



**China Council for International Cooperation on
Environment and Development**

Council Member Paper

Mr. He Jiankun



Mr. He Jiankun

Dean, Research Institute of Low Carbon Economy, Tsinghua University; Former Executive Deputy President, Tsinghua University

Member of the Council, Phase V

Mr. He Jiankun was born in 1945, and is now Director for the Institute of Low Carbon Economy, Tsinghua University, and a professor of Management Science and Engineering. From 1999 to 2007, he was Vice President and Executive Vice President of Tsinghua University. Currently, he is also Vice Chairman of the China Experts Panel on Climate Change, and Vice President of the Chinese Society for Sustainable Development.

His major research areas include energy systems engineering, and strategy and policy addressing global climate change. He has been a principal researcher of many national key science and technology projects and international collaborative research projects. He has received more than 10 national and provincial/ministerial Science and Technology Progress Awards. He has published more than 150 academic articles.



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Realizing Co-Benefits of CO₂ Reduction and Sustainable Development by Promoting Energy Revolution

Mr. He Jiankun
CCICED Council member

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He Jiankun Tsinghua University

China's economic and social development is currently faced with stricter resource limit and environmental constraints as well as the challenge of addressing global climate change. Saving energy, improving energy efficiency, developing new energy and renewable energy, and optimizing energy structure and thus reducing fossil fuel consumption is not only an important strategy to control domestic environmental pollutions and construct a resource-economical and environment-friendly society, but also an strategic option for addressing climate change and reduce CO₂ emissions, as well as a basic solution to promoting coordination between resource and environment and China's economic and social development and maintaining sustainable development. By fully realizing its comprehensive cooperative effect, promoting the revolution in energy production and consumption as a key breakthrough point can further promote the low-carbon transformation of China's economic development path, enhance the implementation of CO₂ reduction strategy, and adapt to the pace of addressing global climate change.

1. Current situation of energy development, environment protection and CO₂ reduction in China

We are facing a more urgent international climate negotiation process than before. By the end of 2015, COP21 Paris will reach an agreement on an international institutional framework applicable to all countries to enhance emission mitigation efforts after 2020, and in the meantime ensuring the emission mitigation actions before 2020. China's "Third Plenary Session" put forward "comprehensively deepening reform", which includes economic development entering a new transformation period, strengthening ecology civilization, promoting the revolution in energy production and consumption, and thus solving the problem of resource limit and environmental constraints and realizing sustainable development and the coordination of economic society, resource and environment. Faced with the current situation and requirements of global climate negotiation and China's low-carbon development, the solution for China is coordinating domestic and international situations, and actively promoting the revolution in energy production and consumption as key breakthrough point to promote the low-carbon transformation of economic and social development and reach a win-

win situation between addressing global climate change and China's sustainable development.

The core task of addressing climate change is the reduction of greenhouse gas emissions, especially the CO₂ emission from the consumption of fossil fuel. China has made tremendous efforts in energy saving and CO₂ emission reduction in recent years. Energy intensity per GDP decreased 59% and CO₂ intensity decreased 62% from 1990 to 2013. Due to China's rapid economic development, however, it is difficult to change the situation where the energy consumption and related CO₂ emission is large and increase faster. China's GDP increased 9.3 times and the energy consumption increased 3.8 times during the same period, while the world's energy consumption only increased by 50%. During 2005~2013, the increase of China's CO₂ emission accounts for around 60% of the world's increase. China's annual CO₂ emission is now 1/4 of the world's total CO₂ emission, with the CO₂ emission per capita of approximately 6 tons, close to the level of some European countries. Durban Platform negotiations will focus on questions such as how to enhance emission reduction for all countries and the peak year and mitigation path to realize the 2°C temperature rise target. China is a country with large amount of emissions, thus the peak year of emission is critical to the global peak year. While persisting on equality and "common but differentiated responsibilities" in international negotiations, China needs to take more active mitigation actions after 2020 and establish an active, strict, and achievable CO₂ emission reduction target to adapt to the cooperation process of addressing global climate change.

Currently the rapid growth of the consumption of fossil fuel such as coal in China has led to the reaching of the limit of resource conservation and environmental pollution. Coal production in 2013 reached 3.68 billion tons – almost twice of the scientific capacity, causing problems like safety issues such as frequent mine accidents and 1 million hectares of land subsidence in the goaf area, as well as ecological and environmental problems such as more serious damage of groundwater resource and air and soil pollution. Emission of 85% of the SO₂, 67% of the NO_x, and 70% of the soot come from the combustion of fossil fuel such as coal. 50% of the primary particle of PM_{2.5} in the summer and 70% of the primary particle of PM_{2.5} in the winter in Beijing come from coal combustion and automobile exhaust emissions. 40%~75% of the heavy metal content in PM_{2.5} comes from the use of fossil energy. Currently the action along the east coast of controlling coal consumption and the number of vehicles is not only a key action on regional environmental governance, but also will promote the implementation of CO₂ emission reduction and addressing climate change strategies.

Currently the coal consumption of China accounts for 45% of the world's total

coal consumption. The increase of coal consumption of China in 2005~2012 accounts for 66% of the world's coal consumption increase. In 2012, the net import of coal of China is 270 million tons and China has become the world's biggest coal importer. 58% of the oil is imported in 2012 in China, more than that of the US which is 48%. 29.5% of the natural gas is imported in China. The increase of oil consumption of China accounts for 63% of the world's total oil consumption increase in 2005~2012. China's energy security is facing new challenges. China's energy consumption in 2013 accounts for the world's 20.6%, while China's GDP only accounts for 12.3% of the world's total GDP. China's energy consumption per GDP is around twice of the average level in the world and 3~4 times of the level of developed countries. There is still a lot can be done on saving energy and increasing the output per energy consumed. An aspiring CO₂ emission reduction target is helpful for controlling fossil energy consumption, reducing emissions of conventional pollutants such as SO₂, NO_x, and PM_{2.5}, and increasing the output from energy consumption. Setting a CO₂ emission peak target will effectively control coal consumption, reduce environmental pollutions from the source, and resolve the situation of resource shortage and environmental pollution in China.

The upcoming IPCC Fifth Assessment Report points out the emission reduction path for controlling the global temperature rise within 2 °C on the basis of the conclusion that the current climate change is mainly caused by anthropogenic greenhouse gas emissions. The global carbon emission must reach the peak around 2020, be at the same level of or 40% less than the carbon emission of 2010 in 2030, and be 40%~70% less than that of 2010 in 2050, and achieve near-zero emission at the end of this century. The current mitigation commitment and development trend of all countries, however, will lead to a 30% increase of global carbon emission in 2030 compared with the 2010 level. If this trend continues, we will lose the chance of controlling the temperature rise within 2 °C, and the actual temperature rise will be 3.7~4.8 °C at the end of this century, which will lead to irreversible disasters on the ecological system and the human society. Thus, it is necessary for all countries to put in more efforts in emission reduction. The economic and social development will be faced with the challenge of limited CO₂ emission, and all countries must seek for low-carbon transformations.

The situation of global climate change mitigation brings new trends of energy revolution globally. One of the new trend is to save energy and increase energy efficiency. The EU has set the target of a 20% increase in energy efficiency in 2020 compared with 1990. Germany further sets the targets of decreasing its primary energy consumption by 20% and 50% respectively in 2020 and 2050 compared with 1990,

while keeping the growing of the economy. The other one of the new trend is to foster the development of new energy and renewable energy and low-carbonize the energy structure. The EU has set the target of renewable energy taking up 20% of total energy share, and Germany further plans to have 30% renewable in 2030 and 60% in 2050 and to have 80% of the electricity generated from renewable energy. The global new trend is that new low-carbon energy systems such as new energy and renewable energy beginning to substitute for conventional carbon intensive systems supported by fossil energy. Thus it is a strategic choice for China to promote the revolution in energy production and consumption and follow the world's energy revolution trend.

Under the situation of addressing global climate change, low-carbon development is becoming a global trend and leading to revolutionary transformation of the global energy system, which will result in new economic and technological competition. New energy technology will become the frontier and a hot area of international technological competition, and will bring new economic growth points, new markets, and new jobs as a high-tech industry which the world's great powers will compete for. Low-carbon technology and low-carbon economy will become a country's core competitiveness. China must implement innovation driven strategies and achieve low-carbon new industrialization and urbanization to achieve the low-carbon transformation of development path, and thus become a strong power in global low-carbon development competition and be in an leading position in international negotiations.

2. CO₂ emission reduction target and emission peak target under domestic and international situations

China's "Twelfth Five-Year Plan" announced the targets of a 16% decrease in energy intensity per GDP and a 17% decrease in CO₂ intensity, and put forward the plan to control total energy consumption. Currently in Beijing, Tianjin, Hebei and the east coast regions coal consumption controlling targets are set to deal with atmosphere environmental problems like haze. Thus during "The Thirteenth Five-Year Plan" period, along with environmental governance and ecological protection targets, targets can be implemented controlling China's total energy (mainly coal) consumption and total CO₂ emission while further decreasing the energy intensity per GDP and the CO₂ intensity, achieving a double control on both "intensity" and "amount". Meanwhile, regional and sectoral targets controlling CO₂ emission peak should be set as a comprehensive goal and key breakthrough point of domestic ecology civilization and addressing global climate change to force the achievement of the low-carbon transformation.

During "The Thirteenth Five-Year Plan" period, due to the transformation of

economic development and the slowing down of GDP growth, demand for energy intensive raw materials such as steel and cement will gradually become saturated. Along with the speeding up of industrial restructuring, the energy consumption elasticity can be further decreased. It will be more difficult for technical energy saving, but structural energy saving will play a more important role. During “The Eleventh Five-Year Plan” period, the energy consumption elasticity was 0.59. The energy consumption elasticity is projected to be 0.54 during “The Twelfth Five-Year Plan” period and should further decrease during “The Thirteenth Five-Year Plan” period. Under the expectation of an average GDP growth rate of 7.0%~7.5% during “The Thirteenth Five-Year Plan” period, the decrease of energy intensity per GDP would be not lower than 15%~16% to make sure that the energy consumption elasticity does not rebound. Thus the total energy consumption could be controlled within around 4.8 billion tce in 2020. With the control on total energy consumption and the governance of environmental problems such as the haze, targets in “The Thirteenth Five-Year Plan” should focus on further controlling total coal consumption and total CO₂ emission to promote the low-carbon transformation of economic development. With the effort of developing clean, efficient, and low-carbon energy such as new energy, renewable energy, and natural gas, the share of coal could decrease to about 60% with the total consumption controlled 4~4.5 billion tons, and the CO₂ emission from energy consumption could be controlled within 10 billion tons. On the basis of non-fossil energy achieving the 15% share in 2020, CO₂ intensity per GDP will be 45%~50% lower than 2005, which overfulfils target of the Copenhagen Climate Change Conference commitment of 40%~45%.

The climate negotiation of “Durban Platform” is focusing on the international emission mitigation framework and the contribution of each country after 2020. China is receiving a lot of attention as a country with large amounts of emissions. When the CO₂ emission of China reaches the peak and begins to decrease and what level will the peak value be are the most important questions that will have a big impact on the global emission mitigation path for controlling the temperature rise within 2°C. As in China, the energy consumption related CO₂ emission reaching the peak means that the total fossil energy consumption reaches the peak, and the increased energy consumption afterwards will mainly come from the increase of the new energy and renewable energy supplies, which will lead to the turning around of the present situation of resource shortage and serious environment pollution. Thus investigating on and setting the CO₂ emission peak target is of great importance to not only China but also the world.

The GDP per capita in most of China’s east coast regions have exceeded \$10,000,

and the CO₂ emission per capita is also close to the peak level in the EU and Japan. The east coast regions of China are heavily polluted regions with resource shortage problems. Currently those regions are dealing with the haze and controlling the total coal consumption. For those regions, the total coal consumption will reach the peak and then decrease during “The Thirteenth Five-Year Plan” period. Although the natural gas consumption will increase, the total CO₂ emission in the east regions will reach the peak due to the completion of industrialization around 2020. China will complete industrialization in 2020~2025, and the end-use energy consumption in industries and the CO₂ emission will reach the peak and begin to decline, which creates the opportunity for China’s CO₂ emission to reach the peak. The urbanization rate of China could reach 60% in 2020, and then grows in a slower rate and reach around 65% in 2030. China’s population and urbanization rate will stay stable after 2030. As the urbanization rate stables, the energy consumption of transportation and construction sectors would have a slow increase. According to related studies, by enhancing overall planning and implementing policy instruments, increasing energy efficiency and developing distributed renewable energy in the construction sector, and improving fuel economy and developing electric vehicle and biofuel in the transportation sector, the CO₂ emission from construction and transportation sectors will increase in a slower rate and finally be stable and the increase of the energy demand of those sectors would be mainly from the increase in the new energy and renewable energy supplies around 2030. Thus it is possible for China’s total CO₂ emissions to reach the peak in 2030.

After the completion of China’s industrialization after 2020, regional economic achieves intensive growth, GDP growth rate decreases, industrial restructuring speeds up, energy consumption elasticity decreases, and the annual decrease rate of energy intensity per GDP stays the same at around 3%. The share of non-fossil energy would reach 15% in 2020. The new energy and renewable energy industries will be more competitive. The new energy and renewable energy will take up above 20% share in 2030, and keep an annual growth rate of 6%~8%. Thus the decrease rate of CO₂ intensity per energy consumption would be above 1.5%. With the 3% annual decreasing rate of energy intensity per GDP, the annual decrease rate of CO₂ intensity per GDP would exceed 4.5%. That means the annual GDP growth rate maintains at the potential growth rate of 4%~5% even when the CO₂ emission is reaching the peak in 2030. Thus instead of limiting the economic growth, the target of CO₂ emissions reaching the peak in 2030 could promote the development transformation. Therefore the annual growth rate of total energy demand can be controlled at approximately 1.5% at around 2030, which the increase of new energy and renewable energy supply can be sufficient for.

There is still great potential for China's economic growth.

Overall, the target of CO₂ emission reaching the peak in 2030 is an achievable target with uncertainties. The achievement of the target depends on the strategy the policy implemented at present and in the future as well as the speed and depth of economic development transformation. The target is of great importance for creating a low-carbon development roadmap for in-depth energy saving and carbon emission reduction, and will play an important role in enhancing the low-carbon transformation of economic development.

3. Strategy for creating a win-win situation of addressing climate change and promoting ecology civilization by promoting the energy revolution

President Xi Jinping has put forward 5 requirements for promoting the revolution in energy production and consumption: promoting energy consumption revolution, promoting energy supply revolution, promoting energy technology revolution, promoting energy system revolution, and comprehensively strengthening international cooperation. Xi Jinping also required a strategic plan for the revolution in energy production and consumption. Thus promoting the revolution in energy production and consumption has become an essential part and breakthrough point for China's economic development transformation and ecology civilization, as well as an essential strategic option for China to combat climate change. A win-win situation of constructing domestic ecology civilization and addressing global climate change can be achieved by realizing overall planning and the comprehensive cooperative effect of the revolution in energy production and consumption, integrating the policy instruments, and ensuring the implementation of the measurements.

Promoting the revolution in energy production and consumption and implementing the energy development strategy requires innovative thinking, changing the thinking mode of traditional energy strategy which puts ensuring energy supply in the center position, and regulating the energy demand from the aspect of ecology civilization. President Xi Jinping prioritized promoting the energy consumption revolution, required controlling of unreasonable energy demand and firmly controlling total energy consumption to force the economic development to fundamentally transform. "The Twelfth Five-Year Plan" includes the target of controlling total energy consumption within 4 billion tce until 2015, which could be achieved hopefully. Total energy consumption could as well be controlled within 4.8 billion tce in 2020 while overfulfilling the target of doubling the 2010 GDP and decreasing CO₂ intensity per GDP by 40%-45% compared with 2005. China will complete industrialization and

regional economic will achieve intensive growth after 2020, and the energy consumption elasticity would drop to below 0.5 and the total energy consumption could be controlled about 6 billion tce in 2030 with a higher GDP growth rate. The GDP in 2030 will be 3.5 times of that in 2010, and total energy consumption in 2030 would be less than 2 times of that in 2010. The energy consumption growth in the future 20 years would be slow compared with the 3.3-time in the 20 years of 1990~2010.

Promoting the development of new energy and renewable energy and achieving the low-carbon transformation of energy system is the key to energy production revolution. The final target is to build a new sustainable energy system with new energy and renewable energy as the main body and achieve near-zero CO₂ emission. Investment and new installed capacity of new and renewable electricity was about 3 times and 2 times respectively of fossil energy electricity in 2013. China has set the target of new energy and renewable energy share reaching 15% in 2020, and that means the annual supply of new energy and renewable energy would be around 700 million tce, which is more than the total energy consumption of the UK and Germany, as well as Japan in 2010. New energy and renewable energy would effectively substitute for fossil fuel energy and avoid the increase of fossil fuel energy. The share of renewable energy and nuclear energy would be above 20% with the annual supply of more than 1 billion tce in 2030, and the installed capacity of wind and solar energy generation would be hundreds of millions kW. The share of electricity generated from non-fossil energy would be more than 40%. Non-fossil energy would be one of the main energy sources in service together with fossil energy such as coal, oil, and natural gas. The share of coal would drop to about 50%. The share of new energy and renewable energy would be 1/3 ~ 1/2 and the share of coal would decrease to under 1/3 in 2050, creating a solid foundation for the new energy and renewable energy based sustainable energy system in the second half of this century. Nuclear energy also plays an irreplaceable part in the transition to a sustainable energy system and achieving the CO₂ emission peak target while the renewable energy develops rapidly. In 2030, the installed capacity of nuclear energy will reach about 150 million kW, substituting nearly 500 million tons of coal, reducing 900 million tons of CO₂ emission, and play an important role in reducing the emission of the pollutants such as SO₂, NO_x, and PM_{2.5}. Therefore China should keep the steady and efficient development of nuclear energy on the basis of ensured safety. Natural gas is a kind of cleaner, more efficient, and lower carbon fossil energy compared with coal. China should as well focus more on the exploration and utilization of conventional and unconventional natural gas and keep increasing the share of natural gas in primary energy to reduce the growth of coal. In “The Fourteenth Five-Year Plan”

period (2020~2025), the share of natural gas would be increased from 4.4% in 2010 to 10% or above, which provides the opportunity for coal consumption to reach the peak before the CO₂ emission reaches the peak. Although the share of coal will decrease in the future, coal will still be dominant in a certain period, which requires the development of clean and efficient coal utilization technologies as the key to saving energy and reducing environmental pollutions. CCS in coal power plants and coal chemistry should be investigated and demonstrated as a low-carbon option when global CO₂ emission reduction is more urgent and the carbon price is higher in the future.

Technology innovation is an important support to promoting the revolution in energy production and consumption. Efficient, safe, clean, and low-carbon are the targets of the revolution in energy production and consumption. The revolution in energy system needs to be supported by advanced technology innovations. The global trend of energy revolution will lead to a revolution in the economic and social development globally, and will thus impact the global situation of international economic and technology competition. Developing advanced energy technology and obtaining the advantage in the competition is an important motivation and strategic target for countries in the climate change negotiation. Developed countries are aiming at expanding the market to developing countries through their advantage in energy efficiency and new energy technology to seize new opportunities for economic growth and maintain the economic vitality. At the same time, China has been developing the advanced energy technology that has its own advantages and characteristics. China needs to further enhance the capacity of investigation and industrialization of advanced energy technologies and obtain the competitive edge in advanced energy technology competitions by the advantage of large market demand of China. China has to strive for the opportunity in the technology competition in the global energy system revolution and achieve the leapfrog development by supporting the technology upgrade and energy system revolution by technology innovation.

Deepening the reform and promoting the energy system revolution are the basics of achieving the revolution in energy production and consumption. It is important to further complete the fiscal and financial policy system promoting the low-carbon development as well as reform and complete the mechanism of energy product pricing and the resource and environmental tax system. Promoting the energy market mechanism reform, ensuring the property of energy as commodity, and establishing the market structure and system with fair and effective competition need not only the breaking of monopoly in some markets, but also avoiding and correcting of the disordered market competition. The present pricing mechanism of fossil energy cannot

reflect the true social cost in China. The social cost such as the air and water pollution and public health damage caused by coal combustion is not reflected in the cost, and there is not a developed tax system for the payment transfer of the benefit, while the environmental and health cost of coal consumption is more than 50% of the current coal price. Conservation of fossil energy, development of new energy and renewable energy, and transformation of energy structure can be achieved by internalizing the social cost of resource and environmental loss through resource and environmental tax reform and establishment of the carbon market

The change of government's development view will promote the revolutionary of energy production and consumption and achieve low-carbon transformation. The Eighteenth National Congress of the Communist Party stressed on the ecology civilization and put forward the concept of green development, cyclic development, and low-carbon development, which is an important and key strategy in the period of economic and social transformation in China. China has to modify its economic growth pattern which is driven by continuously increasing investment, expanding capacity of heavy chemical industry, and increasing the export of low-end manufacturing products, promote industrial restructuring, and decrease the energy intensity per GDP substantially. It is important to change the view of development, focus on the quality and benefit of economic growth instead of pursuing only the amount and speed of GDP growth, and set the constraint and policy "redline" of resource saving, environmental protection, and CO₂ emission reduction. Central and local government should coordinate economic development, increasing employment, and increasing social welfare as well as saving resource and environmental protection, balance the economic benefit and environmental loss of GDP growth, and turn the dilemma into a win-win situation. Sustainable development strategic targets as ecology civilization and low-carbon transformation should be prior to economic growth goal. Government officials should have a different view and standard of political achievement and take responsibility for the targets of energy saving, carbon emission reduction, and environmental protection.

The global trend of energy revolution and addressing climate change together has provided China a great opportunity for international cooperation on promoting the revolution in energy production and consumption. Through enhanced international cooperation, China would obtain the energy supply from other countries. Also by enhancing technology cooperation and transfer, China would obtain the intellectual property of advanced technologies, gain the competitiveness in core technologies, and take an active position in the trend of global energy reform. That is an important field for China to make great contributions, promote the south-south cooperation, and

increase the capacity for developing countries to combat climate change. Therefore China has to play a leading role in promoting international cooperation in climate change mitigation by taking part in international energy technology cooperation.