplomacy. In the global energy diplomacy, China is still a "little partner" who lacking adequate discourse in the major energy organizations, not to mention the initiative power. The participation style of China in international energy cooperation organizations is often constrained as coordination or dialogue type, but excluded from the alliance and collaboration-type. As largest energy consumer and GHG emitter, promoting the clean energy diplomacy/ cooperation could on one hand, reflect a positive commitment to the international responsibility to fight against climate change and accelerate the green-institutionalization process of international energy system; on the other hands, low-carbon energy diplomacy could decrease the head-on collision with U.S. in the traditional fossil fuel fields (especially oil and gas fields).

VI Conclusion

Through constructing the dynamic constructivist theoretical framework of energy security concept, the author points that there are two main characteristics for energy security re-conceptualization process: firstly shifting from external supply- biased energy security (focusing on availability, affordability and accessibility) to also take the internal-oriented energy use security into consideration (societal and environmental acceptability); secondly, shifting from the static energy security to dynamic energy security with resilience capability: to take external changing context of climate change into account, to emphasize on international energy governance as well as competition from the perspective of technology and policy innovation; to enhance the resilience for unpredictable energy disaster.

Based on the theoretical exploration and historical events analysis, we can conclude China's energy security transformation process also embody two features: **first of all, from focus on external dependence to realizing the**

^① China's three main carbon markets – the Beijing Environment Exchange, Shanghai Environment Energy Exchange and Tianjin Climate Exchange –are all formed within two months of each other, towards the end of 2008.

domestic energy challenges. Although there was a self-sufficiency stage focusing on internal supply existing before 1993, the comparatively stagnant oil production and rapid economy growth leads to great demand for energy import. Over the past decade, China's thinking about energy security has widened considerably and external dependence is no longer the sole concern (Kennedy 2010: 147). China has found that the real predicament for energy security is the heavy energy-consumption-based economic growth with low energy efficiency, which further leading to more domestic challenges such as environmental pollution, GHG emission etc. As a result, since 2003, China's energy security connotation has evolved from supply-oriented energy security highlighting the expansion of external supply to comprehensive energy security concept focusing on international cooperation, energy diversification, energy conservation and low-carbon economy.

Secondly, China has pay attention to the energy resilience capacity-building according to the external changing context, especially to the climate change. The author proposes that energy security and climate change mitigation are not separated concepts, instead, climate extreme events has warned us climate change has already set natural constraints for extravagant energy use, even though one country can guarantee to get continuously sufficient energy at reasonable price. The water crisis or food crisis which caused by climate change has repeatedly reminded us the "fragile ceiling" of traditional fossil fuel energy use. From this sense, the real energy security is to promote the national innovation capacity building and make a transition to low-carbon sustainable pattern as soon as possible. Besides, the climate change issue has also added a normative dimension to energy security, the international pressure from climate change negotiation has accelerated the global diffusion of low-carbon development approach.

It is noteworthy that there is a transition from "decreasing energy intensity" to "reducing the carbon intensity" in the third stage of China's energy security evolution (2003-till now), especially the carbon intensity indicator is involved into the 12th Five-year Energy Plan in 2010. Chinese energy policies and each of China's steps and practices bear significant implication on greenhouse gas emissions and climate change (Li and Clark 2010). Moreover, the 2011 Fukushima nuclear accidents in Japan have brought new attention to how national energy systems are vulnerable to climate disasters, as a large nuclear power promoter, China has to reconsider the cost (nuclear leaking disaster or nuclear waste disposal) to development nuclear power, even if it is currently more stable than renewable energy. While along with the technological innovation and smart grid construction, the production cost of renewable energy will be decreased and the transmission capability will be increased. It is foreseeable that the growth rate of renewable energy will be much faster than nuclear power, which staying at a suspension status due to the impact of nuclear crisis.

Based on green evidence of energy security transformation in China through discourse as well as institution analysis, the author argues that green turning of energy security concept has promoted the profound reform in renewable energy sector in two aspects: **domestic policy change of renewable energy as well as international renewable energy strategic policy:**

From the perspective of renewable energy policy change, the energy security greening promotes the continuous policy evolution, from tendering system since 2003, to dominant feed-in tariffs system since 2005, and then introducing the consideration of renewable portfolio standards (RPS) since 2009. During this policy change process, there are three main Chinese characteristics: Firstly, from the single trial policy (tendering system) to a comprehensive policy system (FIT as a main renewable policy, which complemented by tendering and RPS); Secondly, from only emphasis on the production capability of renewable energy to emphasis on both the quantity and quality, even limit the unregulated growth (focus turning to the grid-connected RES and RES electricity utility); Thirdly, from mainly governmental project-led (tendering system) to turn to promote the development of green market (RPS consideration).

From the international perspective of renewable energy strategic policy of China, we can see that the renewable energy development, from marginal position to strategic position, has gained more national investment and favorable policy resources according to the energy security transformation in China. The

contribution of renewable energy to energy security has gained more world-wide recognition, and leading to great reduction of GHG emission. In recent years, it is increasingly recognized that **China's "green leap forward" policy** has made it become the world's largest makers of wind turbines and solar panels surpassing Western competitors in the race for alternative energy (Li and Clark 2010: 16). Especially the great efforts to construct carbon trading market in China will further enhance the promising future of renewable energy development. Further more, this strategic orientation has promoted the international renewable cooperation such as China-US Energy Policy Dialogue (EPD), the China-US Strategic and Economic Dialogue (S & ED) as well as the establishment of Sino-EU Clean Energy Center in 2010, which is conducive to deepening interdependence between China and the rest of the world(Zha 2006: 187-188). This kind of low-carbon energy diplomacy will reduce the risk of more diplomatic clashes between China and the major industrialized countries to certain degree (Zha 2006: 187-188). Generally speaking, it is an embodiment of discourse "harmonious world" put forwards by president Hu. Since China tries its best to be as quo status country in "peaceful rise" process, without challenging the existing energy mechanism. Specifically speaking, besides constructing the cooperation mechanism with major energy countries, China also provides substantial help, such as clean energy skill training or renewable energy development aid, to the least developed countries in Africa, which vulnerable and fragile to the climate change.^①

Finally, the author tends to make a conclusion that evolution of China's thinking about energy security also **presents an opportunity for the outside world** (Kennedy 2010: 138), in other words, "since Chinese consumption has become an important determinant of change in the global economic scene, and the international community increasingly demands China behave in politically acceptable and responsible ways in its pursuit of energy supplies"(Zha 2006: 187-188). By giving priority to improving Chinese energy efficiency as well as low-carbon energy innovation, the entire world can benefit from a managed rise in Chinese demand for overseas oil and gas, and expect China contribute more to the global climate change mitigation(Zha 2006: 187-188). Without a more thorough understanding of China's deliberations about energy security connotation, it is hard to explore the continuous renewable energy policy change in China. The green turning of energy security, especially from focusing on external energy dependence to domestic energy-intensity reduction as well as carbon –intensity reduction, has lead to has lead to quite profound institutional and organizational adjustment, which opening "the window of opportunity" for rapid renewable energy development in China, such as setting renewable energy fund in the national twelfth-five-year-plan. Of course, during the energy security greening and relevant policy transformation process, there are still many apparent challenges existing, such as the lack of coordination and policy consistency (such as controversy between FIT and RPS), short of transparency in government–business interactions associated with its pursuit of energy interests overseas, weakness and incompleteness in incentive system, lack of tech and policy innovation in local policy areas, immature financial system as well as market economy condition for renewable energy projects and the limited investment in research and development of renewable energy (Zhang, Peidong, et al 2007, (Li and Clark 2010: 16)). As a result, there is still a bumpy way for China to go before China's renewable energy policy system as well as carbon trade market becoming mature and ever embedded harmoniously in the national political and economic environment.

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^① However, it is still questionable in the dam construction issue, which is thought to be harmful for local ecological situation.

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