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**China's Low Carbon Transformation:  
drivers, challenges, and paths**

**Jiahua Pan**

Institute of Urban and Environmental Studies

Chinese Academy of Social Science, Beijing

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Centre for Climate Economics & Policy

**Abstract**

National climate change mitigation actions and objectives could be taken from both active and passive considerations. China has multiple objectives to develop a low carbon economy and to decrease carbon dioxide emission per unit of GDP, including mitigation of global climate change, security of energy supply, promotion of sustainable development (environmental protection, poverty alleviation, employment and natural conservation). In this regard, China's actions are more at the active side than from a pressure outside. However, there are some suspicions in the international society about whether China has the determination and efficiency in mitigation actions. The author demonstrates that China's low carbon transformation is largely driven from domestic considerations. For china the question is not to make the transformation into a low carbon economy, but how to accelerate the process. In the meantime, low carbon transformation in China has to face many serious challenges. A dilemma exists that a higher carbon may actually help raise necessary resources for promoting low carbon solutions. Understanding and international cooperation are essential for China's low carbon transformation.

**Crawford School of Economics and Government**

**The Australian National University**

[ccep.anu.edu.au](http://ccep.anu.edu.au)



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# China's Low Carbon Transformation

## --- drivers, challenges, and paths

Jiahua Pan<sup>1</sup>

**Abstract:** National climate change mitigation actions and objectives could be taken from both active and passive considerations. China has multiple objectives to develop a low carbon economy and to decrease carbon dioxide emission per unit of GDP, including mitigation of global climate change, security of energy supply, promotion of sustainable development (environmental protection, poverty alleviation, employment and natural conservation). In this regard, China's actions are more at the active side than from a pressure outside. However, there are some suspicions in the international society about whether China has the determination and efficiency in mitigation actions. The author demonstrates that China's low carbon transformation is largely driven from domestic considerations. For china the question is not to make the transformation into a low carbon economy, but how to accelerate the process. In the meantime, low carbon transformation in China has to face many serious challenges. A dilemma exists that a higher carbon may actually help raise necessary resources for promoting low carbon solutions. Understanding and international cooperation are essential for China's low carbon transformation.

**Keywords:** low carbon transformation, sustainable development, mitigation of climate change, carbon dilemma.

### Introduction

China is well aware of its large amount and high rate of growth in greenhouse gas emissions and made substantial and successful efforts to reduce emissions. However, there are some suspicions, misunderstandings and misinterpretations outside about China's willingness, actions, and efficiency in mitigating climate change. There is a need to understand China's control of GHG emissions is not merely for the sake of climate mitigation, but also for domestic strategic concerns such as energy security and sustainable development.

### Low Carbon Transformation: a question of how to accelerate the process rather than one of whether or not

Under the target of a global 2° temperature limit, sustainable growth requires decrease in carbon emissions. To apply 'Scientific Outlook on Development' in China, and to achieve low carbon growth, the great green transformation has already been put on the way, and is

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<sup>1</sup> Institute of Urban and Environmental Studies, Chinese Academy of Social Science, Beijing  
Email: [jiahupan@163.com](mailto:jiahupan@163.com)

being accelerated.

Firstly, on a strategic point of view, China's low carbon development is not merely in response to global climate change or for the sake of GHG emissions reductions. It is also a necessity for sustainable development, energy security, and environment and ecological protection. China's fossil fuels reserve is characterized by a lack of oil and gas with relative richness of coal. Automobile ownership in China is 50 per thousand people in 2009, which is only 1/15 of the US ownership rate and 1/10 of the ownership level in the EU and Japan. But China's import of oil has been over 204 million tons in 2009, more than half of the consumption. According to the statistics from British Petroleum<sup>2</sup>, China's proven reserve of oil could only support 11.3 years of consumption. Global oil reserve could meet global consumption at current rate for 42 years if the storage-production ratio maintain the same. The disaster of deep sea oil exploration in Mexico Gulf could even probably shorten the ratio<sup>3</sup>. 42 years is a flick of time, even if China could purchase oil unrestricted in the global market, there will be no oil left in 2050, when China's huge transportation system would still have to be running. The storage production ratio of nature gas in China is three times higher than oil, which could only support 32.3 years of consumption and is just half as much as the global 60.4 years. China's coal storage is relatively rich, while if the storage production ratio maintains the same, it could only support 41 years of consumption, which is 1/3 as to the global 122 years. China is becoming a net importer of coal in 2009<sup>4</sup>. Even if China imports coal from the global market, it could only prolong the ratio to 100 years. Of course we know that storage production ratio is dynamic. However, even if the proven reserve increases for sometime, the ratio could still not increase infinitely, because of the existence of the geophysical limit of our planet Earth. China's Yumen Oilfield is totally drained, and Fushun Coal Mine in Liaoning has been depleted too. More of such cases are expected in china, with huge pressure on local economy and employment. Large size of population at 1.3 billion, large scale of the economy, and huge energy demand make it impossible for China to totally rely on the global market. Besides, the exploration of coal destroys the groundwater systems, resulting in geological hazards and frequent accidents, and loss of human lives. The burning of coals emits sulfur dioxide, nitrogen oxide, heavy metal mercury, and dust and solid waste, incurring substantial environmental costs. Energy security, environmental protection and sustainable society objectively need us to transform rapidly and in a large scale. Even if there was no climate change, low carbon and zero carbon development is still imperative. In China, the problem is not whether the transformation should be made, but the question of how to accelerate the process.

Secondly, China announced to the international community that, by 2020, per unit GDP emission of carbon dioxide would be lowered by 40%-45% from the level of 2005; non fossil energy would consist 15% of primary energy consumption. Together with the targets of forest carbon sinks, these are the operational targets for China to achieve low carbon growth and transformation. The goals above are hard to achieve with strong rigid constraints in China. Carbon intensity targets count carbon dioxide from fossil fuel burning only, and it does not

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<sup>2</sup> BP Statistical Review of World Energy, June 2009.

<sup>3</sup> Some proven deep see oil are not exploited for the reason of security.

<sup>4</sup> In the year of 2009, China neatly imports 0.103 billion ton of coal; the estimated net import in 2010 is 0.17 billion ton, which will make China the largest import country of the world. 21<sup>st</sup> Century Economic Report. Xiao Ming, Li Lun, Beijing, 2010, July, 8<sup>th</sup>, 22:34:07

include other GHG. Energy saving target is set to reduce energy intensity by 20% during the 11<sup>th</sup>-Five Year (2006-2010) Plan, and further decreases will increasingly more difficult. However, it is clear that China's 12<sup>th</sup>-Five Year (2011-2015) Plan will include GHG emission target. Disaggregation of such carbon target will be made into individual provinces and key sectors. Up to now, numerous programmes have been initiated, such as low carbon city, low carbon community, low carbon enterprises, and low carbon consumption all around the society. The voice of China's low carbon transformation is louder than that of the developed countries. China's wind power and solar power industries have a higher growth rate than that of most developed countries.

Thirdly, China's low carbon transformation needs international collaborative efforts. As a developing country, China's energy consumption and carbon emission are believed to increase in the future. Further increase would be a challenge to the control of global GHG emissions. Thus it could be clear that China's own efforts are not sufficient and global cooperation is needed. Capital is somehow not so important as it would be thought to. China has its own financial sources, while developed countries have more solid capitals. If sufficient capitals could not transform the developed countries into zero or low carbon economies, the task must be more difficult for a developing country like China to lead the transformation even though there is no lack of finance. Technological cooperation seems rather more important than money. Technology could direct the transformation into a low emission pathway. Thus the most important is that the developed countries should set a good example at first. If developed countries could be able to maintain a high level of living standard with low carbon emissions, there would be no excuse for developing countries not to follow and do even better.

Time awaits for no man. China's low carbon transformation is urgent, thus the quicker, the better. China has already made great efforts to accelerate the process of this transformation. Among the actions taken in China are, promotion of low carbon consumption, construction of low carbon cities, acceleration of the process to get rid of fossil energy and public campaign for a zero carbon society.

### **Low Carbon Transformation: compatible with the Developing Level and Stage**

Reducing carbon emission intensity in China is a relative target. Even if carbon emission intensity has been reduced by 45%, China's GHG emissions would still increase by 60% given the rate of GDP growth rate at 10%. Does this contradict to the global 2° target?

Low carbon transformation should be adapted to China's development stage. Mitigating carbon dioxide emission per GDP by 40%-45% in 15 years (2006-2020) seems to be rather ambitious and difficult a mission for China, as no countries in history have ever made it<sup>5</sup> and China is experiencing a critical period of industrialization and urbanization. Chinese economy has been growing by 10% on average during the past 30 years of reform and opening up. The industrialization has now shifted from a labour to capital intensive stage.

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<sup>5</sup> During the year from 1990 to 2005, the carbon dioxide emission intensity has been reduced by 49% in China in the 15 years (IEA, CO<sub>2</sub> Emissions from Fossil Fuel Combustion, 2007 edition. Paris: OECD). The emission intensity reductions of other countries are mostly under 30% at the same time.

In 2009, China's raw steel output reached 570 million tons, cement 1.65 million tons<sup>6</sup>, accounting for about 50% of the global production. The production capacity is at or close to saturation. As a result, the growth rate of the Chinese economy would slow down and be hard to reach 10% annual rate. Take Germany as an example, as it is one of the mature economies, its growth rate has been stabilized at around 2%. The space for physical expansion of the economy is limited in Germany, and the German quality of living is materially limited for further enhancement. German economy could no longer grow as fast as before or as a fast industrialising developing economy. Nevertheless, China's transformation has turned out to be quality improvement rather than quantity expansion. The share of the manufacturing sector in the economy will surely to decline, while the service sector would rise instead. Therefore, as the overall Chinese economy is developing, GHG emission will surely be increased, but the rate of increase will definitely be much lower than 10%. China is agreeable with the 2° target, and bound to work together with the international communities to achieve this goal.

In the negotiation of the Copenhagen Protocol, China did not accept the long term emission reduction targets, such as reducing the emission by half till 2050. Why<sup>7</sup>? There are a few reasons behind China's rejection of such a definitive emission reduction target as such a simple number of 50% reduction by 2050 is not grounded on scientific and justice basis. Firstly, medium target should be agreed and made compatible with a long term target but the developed countries have not committed their reasonable medium term target for 2020 yet. Some countries have already set their medium target, but such reduction is not sufficient to achieve the half down target by 2050. Without a 2020 target, it would be logically unreasonable for a 2050 target. Secondly, the relationship between the 2° target and the half down target is further complicated by scientific certainty, which needs further study to make it clear. Thirdly, we should consider fairness. Up to now, the emissions in developed countries and developing countries are 50% to 50%<sup>8</sup>. If developed countries could be able to achieve their emission reduction by 80% from the level of 12.6 ton per capita, there would be 2.5 ton per capita left in 2050; while if developing countries could be able to achieve the emission reduction by 20% from the level of 2.6 ton per capita, there would be only 2.1 ton left in 2050. It is obviously unfair. If we are not following the Grandfather Principle to achieve a proportional reduction, but to follow the 'Historical Cumulative Emissions per Capita Principle' to allocate the carbon emission quotas<sup>9</sup>, things would be fair and reasonable. In that way, the Human Right in developing countries could be secured, and the developing countries would surely approve the 2050 half down emission reduction proposal.

### **The Dilemma of Transformation: Subsidizing Low Carbon with High Carbon actions**

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<sup>6</sup> National Bureau of Statistics, 2009 National Economic and Social Development Statistics Bulletin, 2010, Feb. 25<sup>th</sup>, Beijing

<sup>7</sup> The Chinese Delegation opposed to this long term emission reduction target during Copenhagen Negotiation. Minister of British Energy and Climate Change criticized that China 'hijacked' the Copenhagen Negotiation. In the international seminar of Great Green Transformation in Berlin, someone put forward this question to the author again.

<sup>8</sup> In 2007, GHG emitted by fossil fuel burning in Non-annex I Countries (developing countries) consists 47.24% of global sum. During 1990 to 2007, Annex I Countries increased only 2% of the global sum emission, while Non-annex I Countries increased by 111.4%. IEA, 2009. CO<sub>2</sub> Emissions from Fossil Fuel Combustion. Paris.

<sup>9</sup> Chinese scholars (Jiahua Pan, Ying Chen. Carbon Budget: A Fair, Sustainable International Climate Change Framework. Chinese Social Science. 2009, 5, pp: 83-98) and German Advisory Council on Climate Change separately put forward Historical Accumulative Emission Carbon Budget Plans.

Low carbon transformation in China is in need of capital and technologies. The transformation to zero carbon emission could only be achieved through development. No body would accept going back to traditional agrarian society in which carbon emission is near zero but quality of living is low as well. Industrialization and urbanization process are characterized by accumulation of energy intensive capitals, such as urban infrastructure, housing construction, and so on. Under current economic and technological conditions, the comparative advantages of fossil energy are clearly superior to other energy sources. If we instantly turn low cost fossil energy to high cost renewable energy, the urbanization and industrialization process would surely be slowed down and prolonged. The living condition could not be enhanced to a comparable level to that in the developed countries. Moreover, renewable energy development requires investment of large amount of capitals and technologies. Where does the money come from? ‘Wool has to come from the sheep’. The subsidies for renewables in the developed countries come from the fossil energy taxes. If we develop electrical vehicles in China<sup>10</sup>, there is a need to raise a large scale of funds through taxing ordinary car users. If there are only 1 million cars, we charge 1000 RMB per car, there would only be 1 billion RMB. Using this money to support R&D and subsidize electrical cars, such an amount would be like a drop in the ocean. If there are 100 million cars, we still charge 1000 RMB per car, there would be 100 billion RMB to develop and promote R&D and subsidize electrical cars. Therefore, it is unrealistic and unnecessary to achieve zero carbon emission all at once. There is a dilemma in the transformation process to zero carbon emission: low carbon industries requires support from high carbon industries at first, or high carbon emissions could help the process of transformation to a low carbon economy. There must be, however, a cap for high carbon development, while there also should be a clear target for low carbon development. That should be the way we achieve low carbon transformation.

Because of the international financial crisis, the European PV power industry was forced to reduce the scale of subsidies<sup>11</sup>. Germany takes the approach of ‘cross subsidy’, using the money from cheaper high carbon coal electricity or ‘non-environmental friendly’ nuclear electricity to subsidize expensive wind power and PV power industries. If the percentage of the supported becomes too high or the scale becomes too large, there exist risks to raise sufficient money or the retail price of electricity must be increased, which might cause social and economic instability. For example, the feed-in price for wind power on land is 9 euro cents per kWh in German, and the feed-in price for solar PV power is set at 40 euro cents per kWh. The protocol of such feed-in tariff is for 20 years and the power companies could only pass the costs on to consumers. Such issues already lead to a lot of problems up to now. In early 1990’s, China made a levy on electricity consumption at 0.03 cents per kWh for cross-subsidizing the construction of the Three Gorges Hydropower Base. It is normally fair to use the tool of cross subsidy for raising financial resources for promotion of solar and wind powers. According to Renewable Energy Law published in 2006, there are also subsidies to

<sup>10</sup> Ministry of Finance, MOST, MII, NDRC jointly issued Notification of Subsidy Pilots of Private Purchasing of New Energy Cars, which mentions that the pilots subsidy work of private car purchasing should be applied in 5 cities, including Shanghai, Changchun, Shenzhen, Hangzhou, and Hefei. Plug-in hybrid cars could get at most 50 thousand RMB per car. Pure electricity cars could get at most 60 thousand RMB per car. <http://www.sina.com.cn> 2010 June, 12<sup>th</sup>. 02:46 Securities Daily.

<sup>11</sup> In the seminar of Great Green Transformation, Ms. Slade, the Senator of Berlin City Council, asked the author to suggest the Chinese government to enhance the subsidies to solar PV power industry and to support and save Germany PV industry.



wind power and solar power industries. For example, solar PV power enterprises could get subsidies by 20 RMB per watt, which means 20 thousand RMB per kilowatt. However, comparing to thermal power capacity installation cost at around 6000 RMB per kilowatt, we could not judge the level of that subsidy as low. The official PV electricity price is regulated by the government as five times high as the thermal power electricity, or even higher than that. A more substantial, larger scaled subsidy is limited to the financial capacity.

About nuclear power, developed countries have been debating its acceptance. The American senate put forward and discussed the American Power Act, during which they clearly ask for restarting the procedures of approval and construction of nuclear power stations controlling GHG emissions<sup>12</sup>. German Green Party insists that they should accelerate the process for phasing out nuclear power and abandoning its development. However, people in the fields of energy and economics in Germany have different considerations as well. Even if wind power could take the place of nuclear power, there exists a problem of transmission between power grids. Large scale wind power in Germany could only be located in northern sea areas. Besides the high costs, the key problem is how to transmit the electricity to southern electric load centres. The experience of China's long distance electricity transmission makes it rather easy for transmitting electricity in long distances. For example, the electricity produced in Three Gorges Power could be transmitted for 1000 kilometers to the cities of Shanghai and Guangzhou. But things are much more different in Germany. The German people are against to the construction of transmission lines. Thus it would be impossible to transmit electricity in long distance in Germany without the permission of people.

The dilemma of low carbon transformation is universally significant. The development of renewable energy and the status of nuclear power are under more criticala scrutiny in developed countries. And that is why developed countries are apt to being conservative and watered about the emission reduction figures. China as a developing country with limited capital and technologies, the pressure of 'high carbon for promoting low carbon' is even larger. That means China would have to experience a high carbon developing stage in order to accelerate the low carbon transformation.

## **Conclusion and Policy Implications**

China's low carbon transformation is imperative. We need an environment of international understanding and collaboration. Positively propagating China's effort and performance in energy saving and emission reducing areas, eliminating the misunderstandings of the people in developed countries is indeed necessary and urgent. We do not only have to get the power of discourse, but it is more important to lead the power of discourse. Reports from western mainstream media are apt to being misleading and distorted.

As to the usage of renewable energy, we need international cooperation and

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<sup>12</sup> See American Power Act. That Act consists a series of financial incentive solutions to promote nuclear power, including providing security to 12 projects, accelerating depreciations of nuclear plants, promoting new power infrastructures through decreasing investment tax, providing supervision for investment by 54 billion US dollars, providing tax relief measures to manufacture industries, promoting domestic production of nuclear parts, and so on.

collaboration to eliminate the risks and to promote the process. Developed countries have more historical experiences in transformation, and they have more solid basics. They can totally be capable to find a proper way to develop the market of renewable energy. While in China, we should be positively and with security to develop the market of renewable energy. We should vigorously invest in R&D and should not widely subsidize the exploitation and utilization of renewable energy. Especially, we should not use the money of taxpayers to subsidize individual consumption, including the subsidies to solar PV power enterprises. 'Cross subsidy' is advisable both theoretically and practically. We should be careful of the extent for high carbon promoting low carbon. We still have to do further investigation and estimation about the nuclear raw materials, safety and environment, eliminating the risks.

For saving energy and lowering carbon emissions, we should take a strategic view to create and enhance the overall carbon productivity and competitiveness. We should actively participate in international climate negotiation; however, there is no need to take too high an expectation on it. 'Transformation dilemma' is an objective existence which would be more obvious with the background of China's developing stage. Therefore, we should take an active attitude to international emission reduction activities, while prudent in commitments.