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An analysis of China's CO_2 emission peaking target and pathways

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Abstract

China has set the goal for its CO_2 emissions to peak around 2030, which is not only a strategic decision coordinating domestic sustainable development and global climate change mitigation but also an overarching target and a key point of action for China's resource conservation, environmental protection, shift in economic development patterns, and CO_2 emission reduction to avoid climate change. The development stage where China maps out the CO_2 emission peak target is earlier than that of the developed countries. It is a necessity that the non-fossil energy supplies be able to meet all the increased energy demand for achieving CO_2 emission peaking. Given that China's potential GDP annual increasing rate will be more than 4%, and China's total energy demand will continue to increase by approximately 1.0%−1.5% annually around 2030, new and renewable energies will need to increase by 6%−8% annually to meet the desired CO_2 emission peak. The share of new and renewable energies in China's total primary energy supply will be approximately 20% by 2030. At that time, the energy consumption elasticity will decrease to around 0.3, and the annual decrease in the rate of CO_2 intensity will also be higher than 4% to ensure the sustained growth of GDP. To achieve the CO_2 emission peaking target and substantially promote the low-carbon development transformation, China needs to actively promote an energy production and consumption revolution, the innovation of advanced energy technologies, the reform of the energy regulatory system and pricing mechanism, and especially the construction of a national carbon emission cap and trade system.

Keywords: CO_2 emission peak; Energy revolution; Climate change; China's carbon emission mitigation target

1. Introduction

China and the U.S. released the Joint Announcement on Climate Change during November 2014 when the APEC summit was held in Beijing, highlighting both countries' post-2020 emission reduction targets. China intends to achieve peak CO_2 emissions around 2030, to make its best efforts to peak early, and to increase the share of non-fossil fuels in primary energy consumption to approximately 20% by 2030 (XNA, 2014). The Joint Announcement demonstrates China's strategic decision and set an overarching target to coordinate global climate change mitigation and its domestic sustainable development. This will have significant impacts not only on international cooperation in tackling global climate change but also on China's domestic course toward the low-carbon transformation of its economic and social development.

2. Analysis of China's CO_2 emission peak target

Energy consumption generates most, approximately 80%, of China's greenhouse gas (GHG) emissions and has increased more quickly than other sources. An increase in China's forest carbon sink can offset the CO_2 emissions from industrial processes, so the peaking of CO_2 emissions from fossil energy consumption indicates the peaking of total GHG emissions (CDNDRC, 2014).

China remains in a phase characterized by fast industrialization and modernization, with the rapid increase in energy

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demand and related CO_2 emissions attributable to this economic and social development. Formulating a CO_2 emission peak target is not a projection of future energy consumption and CO_2 emissions, but instead calls for an analysis of the time and pathways to reaching peak CO_2 emissions within the shortest time frame and with the greatest policy supports. The CO_2 emission peak target serves as an instruction for formulating sectoral and regional low-carbon development initiatives, strengthening public interventions, and creating innovative low-carbon transformation mechanisms.

China's CO_2 emission peak would happen far later than 2030 under the present policy efforts, which serves as a reference scenario. To reach the CO_2 emission peak target around 2030, China needs to implement stronger low-carbon development strategies besides the existing energy conservation and substitution policies. Referred to comprehensive domestic study (He, 2013; PGCAE, 2011; DRCSC and Shell, 2013), Table 1 shows the deep emission reduction and low-carbon development scenario designed to analyse and understand the CO_2 emission peak target around 2030.

To reach the CO_2 emission peak while maintaining sustainable economic and social development, China will have to make great efforts in two aspects. Specifically, China has to significantly reduce the energy intensity and increase the output benefits of energy consumption, as well as promote the low-carbonization of its energy supply mix and continuously reduce the CO_2 emission per unit of energy consumption. According to the definitions and principles of climate economics, we know that there are two necessary conditions for the peaking of CO_2 emissions. The first one is that the annual decrease in the rate of CO_2 intensity needs to be greater than the annual GDP growth rate such that the decrease of the CO_2 intensity would be able to offset the increase of CO_2 emissions caused by the growth of GDP. The second one is that the annual decrease in the rate of the CO_2 emissions per unit of energy consumption needs to be greater than the annual growth rate of energy consumption such that the decrease of the CO_2 emissions per unit of energy consumption would be able to offset the increase of CO_2 emissions in increased energy consumption. Thus, to reach the CO_2 emission peak while maintaining a rapid increase in GDP, China needs to significantly reduce the energy intensity and change the energy supply mix. After reaching the CO_2 emission peak, the increased energy demand will come from an increase in non-fossil energy supplies. The fossil energy consumption will stop increasing; thus, CO_2 emissions will be stabilized or begin to decline (He, 2011).

China will complete its rapid industrialization and urbanization development around 2030. The GDP per capita of China will reach the level of that of the high-income countries by then. In addition, the population will be stabilized, the economy will achieve intensive growth, the large-scale construction of infrastructure and expansion of industrial capacity will be completed, the GDP growth rate will be slower, the elasticity of energy consumption will decrease, and the growth in energy demand will slow down. At that time, there will be complete industrial systems for new and renewable energy, while the supply capacity will continue to increase. Therefore, the increase in total energy demand will be mainly met by increases in non-fossil energy supplies and the CO_2 emissions will peak.

China's economic development is now entering a new transition period. The annual GDP growth rate has been turning from 10% to 7%. The focus of economic development will shift from its orientation on scale and GDP growth to quality and efficiency improvements. The economic development pattern will shift from extensive, traditional, resource-heavy expansion to intensive, innovation-driven, low-carbon development. Thus, the coordination between sustainable economic and social development, resource conservation and environmental protection can be achieved through overcoming the increasingly prevalent constraints of resources and the environment. The 2030 CO_2 emission peaking target will be an overarching goal and a key point of action for promoting China's energy revolution, overcoming the environmental constraints, and facilitating the transformation to low-carbon development. The target will also help to promote China as an active and responsible country in combating global climate change and facilitate international cooperation on global climate change mitigation.

Table 1
Enhanced emission reduction scenario for reaching peak CO_2 emissions around 2030.

		2013	2020	2025	2030	2035
GDP growth rate (% per year)			7.0	6.0	5.0	4.0
Elasticity of energy consumption			0.48	0.40	0.33	0.17
Decreasing rate of energy intensity (%)			3.4	3.4	3.2	3.2
Energy consumption (Mtce)		4170	5250	5920	6420	6640
Energy consumption mix (%)	Coal	68.0	58.0	53.0	48.0	42.0
	Oil	17.0	16.0	16.0	16.0	16.0
	Natural gas	5.2	11.0	14.0	16.0	18.0
	Non-fossil energy	9.8	15.0	17.0	20.0	24.0
CO_2 emissions per unit of energy consumption (kg CO_2 (kgce)$^{-1}$)		2.20	2.01	1.92	1.82	1.69
Decreasing rate of CO_2 intensity (% per year)			4.7	4.2	4.2	4.6
CO_2 emission (10^9 t CO_2)		9.2	10.6	11.3	11.7	11.2

Note: The data mainly references “Analysis of CO_2 emission peak: China's objective and strategy” (He, 2013), “Study on Medium and Long-term (2030, 2050) Development Strategy of China's Energy” (PGCAE, 2011), and “Study on Medium and Long-term Development Strategy of China's Energy” (DRCSC and Shell, 2013).

3. Assessment of China's CO_2 emission peak

The CO_2 emission peak of developed countries always occurred in the post-industrialization stage in the past, where the population growth rate was low, the GDP growth rate was low (not higher than 3% annually), the economy had already achieved intensive growth, the elasticity of energy consumption was low (not higher than 0.4), and the energy intensity was declining (annual rate of decline not lower than 2%). With substitutions for carbon-intensive fuels, the decline in the rate of the CO_2 intensity was greater than the GDP growth rate, which led to the peak of CO_2 emissions. For example, when the EU (15 countries) reached its CO_2 emission peak in 1980, the GDP per capita (in 2000 real terms) was US$14,200. Its annual GDP growth rate was 2.43%, and the elasticity of energy consumption was 0.32 from 1973 to 1990. Because of the restructuring of the energy supply mix, the annual decline in the rate of the CO_2 intensity was 2.75%, higher than the GDP growth rate at that time, which led to the peak and then decline of CO_2 emissions. The U.S. reached its CO_2 emissions per capita peak in 1973, but its population grew quickly and the U.S. did not reach its total CO_2 emission peak until 2005 (IEA , 2012; EDMC, 2013). Even if the CO_2 intensity declines quickly, the CO_2 emissions will keep increasing in the developing countries that are still at the industrialization and urbanization stage where the potential GDP growth rate is high.

Since the oil crisis in the 1970s, the developed countries have been vigorously developing new and renewable energy and promoting the low-carbonization of their energy structure to ensure energy security, which led to the earlier peaking of total CO_2 emissions compared with the peaking of total energy consumption in general. For example, the EU (15 countries) reached its CO_2 emission peak in 1980. The CO_2 emissions per unit of energy consumption declined by 1.0% annually, a little higher than the energy consumption growth rate of 0.9% annually, during 1980–2005. The CO_2 emissions declined slowly while the energy consumption kept increasing and reached its peak in 2005, 25 years later (IEA , 2012; EDMC, 2013). The developing countries have the second-mover advantage. If they can promote the development and utilization of new and renewable energy to increase the non-fossil energy share and growth rate, the non-fossil energy supply would be sufficient to meet the total energy demand. Therefore, the CO_2 emissions would peak a lot earlier than when the total energy demand peaks and earlier than the development stage where the developed countries had reached their CO_2 emission peaks.

If China reaches its CO_2 emission peak around 2030, it will be at an earlier development stage than the stage the developed countries were at when they reached their CO_2 emission peaks; thus, China needs to make more effort than the developed countries. When the developed countries reached their CO_2 emission peaks, energy consumption was mostly stabilized. The U.S. and Japan reached their energy consumption peaks and CO_2 emission peaks at the same time. The potential GDP growth rate of China in 2030 should be higher than 4%. Even if the elasticity of energy consumption drops to 0.3, the energy consumption growth rate should be approximately 1.2%. At that time the total energy demand will be 6000 Mtce, and the newly increased demand for energy will be more than 70 Mtce annually. The newly increased energy demand will have to be met by non-fossil energy supplies for CO_2 emissions to peak. That requires a much faster development pace and larger scale of non-fossil energy in China compared with developed countries. China will have to install 20 GW of wind power and 20 GW of solar power electricity-generating capacity and nearly 10 GW of nuclear electricity-generating capacity each year. That means one wind generating set installed each hour and eight to ten nuclear power units installed each year. Development on such a large scale is unprecedented in the world (He, 2013).

For China's non-fossil energy share to reach the 20% target in 2030, the non-fossil energy supply must reach 1200 Mtce annually. China's non-fossil energy supply was 280 Mtce in 2010. The non-fossil energy supply will need to more than quadruple in the coming 20 years, and that means around 1 TW of new non-fossil energy power installations (NBSC, 2013), which is about the same as the total installed capacity of the U.S. now (Table 2).

China faces bigger challenges than the developed countries in promoting a low-carbon transformation of its energy structure. For developed countries that are at the post-industrialization development stage, the energy demand tends to stabilize; thus, developing renewable energy could effectively substitute for and reduce the consumption of fossil energies such as coal and reduce CO_2 emissions. China is, however, still at its industrialization and urbanization stage

Table 2
Scenarios of China's non-fossil energy installation.

	2013		2020		2030	
	Installation (10^6 kW)	Primary energy equivalence (Mtce)	Installation (10^6 kW)	Primary energy equivalence (Mtce)	Installation (10^6 kW)	Primary energy equivalence (Mtce)
Hydro	280	271	360	377	450	473
Wind	76	49	230	166	400	288
Solar	15	6	120	52	350	147
Biomass	10	15	30	47	50	83
Nuclear	15	35	58	142	136	320
Total non-fossil energy	394	396	798	794	1386	1311
Total primary energy demand (Mtce)		4170		5250		6420
Non-fossil energy share in primary energy (%)		9.5		15.1		20.4

where the energy demand keeps increasing. The development of new and renewable energy must first satisfy the newly increased energy consumption demand and then serve as a substitution. The amount of investments, number of new installations, and growth rates of renewable energy in China have led the world in recent years. China's non-fossil energy supply more than doubled from 2005 to 2013, with an average annual growth rate of approximately 10%, which is much higher than the total energy consumption growth rate of 6.0% over the same time. The share of non-fossil energy in primary energy has increased from 6.8% to 9.8%. The scale of investments and the newly installed capacity of China's renewable energy power have exceeded those of coal power in China. In 2013, non-fossil energy makes up 60% of the new installation and 75% of the new electricity power generation investments. The above figures are continuously increasing. However, as renewable energy was not a large part of the energy mix in the first place, the rapid increase cannot yet satisfy the increase in total energy demand. Coal consumption increased 48% from 2005 to 2013 (NBSC, 2013; CESS, 2014). Therefore, China still faces severe challenges in restructuring its energy structure and controlling its coal consumption.

In June 2014, the U.S. Environmental Protection Agency proposed the Clean Power Plan, seeking to cut CO_2 emissions from the power sector by 30% from 2005 levels by 2030. By the end of 2011, CO_2 emissions from the power sector had been reduced by 10.7%; thus, CO_2 emissions from the power sector need to be cut by 21.6% during 2011−2030. In 2011, coal-fired power generation in the U.S. was 1875 TW h, 43.1% of its total power generation. The power demand of the U.S. in the future will be stable. Natural gas and non-fossil energy installations will replace coal power units so that the U.S. can achieve its 2030 emission reduction target. Both natural gas and non-fossil energy installations will need to increase by 50−100 GW. The amount of power from coal will fall by 150 GW. The coal power share will fall to 28%. In China, new non-fossil energy (hydro, wind, solar, nuclear, etc.) installations during 2011−2030 will reach 1 TW, i.e., 5−10 times that in the U.S. The speed and scale of the development of new and renewable energy in China will be much larger than that in the U.S. The CO_2 emissions per unit of kilowatt-hour will decline by 20% in the U.S. and by 35% in China. The energy substitution in China will be more rapid than that in the U.S. China's total power demand in 2030 will, however, be twice that in 2011. The increase in the rate of total demand will be larger than that for energy substitution. Thus, CO_2 emissions from the power sector will increase by approximately 30% in China, while the CO_2 emissions from the power sector will decrease by 30% in 2030 due to the stabilization of the power demand in the U.S. (CESS, 2014). Therefore, China has to actively promote the energy revolution, develop as much new and renewable energy as possible to satisfy the increased energy demand, control the increase of fossil energy supplies, and avoid the technological lock-in of the fossil energy supply to achieve a great-leap-forward development of new energy technologies at the present stage with an increasing total energy consumption.

4. Strategy and policy to accelerate the peaking of CO_2 emissions

The peaking of CO_2 emissions largely depends on the development strategy and policy at present and in the future, as well as the progress of future scientific and technological innovations and the transformation of economic development patterns. It is important to conduct forward-looking strategic planning, promote energy conservation and substitution, and establish and improve the policy system and implementation mechanisms for promoting the low-carbon transformation under the guidance of an urgent CO_2 emission peaking target to guarantee the achievement of the target.

4.1. First of all, China needs to discover the co-benefits of CO_2 emission reduction on energy conservation and environment protection, and promote the energy production and consumption revolution

China has made tremendous efforts on energy conservation and CO_2 emission reduction. During 2005−2013, China's CO_2 intensity was reduced 28.5%, much higher than the reduction rate in developed countries during the same period. However, China's energy consumption and CO_2 emissions are still inevitably large and growing quickly because of the continuous economic and social development. Coal is dominant in China's energy supply mix, being 70% of the total. The share of coal in the world energy mix is less than 20%, and that makes the CO_2 emissions per unit of China's energy consumption 20% higher than the world average. The CO_2 emissions from energy consumption in China are 25% of the world's total. China is facing serious challenges in combating climate change and reducing CO_2 emissions. Conversely, fast-growing fossil energy production and consumption is the main reason for the resource shortage, environmental pollution, and ecological deterioration in China. The present fast-growing trend of fossil energy use brought more severe ecological and environmental problems such as underground water resource, air, and soil pollution. China's dependence on oil and natural gas imports has also increased, with 58% and 31% in 2013, respectively, and projected to be 70% and 50% in 2020. China will also be the largest net importer of coal. China is facing new challenges in energy security (He, 2015).

It is not only China's internal demand for sustainable development but also a strategic option to actively promote the global climate change mitigation process to significantly increase energy efficiency, improve the energy structure, and promote an energy production and consumption revolution, which will bring significant co-benefits given limited domestic resources and global climate change. An early CO_2 emission peak target can serve as an overarching target for resource conservation, environmental protection, and the promotion of domestic sustainable development as well as the mitigation of global climate change. Promoting the energy revolution is a core strategy and key point for achieving the objectives of economic development, social progress, environmental protection, and climate change mitigation, and it is essential to establishing efficient, safe, clean, and low-carbon energy supply and consumption systems and coordinating both sustainable development and climate change mitigation.

4.2. Second, China needs to set and implement stage-specific and region-specific CO_2 emission reduction or peak targets

China's Twelfth Five-Year Plan set the target of a 16% decrease in the energy intensity and a 17% decrease in CO_2 intensity, which can be achieved through taking substantial efforts. As the economic development pattern transforms and the GDP growth rate decreases during the Thirteenth Five-Year period, demand for energy-intensive raw materials such as steel and cement will tend to stabilize, industrial restructuring will speed up, and the elasticity of energy consumption will decrease further. The decrease in the energy intensity will not be lower than 16% during the Thirteenth Five-Year period, with its projected 7.0% GDP annual growth rate. Thus, the total energy consumption could be kept around 5000 Mtce in 2020. With the total energy consumption controlled and the mitigation of environmental problems such as smog, total coal consumption and total CO_2 emissions should be controlled during the Thirteenth Five-Year period as the energy intensity and CO_2 intensity decrease, meeting the intensity target and the total amount target. In part because of the development of clean, efficient, and low-carbon energies such as new and renewable energy and natural gas, the share of coal will be reduced to below 60% with coal consumption kept between 4.0 and 4.5 Gt and CO_2 emissions from energy consumption kept around 10 Gt in 2020. In 2020, the non-fossil energy share will be 15%, and the CO_2 intensity will decrease by 45%−50% compared to the 2005 level, exceeding the 40%−45% target set by the Copenhagen Climate Change Conference (Han et al., 2012).

After 2020, China will reach its industrialization stage and achieve intensive economic growth. The decline in the rate of the energy intensity will be kept around 3%. The non-fossil energy share will be 15% in 2020, and the new and renewable energy industry will be mature and more competitive, with a market share of 20% in 2030 and a 6%−8% annual growth rate afterwards. The CO_2 emissions per unit of energy consumption will decrease by more than 1.2% annually. While the energy intensity will decrease by more than 3% annually, the CO_2 intensity will decrease by more than 4% annually. That means even with the peaking of CO_2 emissions the GDP growth rate could be kept above 4%, which is in accord with the actual GDP growth potential. Thus, the CO_2 emission peak target around 2030 will not put rigid constraints on economic growth but will promote the transformation of development patterns.

Because of imbalanced regional development in China, the GDP per capita in the east coast developed regions are mostly higher than or near US$10,000, with the CO_2 emissions per capita almost the same as those in the EU or Japan when they reached their respective emission peaks. The east coast regions are also facing energy and resource shortages and severe environmental pollution; thus, they should have more urgent low-carbon development targets than the national ones. Eastern developed regions such as the Beijing-Tianjin-Hebei region, Yangtze River Delta region, and Pearl River Delta region will reach their total coal consumption peak around 2015, with the CO_2 emissions from industrial sectors reaching their peak as well. In addition, these regions should reach their total CO_2 emission peaks in 2020, ahead of the other parts of China.

China will complete industrialization by 2020, with the stabilization of the end-use energy consumption of the industrial sectors. Thus, the growth in the total energy demand of China will slow down. The natural gas supply will increase rapidly, non-fossil energy will also develop quickly, and coal consumption will tend towards tabilizing. Coal consumption will peak before the CO_2 emissions peak, and the peak should be within 4.0−4.5 Gt CO_2 emissions from industrial sectors will peak around 2025, which will lay the foundation for CO_2 emissions in China to peak by 2030. The total GDP in 2030 will be 3.3 times that in 2013, while the energy intensity will decrease by above 50%. The CO_2 intensity will decrease by around 60%, and total CO_2 emissions will be within 11−12 Gt, is less than 30% compared to 2013. Compared to the increase in CO_2 emissions of 210% during 1990−2010, the CO_2 emission increase in the next 20 years will be significantly lower, with peaking happening during this period. China's peak emissions per capita will be lower than 8 t CO_2, which is still lower than the 9.5 t CO_2 in the EU and Japan and far lower than the 22.2 t CO_2 in the U.S. China can achieve a much lower level of carbon development than developed countries through the second-mover advantage of technology innovations (He, 2013).

4.3. Third, China should promote technology innovation and international cooperation as strong supports for the energy revolution

To achieve the strategic target of an efficient, safe, clean, and low-carbon energy supply and consumption system, it is essential to promote a revolution in energy technologies, the revolution of the energy system that is supported by innovations in advanced technology. The global trend of the energy revolution will lead to a revolution in economic and social development globally, and this will thus impact international economic and technological competition. Developing advanced energy technologies and obtaining the advantage in this competition are important motivations and strategic targets for countries in climate change negotiations. Low-carbon technology innovation and low-carbon development transformation are becoming world trends and representations of the core competitiveness of a country. China has to implement innovation-driving strategies and achieve new industrialization and urbanization development characterized by low carbon. China has been developing advanced energy technologies that have their own advantages and characteristics just like the developed countries. China needs to further enhance its capacity for the investigation and industrialization of advanced energy technologies and obtain the competitive edge in advanced energy technology by taking advantage of the large market demand of China. China has to strive for opportunities in the technology competition in the global energy system revolution and achieve rapid development by supporting technology upgrades and the energy system revolution through technological innovation.

When China promotes the research, development, and industrialization of advanced energy technologies, it should consider not only the development of renewable energy like solar and wind, hydrogen energy, energy storage, and smart grid technology but also the development of carbon dioxide capture and storage (CCS) and advanced nuclear technologies. Coal will be dominant in China's primary energy mix in the long term, and will make up 50% of the primary energy in 2030. CCS technology will be an important option after 2030, because of the stringent emission reduction target and a high carbon price globally in addition to clean and efficient coal utilization. The amount of CO_2 sequestrated will be several hundred million tons to 1 Gt annually, which will play a crucial role in achieving the long-term CO_2 emission mitigation target. Enhanced research, development, and deployment of the technology are essential at present. Nuclear technology is mature, with stable operation systems and a competitive cost. On the basis of safety, large-scale and efficient nuclear technology development is needed and will play an irreplaceable role in ensuring energy security and CO_2 emission reduction. Natural gas is a cleaner, more efficient, and lower-carbon fossil fuel energy compared to coal. Breakthroughs in conventional and unconventional natural gas technologies will also be important to the restructuring of the energy supply mix (He, 2015).

4.4. Fourth, China should establish and improve its policy system and implementation mechanisms for low-carbon development, which is an important part of the construction of China's ecological civilization system

The Third Plenary Session of the Eighteenth National Congress of the Communist Party of China has drawn a comprehensive plan to deepen reform, which creates opportunities for an earlier establishment of the supporting system and an implementation mechanism for low-carbon development legislation, regulation, and policy. China should at present highlight the policy orientations of low-carbon development and the co-benefits of CO_2 emission reduction in the process of promoting ecological conservation and implementing the regime of paid resource utilization and eco-compensation. China should also further promote an emission-reduction, target-oriented responsibility system at all levels of government, further complete its policy systems such as the fiscal, taxation, and financial systems to enhance low-carbon development, and reform and improve the price mechanism for energy commodities and the taxation mechanism for resources and the environment. By resource and environment taxation system reform, especially the establishment of a carbon market, the value of carbon emissions and environmental capacity as scarce public resources and production factors could be reflected, the social cost of resource and environmental loss could be internalized, the saving of fossil energy would be promoted, new and renewable energy development would be fostered, and the energy structure transformation could be enhanced. Conversely, by energy-pricing reforms such as time-of-use (TOU) pricing and tiered electricity pricing, high-quality energy service could be obtained by low-income households while energy conservation is promoted, ensuring the development of a harmonious society.

The change in how government and officials view development and political achievement is the key to promoting the revolution in energy production and consumption and achieving a low-carbon development transformation. The Eighteenth National Congress of the Communist Party stressed the ecology civilization and put forward the concept of green development, cyclic development, and low-carbon development, which are important and key strategies in this period of economic and social transformation in China. The central and local governments should coordinate economic development, increase employment, increase social welfare, save resources, protect the environment, balance the economic benefits and environmental losses of GDP growth, co-ordinate domestic sustainable development, and tackle global climate change. The strategic sustainable development target of low-carbon transformation should be prioritized over economic growth. Government officials should develop a new view and standard of political achievement and promote the establishment of the eco-civilization system.

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