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**CHINA
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Insights to Chinese Environmental Policy

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SYSTEMATIC ANALYSIS OF THE ACTUAL DEVELOPMENTS IN CHINA - CHINA'S 12TH YEAR PLAN AND THE ENVIRONMENT

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Systematic analysis of the actual developments in China

- China's 12th Year Plan and the Environment

Andreas Oberheitmann⁺ and Ruan Xiaodong⁺⁺

1. Socio-economic development targets in the 11th Five Year Plan

China is the world's largest developing country with a fast growing economy. The fast economic growth is connected with a large variety of climate, energy and environmental policy issues. Currently, the 12th Five-Year Plan (2011-2015) is being implemented. To better understand this new scheme and to explore the research opportunities in the field of climate change, environment and energy in China, we need to retrospect the outcome of the previous 11th Five-Year Plan (2006-2010). This outcome primarily reflects political, economic, cultural, educational, scientific and technological aspects. Following up, the main results of the 11th Five-Year Plan are listed:

- (1) China's urbanization rate (the proportion of urban population to total population) increased from 43% in 2005 to 47.5% in 2010, and the annual increase is of 0.9% on average.
- (2) China's GDP per capita increased from 1,700 dollars to 4,000 dollars.
- (3) The proportion of Research and Development in GDP increased from 1.3% to 1.8% during the 11th Five-Year Plan period.
- (4) The amount of invention patents in 2009 was 128,000, with a 142% increase over 2005, ranking third in the world; by in 2010, the number rose to 135,000.
- (5) The gross enrollment rate to higher education increased from 21% in 2005 to 24.2% in 2009; and the people at school in China reached 29.79 million, ranking first in the world. The gross enrollment rate to senior high school increased from 52% in 2005 to 79% in 2009.
- (6) The average schooling time of working-age population was 9.5 years in 2009.

The indicators listed above reflect the tremendous achievements China had made. However, China is still in the process of accelerating industrialization, urbanization, marketization and internationalization, and there is still a long road ahead for its development.

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At present, the conflict between China's social and economic development on the one hand and environment and resources on the other hand is becoming more and more prominent. Energy supply and environmental protection in China is facing great challenges. With a large population and an uneven development, China is currently in complex and contradictory conditions. Against this background, the Chinese government formulated the 12th Five-Year Plan, including goals to tackle the issues of climate change, environment and energy in China. Highlights of the 12th Five-Year Plan are (XINHUA, 2011):

- (1) Population will be controlled below 1.39 billion;
- (2) Urbanization rate will reach 51.5 percent;
- (3) Value-added output of emerging strategic industries will account for 8 percent of GDP;
- (4) Foreign investment in modern agriculture, high-tech and environment protection industries will be promoted;
- (5) Coastal regions shall turn from "world's factory" to hubs of R&D, high-end manufacturing and the service sector;
- (6) Nuclear power will be developed more efficiently under the precondition of ensuring safety;
- (7) Construction of large-scale hydropower plants will gain momentum in southwest China;
- (8) Length of high-speed railway will reach 45,000 km;
- (9) Length of highway network will reach 83,000 km;
- (10) A new airport will be built in Beijing;
- (11) China will build 36 million affordable apartments for low-income people.

On 28 January 2010, China submitted its proposed climate mitigation action to the UNFCCC. By this, the country reaffirmed earlier announced policies, first presented on 22 September 2009 by Chinese President Hu Jintao at the United Nations climate change summit in New York (NATIONAL DEVELOPMENT AND REFORM COMMISSION, 2009):

- A reduction in carbon intensity by a notable margin in 2020 against 2005. In December 2009 in Copenhagen this "notable margin" was defined as a target to reduce carbon intensity by 40-45%.
- An increase in the non-fossil fuel share of primary energy supply to 15% by 2020 compared to 2005.
- An increase in forest coverage of 40 million hectares, and of forest stock volume of 1.3 billion square metres by 2020 against 2005.

- The promotion of Green Economy, Low Carbon Economy, Circular Economy and technology development.

To cope with climate change, in recent years the Chinese government has issued several action plans and legislation. The most important include the following:

- the Renewable Energy Law of the People's Republic of China (STANDING COMMITTEE OF THE NATIONAL PEOPLE'S CONGRESS, 2005).
- Scientific and Technological Actions on Climate Change (MINISTRY OF SCIENCE AND TECHNOLOGY ET AL., 2007).
- the National Climate Change Programme (NATIONAL DEVELOPMENT AND REFORM COMMISSION, 2007).
- the Medium and Long-term Development Plan for China (NATIONAL DEVELOPMENT AND REFORM COMMISSION, 2007a).
- China's Policies and Actions for Addressing Climate Change White Paper (STATE COUNCIL, 2008).
- Implementation of the Bali Roadmap: China's Position on the Copenhagen CLIMATE CHANGE CONFERENCE (NATIONAL DEVELOPMENT AND REFORM COMMISSION, 2009).

With this background set, we can make a better understanding of the 12th Five-Year Plan and a comprehensive exploration of research opportunities in the field of climate change, environment and energy in China.

2. Socio-economic development targets in the 12th Five Year Plan

2.1 Urbanization and population transformation

According to the 12th Five-Year Plan, China should continue to promote urbanization, constantly improving the level and quality of urbanization, and enhancing the carrying capacity of cities and towns. And at the same time, "urban disease" should be under close guard and some work should be done to put it in prevention and treatment.

Based on the estimation, by 2014, urban population will exceeded rural population for the first time in China. This will be a historic change for a nation with a population of almost 1.4 billion. No doubt, the period in 12th Five-Year Plan is a critical period for China to build a comprehensive well-off society. The life style of most Chinese will change continuously and more cities and towns will be built. Hence, more steel products, cement, electric power, petroleum, non-ferrous metals, chemicals and manpower will be needed.

With the urbanization process being accelerated, the total economic volume will increase by 40% or above by 2014 (Figure 1). The demand for land, energy, water and many other

resources will keep increasing and the contradiction between social and economic development and restrictions from resources and environment will become more and more prominent. China has to search for more resources to sustain its development and do more research to resolve the problems aroused by the lack of reserves. Meanwhile, the pressure exerted by the international society on environmental protection will also increase and China's environmental protection will face more and more stringent challenges.

Figure 1:
The strategy setup of urbanization process in 12th Five-Year Plan



Source: Xinhua (2011).

We can predict that the challenges and problems in the fields of climate change, energy and the environment in China will be more and some of them may be absolutely new to human societies in the world. Society, economy, science, technology and culture will be cooperating with each other to cope with this massive transformation needed in China.

2.2 Transformation of economic development patterns

In the last three decades, China's has achieved a rapid economic development. But due to the its huge dependence on the consumption of resource and energy, this has exerted heavy influence in the environment and natural resources. Now, China's merchandise export has been ranked first in the world, but these are mainly exports of labor-intensive products. As for

the export of electromechanical products and high-tech products, as most of it is low-end product assembly, domestic value added is not high. Additionally, prices of resources in the international market have been growing, increasing the manufacturing costs in China and partly weakening the competitiveness of China's industry. Severe industrial and agricultural pollution is already taking a toll on public welfare and economic development. In the 12th Five-Year Plan, transformation of economic development pattern has been brought forward to decrease the dependence on resources and increase the dependence on innovation. Meanwhile, climate change also exposes China to an increasing international pressure. To maintain a sustainable development, China has to restructure its economic goals and to transform its economic growth patterns.

According to the 12th Five-Year Plan, China expects that local governments and more industries will be far-sighted enough to place new technology and new industries to promote the depth of transformation of economic development pattern. Here, the transformation must be based on actual conditions and the actual situation.

In the Plan, some new strategic industries will be developed first. Considering the aspects of climate change, environment and energy, more attention is paid on the following fields: efficient energy-saving and environmental protection industry, key technologies and equipment for recycling of resources, new generation of nuclear power, solar thermal, concentrated solar power and photovoltaic solar power generation, wind power technology and equipment, smart grid, biomass energy; new energy automotive industry; plug-in hybrid electric vehicles, pure electric vehicles and fuel cell vehicle technology. The share of added value of these new strategic industries shall account for 8% of GDP in 2015.

With urgent response to climate change, the demand for low-carbon technologies will increase intensively in 2011-2015. This will promote low-carbon technology innovation and industrial development, such as ultra-low energy consumption buildings, waste heat recovery, clean coal technologies, bio-fuels, advanced nuclear energy, hydrogen energy technologies, carbon capture and storage (CCS) etc.

If China could seize the opportunity of this “green transformation” and make efforts to reverse the trend of environmental destruction and degradation, high-tech industry would be continuing to be strengthened and expanded, and the sustainable and healthy economic development in China could be realized. In this process, lots of research opportunities can be found in the field of environment and energy, and more public-private partnerships and corporation between research institutions and universities will come forth.

3. Energy security concerns and plans

China is the world's largest energy producer and consumer. The sustained growth of energy supply has provided an important support for the country's economic growth and social progress, while the rapid expansion of energy consumption has raised energy security concerns. In the previous 11th Five-Year Plan, some energy issues had been already included. Here, we show some issues which were observed and discussed:

- (1) The increase of energy demand is accelerating year after year;
- (2) Energy supply increasingly depends on imports; especially China's oil imports increased rapidly, and more uncertainties of energy security emerged.

In 2009, China's total energy consumption was equal to 3 bn. tons of standard coal equivalents (sce). Experts predicted that by 2020, total energy demand will be up to 4.5 bn t sce, which means that China have to increase investment in new energy fields in order to ensure that the a stable, economical, clean and safe energy supply system can prevail. The major issues in the 12th Five-Year Plan referring to energy planning are:

- Non-fossil fuel to account for 11.4 percent of primary energy consumption; and
- Energy consumption per unit of GDP to be cut by 16 percent;

Based on the 12th Five-Year Plan and the outcome of preliminary analysis, to achieve the goal of “non-fossil fuel to account for 11.4 percent of primary energy consumption”, China's hydropower capacity installed will reach to 300 million kW or more by 2020, and the sum of wind power, solar energy and other renewable energy will equal to 1.5 million tons of standard coal equivalents.

China continues to exceed earlier targets in non-fossil development. For example, the five-year target for wind is 70 GW of additional installation, which exceeds the 2020 target of just a few years ago. As for nuclear energy, the plan is to install 40 GW of additional capacity by 2015. China currently has around 10 GW of installed nuclear capacity, which means that if this five-year target is achieved, China is likely to exceed even the expectation of 70 GW by 2020 and would have the world's largest installed capacity of nuclear energy by this time.

Energy supply security is becoming a "rigid" constraint to sustainable economic and social development in China. Energy security has been seen as equal to economic security, military security and national security. To get rid of energy constraints, the Chinese government is planning to accelerate its development of a modern energy industry, and to give priority to build a resource-conserving and environment-friendly society in the course of its industrialization and modernization, and striving to enhance its capability for sustainable development and make China as an innovative country. China strives to build a stable, economical, clean and safe energy supply system and has made resource-conservation a basic state policy: This would facilitate the changing of economic growth patterns. Along with the change and development, more research and studies related to

- energy-saving technologies,
- popularizing energy-saving products,
- improving energy management expertise,
- improving energy-saving legislation and standards, and
- enhancing energy efficiency

are needed and encouraged to be carried out.

In a word, energy supply security is an issue regarding a long-term strategy, not of a short-term balance in China. Keeping energy supply in security is vital to the resolution of a series of problems.

4. Challenges of climate change

During the past 100 years, the Earth's climate is experiencing significant changes characterized by global warming. This trend is also happening in China. The impact of climate change on China's agriculture and livestock breeding, forestry, water resources, coastal zones and many other natural eco-systems is evident, such as sea level rise in the coastal areas, glacial retreat in Northwest area, and the earlier arrival of the spring phenophase. More weather events caused by drought, rainstorm and frost happened in recent years. In 2008, frost in Central and South China has disrupted the beginning of the annual Spring Festival travel rush, with temperatures reaching their lowest since 1961 in Guizhou, Hunan and Hubei provinces. Millions of passengers got stuck in railways, buses, or stations for several weeks during an extreme snow and frost disaster. From October in 2010 to January in 2011, a historical period of drought had been seen by Beijing's 20 million inhabitants. The capital city did not receive any rainfall in nearly four months. North China and the Yellow-Huaihe River valley have seen continuously less rainfall up to 90% below average which led to drought in China's eight important areas in Shandong, Henan, Hebei, Shanxi, Anhui and Jiangsu, Shaanxi and Gansu and left some 7 million hectares or farmland short of water supply. East China's Shandong Province, one of the country's major grain producers, recorded the worst drought in 200 years.

Meanwhile, as a developing country with a huge population, a coal-dominant energy mix and relatively low capacity to tackle climate change, China will surely face more severe challenges coping with climate change along with the acceleration of urbanization, industrialization and the increase of residential energy consumption.

Climate change is projected to increase the frequency and intensity of climate and weather-related hazards in China, imposing more risks to a society that has been emerging on its path to a sustainable development. In the 12th Five-Year Plan, China attaches great importance to the issue of climate change, and a series of policies and measures to address climate change has been formulated in the overall context of the Plan. The outlining objectives, basic principles, key areas of actions, as well as policies and measures to address climate change has been put forward. Here, four areas should be emphasized:

(1) Low carbon city pilot approaches

The National Development and Reform Commission (NDRC) launched a national low-carbon province and city experimental project already in 2010. The project will be implemented in five provinces, namely Guangdong, Liaoning, Hubei, Shaanxi and Yunnan, and in eight cities, namely Tianjin, Chongqing, Shenzhen, Xiamen, Hangzhou, Nanchang, Guiyang and Baoding. According to the project, these 13 pilot areas will include the work on climate change into the

local "12th Five-Year Plans" and formulate the low-carbon development plan. The government officials of those provinces and cities should develop a low-carbon development plan to accelerate the establishment of an industry structure featuring low carbon emissions and actively promote low-carbon lifestyles and consumption patterns in order to tackle global climate change. The targets for the project are characterized by the establishment of low-carbon emissions industrial systems, the establishment of greenhouse gas emissions data statistics and management systems, the promotion of a low carbon green lifestyle and consumption patterns.

(2) Developing a circular economy to reduce greenhouse gas emissions

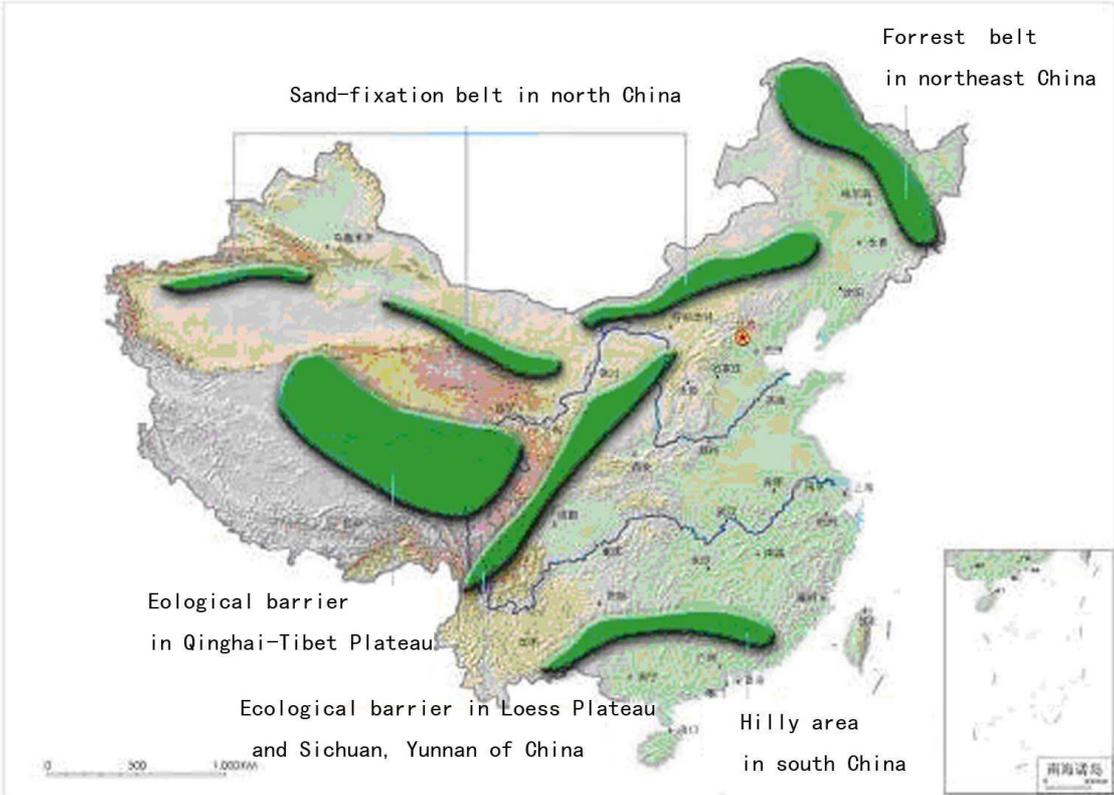
The Chinese government is doing its best to reduce resources consumption, adjusting industrial structure and increasing energy conservation and energy efficiency to control greenhouse gas emissions. China is expediting the transformation of its economic development mode, developing a recycling economy and endeavoring to cut fossil energy consumption. For this, the research on coal gas, coal to liquid fuel and mine-mouth electricity generation has been put forward. In the Plan, a clear goal of total control of the total energy consumption, management of energy utilization and low-carbon technology application are promoted. The greenhouse gas emissions in the fields of industrial, construction, transportation and agriculture will be strictly controlled and a carbon trading market and labeling and certification system of low-carbon product standards will be established.

(3) Launching afforestation campaigns and enhancing ecology restoration and protection

In the recent decades, China government has been continuously investing in tree planting and forest protection, about four million ha of trees have been planted every year. In recent years, through the reform of the collective forest right system, farmers' enthusiasm for tree planting and forest protection has been aroused.

Figure 2:
The strategy setup of ecological safety in 12th Five-Year Plan (Xinhua,2011)

图5 “两屏三带”生态安全战略格局



Source: XINHUA (2011).

The country's rate of forest coverage is going up from 12.0 percent in the early 1980s to 18.2 percent by now. In the 12th Five-Year Plan, to enhance capacities for carbon sequestration, 1250 hectares of forest will be planted. To enhance capacities for climate change adaptation, forest and wetland restoration will be strengthened (Figure 2).

(4) Enhancing the adaptive capacity to climate change

To cope with the weather-related hazards in China, the government will establish an overall strategy of strengthening the adaptability to climate change. For this, the research, observation and impact assessment of climate change will be reinforced. In the design and construction of major projects and infrastructure, climate change should be fully taken into consideration. To deal with extreme weather events, monitoring, early warning and prevention and extensive international cooperation will be improved. In the ecologically fragile areas like agriculture, forestry, water resources and coastal areas, more new technologies will be applied and developed to improve prevention and mitigation of natural disasters.

5. Requirements for environmental protection

During the 11th Five-Year Plan, some breakthrough have been made in the environmental protection field. However, due to problems of an unreasonable industrial structure and an extensive growth mode of economy, environmental protection is still lagging behind the economic development.

According to the 12th Five-Year Plan, the main objectives are focusing on the total discharge control of major pollutants, pollution prevention and control and taking action to guarantee water and air safety for urban and rural people. We have noticed that some details in the Plan indicated the emphasis on water, air and solid waste treatment. The main objectives are listed blow as follows:

- (1) China will continue to reduce the discharge of chemical oxygen demand and sulfur dioxide thus improving water quality and preventing atmospheric pollution. At the same time, ammonia (NH₃-N), nitrogen oxides (NO_x), total nitrogen (TN), total phosphorus (TP), and heavy metals (M+) will be addressed by introducing indicators for the restriction of water pollution treatment.
- (2) China will improve the disposal of urban sewage and garbage. By 2015, the disposal rate of urban sewage and garbage shall reach 85% and 80%, respectively.
- (3) China will make efforts to improve the air quality of urban areas and prevent and control the air pollution in urban and rural regions; the ratio of the days in which the quality of urban air reaching Grade II in the whole year will take more than 80%;
- (4) China will attach importance to control industrial pollution, guarantee nuclear and radiation safety, and make efforts to resolve safety problem about hazardous wastes, persistent organic pollutants (POPs) and hazardous chemicals.

In the 12th Five-Year Plan, environmental monitoring, early warning and emergency response capacity also need to be strengthened to improve environmental protection effects. Some laws, regulations and standards need to be completed and enforced, and the accountability system and social supervision system for pollution accidents and environmental protection needs to be established and improved.

China is the most populated developing country in the world. Although China has made substantial progress in environmental protection in recent years, serious conflicts between environmental protection, economic and social development are still existing. Today, many environmental problems that have haunted developed countries in different phases of their 100-year-long industrialization have occurred in China all at the same time. The conflict between environment and development is becoming ever more prominent. Relative shortage of resources, a fragile ecological environment and insufficient environmental capacity are becoming critical problems hindering China's development.

Environmental protection is not only concerned as being positive for the country's economic development, but also as being crucial to improve people's living standards. In order to achieve these goals listed in the Plan, additional research is needed to provide better information and technology. Up to now, hundreds of institutes and universities are involved in this research and many new technologies have been developed.

Annex:

Summary of the 12th Five Year Plan targets

Economic targets

- GDP to grow by 7 percent annually on average;
- More than 45 million jobs to be created in urban areas;
- Urban registered unemployment to be kept no higher than 5 percent;
- Prices to be kept generally stable.

Economic restructuring

- Rise in domestic consumption;
- Breakthrough in emerging strategic industries;
- Service sector value-added output to account for 47 percent of GDP, up 4 percentage points;
- Urbanization rate to reach 51.5 percent, up 4 percentage points.

Innovation

- Expenditure on research and development to account for 2.2 percent GDP;
- Every 10,000 people to have 3.3 patents.

Environment & clean energy

- Non-fossil fuel to account for 11.4 percent of primary energy consumption;
- Water consumption per unit of value-added industrial output to be cut by 30 percent;
- Energy consumption per unit of GDP to be cut by 16 percent;
- Carbon dioxide emission per unit of GDP to be cut by 17 percent;
- Forest coverage rate to rise to 21.66 percent and forest stock to increase by 600 million cubic meters;

Agriculture

- Annual grain production capacity to be no less than 540 million tonnes;
- Farmland reserves to be no less than 1.818 billion mu.

Livelihood

- Population to be no larger than 1.39 billion;
- Life span per person to increase by one year;
- Pension schemes to cover all rural residents and 357 million urban residents;
- Construction and Renovation of 36 million apartments for low-income families;
- Minimum wage standard to increase by no less than 13 percent on average each year;

Social management

- Improved public service for both urban and rural residents;
- Improved democracy and legal system;
- Better social management system for greater social harmony;
- More than 10 percent of all residents will be registered as community volunteers.

Reform

- Encourage qualified enterprises to get listed in stock markets;
 - In-depth reform in monopoly industries for easier market entry and more competition;
 - Improved government efficiency and credibility
-

Source: Xinhua (2011).

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