

Green Transformation in China: Progress and Outlook



Yiming Wang

Since reform and opening-up started, China has created a miracle by launching the largest ever industrialization drive in human history. This, however, has brought unprecedented environmental pressure, making it necessary for China to embark on a path of green development distinct from traditional industrialization. Through the past forty years of unremitting exploration, China has made great strides in green transformation but still faced various challenges. For years to come, China will remain at a turning point of the Environmental Kuznets Curve and must stick to the path of green development and strive to build a resource-conserving and environmentally friendly green development system and a new modernization pattern featuring harmony between human and nature.

1 Main Progress and Achievements in China's Green Transformation

Green transformation refers to a shift from a traditional development model characterized by high resource consumption, high emissions, and environmental damage to a green development model where economic growth goes hand in hand with resource conservation, emission reduction, and environmental improvement. Green transformation is not designed to fix the traditional industrialization model but represents a revolutionary change in the way of development.

Since the start of reform and opening-up, China's economy has achieved exceptional development, which, however, has led to a drastic increase in resource and energy consumption and pollutant emissions. In 2018, China's total energy consumption reached 4.64 billion tons of standard coal equivalent, 7.7 times that in 1980. From 1990 to 2017, energy consumption by China's industrial sector grew by about

Y. Wang (✉)

Development Research Center of the State Council, Beijing, China

© China Environment Publishing Group Co., Ltd. 2021

J. Pan et al. (eds.), *Beautiful China: 70 Years Since 1949 and 70 People's Views on Eco-civilization Construction*, https://doi.org/10.1007/978-981-33-6742-5_26

4.4 times.¹ With the rapid industrial growth, discharges of major pollutants have increased substantially. In 2017, about 3.32 billion tons of industrial solid waste was generated, an increase of 5.7 times over 1990. This pattern of economic growth at the expense of resources, energy, and environmental quality has in fact undermined development quality and efficiency, bringing enormous pressure to the environment. In the process of economic development and reform and opening-up, China has adopted the basic national policy of conserving resources and protecting the environment, implemented the sustainable development strategy, and blazed a trail for green transformation while promoting the transformation of the economic growth model. Since the 18th CPC National Congress, China has incorporated development of an ecological civilization into the Five-Sphere Integrated Plan, established the new concept of green development, and sped up top-down design and institutional building in an endeavour to make historic breakthroughs in green transformation.

1. Significant results have been achieved in the improving of energy efficiency and adjustment of the energy mix

China's coal-dominated resource endowments fully justify why it is important to adjust the energy mix and build a modern energy system in green transformation. Since the 17th CPC National Congress, China has made energy consumption per unit of GDP a mandatory indicator, incorporated it into three five-year plans in a row, and taken solid measures to reduce energy consumption in key fields such as industry, construction, and transportation. As a result, energy efficiency has improved greatly, and energy consumption per unit of GDP has been on the decline, falling by 41.5% from 2005 to 2018, or an annual average of 4.0%. Progress has been made in the adjustment of the energy mix, with the proportion of coal in primary energy consumption declining from 67.4% in 2012 to 59.0% in 2018. The use of clean and low-carbon energy has picked up pace. In particular, substantive steps have been taken to promote clean and high-efficiency coal use. Upgrading for ultra-low emissions has been completed for coal-fired units with a total capacity of over 700 million kWh, hitting the target for 2020 ahead of schedule. All new coal-fired units meet ultra-low emission standard, bringing China to the forefront of the world by emission control indicators of coal-fired units. The use of clean energy has seen a significant increase. China has the largest installed capacity of hydropower, wind power, and solar power in the world; the share of non-fossil energy and natural gas in total energy consumption has grown to 14.3% and 7.8%, respectively, and the proportion of electricity in final energy consumption has increased to 25.5%. In short, China has become a world leader in the use of non-fossil energy.

2. Great progress has been made in the adjustment of industrial structure and development of green industries

Adjusting the industrial structure and improving industry chains are an important measure of green transformation. Structural adjustment is estimated to contribute

¹The industrial sector consumed 675.78 million tons of standard coal equivalent in 1990 and 2,944.88 million tons in 2017.

more than 50% to the reduction in carbon emissions. Since reform and opening-up started, China has pressed ahead with structural adjustment while ramping up the industrialization drive. In 2012, the service sector for the first time overtook the industrial sector to be the largest sector in the national economy and the biggest engine of economic growth. The sectoral composition of the economy changed from 27.7:47.7:24.6 in 1978 to 7.2:40.7:52.2 in 2018. Compared with the early days of reform and opening-up, the share of the industrial sector dropped by 7%, while that of the service sector rose by 27.6%. Within the industrial sector, vigorous efforts have been made to phase out backward and excessive capacity in coal, steel, cement, flat glass, electrolytic aluminum, and other industries, speed up upgrading and green transformation of traditional industries, and introduce new technologies, processes, and equipment to reduce energy consumption and emissions. For example, the outdated technology of self-baking anodes for aluminum electrolysis has been eliminated, and the NSP cement technology has become the mainstream technology in cement production. Meanwhile, China is working hard to foster strategic emerging industries such as new energy, energy conservation and environmental protection, next-generation information technology, biology, new materials, and new energy vehicles, develop green services, promote energy performance contracting and water conservation contracting, and build a green industrial system. In recent years, China has vigorously promoted intelligent manufacturing. As a result, “Internet Plus” manufacturing models have cropped up, and industrial Internet has been widely used in such industries as petroleum, petrochemicals, steel, home appliances, apparel, machinery, and energy, giving a strong boost to the green transformation of manufacturing.

3. Resource conservation and recycling has been pushed forward

Resource conservation and recycling is an important part of green transformation. In 2002, China promulgated the *Law on the Promotion of Clean Production*, its first law on circular economy, marking the shift from end-point pollution control to whole process control. Since then, China has ramped up green, circular, and low-carbon development, strengthened the management of obligatory targets, imposed controls on the total amount and intensity of energy and water consumption, construction land, and so forth, and raised the standards for the conservation of energy, water, land, and materials and for green mines. It has doubled down on energy conservation and emission reduction in key industries, enterprises, and projects, promoted circular production at enterprises, circular industrial portfolios, and circular transformation of industrial parks, and propelled the shift from the traditional linear growth model of “resources—products—waste” to a sustainable development model where materials flow in a closed loop. The near-zero carbon emission zone demonstration project has been launched, and effective control of carbon emissions has been implemented proactively. A series of resource conservation campaigns have been carried out, such as the energy-saving and low-carbon campaign of 10,000 enterprises, the green building campaign, the low-carbon transportation campaign of 1,000 vehicle, ship, road, and port enterprises, the energy-saving public institution demonstration

program, and the circular economy models demonstration and promotion program. These campaigns intend to promote green and low-carbon use and recycling of resources, opening up new space for green development.

4. Green technology innovation and construction of the standard system have been strengthened

Technological innovation can bolster high-efficiency and intensive use of energy and resources and is a key measure to promote green transformation. Since reform and opening-up started, China has implemented the strategy of reinvigorating the country through science and education and substantially increased investment in science and technology. In 2014, China overtook Japan and the EU to become the world's second largest economy by R&D investment, with its R&D spending making up nearly one-fourth of the global total. In 2018, China spent nearly RMB 2 trillion in R&D, which accounted for 2.19% of its GDP, exceeding the average of 2.1% of fifteen EU countries. Investment in green technology R&D has also increased significantly. From 1990 to 2014, the number of China's environment-related patents surged by 60 times, compared to only three times in OECD countries; the growth rate of green technology patent applications in the last ten years, especially since 2005, has exceeded that all technology patent applications. In the meantime, China has reduced the transfer cost and boosted the demonstration and application of green technology and promoted the use of new technologies for energy conservation, emission reduction, and comprehensive use of resources. Therefore, green technology innovation has become a powerful driving force of green development. China has promoted the unification of green development standards, underlined the role of science and technology in standard setting, and dynamically raised industry-specific green standards. For instance, the actual energy consumption and emission standard for large coal-fired units in China has been one of the most stringent in the world. Green product and service labelling or certification systems have been established based on international experience, including the standards and labels for production equipment and consumer goods similar to the Energy Star program of the U.S. and the Blue Angel ecolabel of Germany. In a nutshell, the development and diffusion of green technology has provided strategic support for China's green transformation.

5. Green consumption and lifestyles have gained popularity

Green consumption plays a vital role in promoting green production and green development. In recent years, China has vigorously encouraged consumers to buy green and energy-saving products such as high-efficiency light-emitting devices and water-saving products such as water-saving faucets, toilets, and washing machines. It has increased efforts in promoting new energy vehicles and stepped up the construction of electric-vehicle charging infrastructure. From 2012 to 2016, total government procurement of China's energy-saving/water-saving products amounted to RMB 746 billion. The number of green consumers on Alibaba's retail platforms surged by 14 times from 2012 to 2015, accounting for 16% of active users. According to estimates, high-efficiency and energy-saving air conditioners, refrigerators, washing

machines, flat-panel TVs, and water heaters sold in China in 2017 alone could save roughly 10 billion kWh of electricity, equivalent to a reduction of 6.5 million tons of carbon dioxide, 14,000 tons of sulfur dioxide, 14,000 tons of nitrogen oxides, and 11,000 tons of particulate matter. Green home, school, community, shopping mall, and restaurant campaigns have been carried out across the country; green lifestyles have been advocated, calling on the public to save water and electricity, for example, by setting air conditioners to reasonable temperatures; vigorous efforts have been made in developing public transport and encouraging cycling, walking, and other green mobility options; household waste classification systems have been established in an effort to encourage public participation in waste classification and recycling. Green lifestyles give an impetus to the supply of green products and services and the green transformation of modes of production.

6. Green finance and green service markets have started to flourish

To develop green finance and green service markets is a necessary requirement of green transformation. Green finance can funnel funds towards the fields in favor of conservation and efficient use of resources, environmental improvement, and response to climate change, and guide enterprises to produce green and environmentally friendly products. In August 2016, seven central government departments including the People's Bank of China jointly issued the *Guidelines for Establishing the Green Financial System*, calling on the financial industry to provide financial services in various fields such as environmental protection and energy conservation, clean energy, green transportation, and green buildings. For example, green credit, in combination with national energy conservation and emission reduction funds and circular economy funds, should give priority to green development projects. In 2017, the executive meeting of the State Council decided to set up green finance reform and innovation pilot zones in five provincial-level regions including Zhejiang, Jiangxi, Guangdong, Guizhou, and Xinjiang to support the development of green finance. Meanwhile, China is actively promoting the energy rights and carbon trading systems. It will establish a national carbon trading market on the basis of pilot programs, draw up corresponding regulatory rules, and put in place a carbon trading market regulatory system; promote the pollutant emission permit system, and expand the pilot program on paid use and trading of pollutant emission rights to lay the groundwork for further development of carbon trading. The development of green finance and the establishment of carbon trading and emission rights trading markets have provided financing channels and market-oriented tools for green transformation.

7. Unprecedented efforts have been made in pollution prevention and control

Increased efforts in pollution prevention and control are vital for promoting green transformation. Since the *Plan for Aggregate Emissions Control* was developed for the first time during the 9th Five-Year Plan period, aggregate emissions control has been incorporated in China's five-year plans and become an obligatory target since the 11th Five-Year Plan. The *Outline of the 11th Five-Year Plan* set the obligatory target of reducing chemical oxygen demand (COD) and sulfur dioxide emissions by

10%. The *Outline of the 12th Five-Year Plan* put forth the obligatory targets of cutting COD and ammonia nitrogen, sulfur dioxide, and nitrogen oxide emissions by 8, 10, 8, and 10%, respectively. Since the beginning of the 13th Five-Year Plan period, China has enacted the new Environmental Protection Law, which is considered “the most stringent in history” and implemented the *Action Plan for Air Pollution Prevention and Control*, the *Action Plan for Water Pollution Prevention and Control*, and the *Action Plan for Soil Pollution Prevention and Control*. As a result, the emissions of some major pollutants have hit their peaks. In 2018, 338 cities in China saw 79.3% of days with good air quality, up 2.6% from 2015; the number of days with heavy pollution accounted for 2.2%, down 1.0%. GHG emissions have decreased dramatically. In 2018, carbon dioxide emissions per unit of GDP fell by 45.8% over 2005, meaning that the target of a 40% to 45% reduction by 2020 was met ahead of schedule. Surface water quality has improved on the whole. In 2018, out of 1,935 river cross sections in the country, 71.0% met grade I-III water quality standards, up 3.2% compared with 2016, while the proportion of those with quality below grade V was 6.7%, down 1.9%. Increased efforts in tackling pollution have improved the environmental quality, paving the way for green transformation.

8. Reform of the green development system has been accelerated

The key to promoting green transformation lies in systems and institutions. Since the 18th CPC National Congress, China has rolled out environmental policies with unprecedented frequency and carried out the strictest supervision and law enforcement ever. It successively issued the *Guidelines on Accelerating Ecological Civilization* and the *Integrated Reform Plan for Promoting Ecological Civilization* and formulated more than 40 reform plans regarding ecological progress, which constitute the basis of the ecological civilization system. Smooth progress has been made in all reform tasks. Specifically, China has advanced the reform of the property rights system for natural resource assets, improved the territorial space development and protection system, launched the pilot programs for the spatial planning system reform, strengthened the aggregate resource management and comprehensive conservation systems, pushed forward the system of paid use for natural resources and ecological compensation system, increased efforts in the environmental governance system reform, and basically established the ecological progress performance evaluation system and accountability systems. In particular, the national environmental protection inspection system has been in place. According to the five-step approach of supervision, assignment, tour of inspection, interview, and special inspection, four batches of central environmental protection inspections have been carried out, covering all thirty-one provincial-level regions. Special inspections in key regions, fields, and industries have been carried out. Supervision and law enforcement has been tightened; the policy of “co-responsibility of the Party and governmental officials” and the policy of “one post with dual responsibilities” have been effectively implemented; the accountability system has been strengthened, violations have been

handled severely, and a large number of outstanding environmental problems have been resolved. To sum up, the system reform aimed at promoting green development has provided effective institutional support for green transformation.

2 Advantages and Challenges for Promoting Green Transformation

Green development is a long-term, complicated, and uphill task that involves economic, industrial, and technological progress and institutional changes. China has institutional advantages, the latecomer advantage, and the advantage as an enormous economy in promoting green transformation, with large space for green technological transformation of traditional industries. However, various constraints such as “squeezed growth” in industrialization, deficient resource endowments and energy mix, and peaking major pollutant emissions will pose great challenges to China’s green transformation.

1. Advantages

The first is China’s institutional advantages as a socialist country. Green transformation requires the market to play a pivotal role, of which the premise is that the government effectively fulfills its public functions. China has incorporated ecological progress into its Five-Sphere Integrated Plan, established the new concept of green development, and advanced the construction of a resource-conserving and environmentally friendly green development system. These efforts, together with the government’s effective decision-making system and strong execution and society-wide consensus on green development, give China unique institutional advantages in promoting green transformation.

The second is the latecomer’s advantage in green development. China’s industrialization and urbanization started relatively late and are still at a low level. The new demand for industrial capacity and urban infrastructure can be satisfied by developing green capacity and green infrastructure, thus avoiding the lock-in effect of industrialization and urbanization and bringing enormous green benefits. For example, China is undergoing a sustained urbanization process. In 2018, the urbanization rate was close to 60% and is expected to exceed 70% in the future, meaning that 150 million rural people will flow to cities. This will lend momentum to economic growth and generate great green benefits from the circumvention of the lock-in effect.

The third is the advantage as a major economy. In 2018, China’s GDP reached USD 13.6 trillion, accounting for 66% of that of the U.S. and remaining the second largest in the world. The tremendous economic size provides a solid basis for developing green technology and shaping complete industry chains, since the initial costs of green technology R&D can be shared and start-ups can be incubated within the domestic market. What’s more, China has an enormous, full-fledged manufacturing system where some industries and technologies are leading the world and other are

catching up with developed countries. This is conducive to forming complete industry chains by exploiting industrial and technological strengths in different fields.

The fourth advantage is the broad space for technological transformation of traditional industries. Traditional industries still make up a large part of the economy, with huge space for efficiency improvement. For instance, clean use of traditional energy sources has a broad prospect, and China ranks the first in the world by the share of energy technology R&D spending in GDP and has made great strides in improving the efficiency of coal-fired power plants.

Lastly, China is leading the world in new energy development. China has an abundance of wind energy, solar energy, shale gas, and biogas resources. Since 2005, the capacity of wind turbines has doubled almost every year and is still growing at a high rate. China is also the largest manufacturer of solar PV panels and has the largest solar PV power generation capacity in the world, making it possible for China to reduce its dependence on fossil fuels and improve its energy mix.

2. Challenges

The first challenge comes from the centralized discharges of pollutants brought by the industrialization. Compared with industrialized countries, China's industrialization process is marked by "squeezed growth," meaning that a broad range of industrial products have seen an explosive growth and the scale production reached unprecedented levels in a short period of time. As China is becoming a "world factory," massive volumes of pollutants, greenhouse gases, and waste are generated, putting enormous pressure on the environment and resulting in hefty treatment costs. In recent years, China has advanced the supply-side structural reform and stepped up efforts to phase out high-energy-consuming and high-polluting backward capacity and cut excess capacity. However, that will inevitably bring impact on employment, leading to a substantial increase in public expenditures for social security, reliefs, compensations, and placement costs for the unemployed. Additionally, financial institutions have to pay bad debt expenses.

Second, there are challenges in the adjustment of the energy mix and improvement of energy efficiency. Given China's resource endowments, the dominance of coal in the energy mix is unlikely to change in a short period of time. The imbalanced distribution of energy producers and consumers poses a barrier to the development of clean energy in terms of accommodation and transmission channels and cultivation of domestic markets. Therefore, hydropower, wind, and solar curtailment occurs more often than not. Meanwhile, China still lags behind in terms of energy resource use efficiency. According to OECD estimates, in 2016, China's energy output rate was equivalent to 84% of that of the U.S., 57% of that of Germany, and 59% of that of the Japan. In China, one ton of CARBON DIOXIDE can bring in economic benefits of USD2, 150, roughly half of the USD4, 240 of OECD countries. In the past twenty-plus years, green total factor productivity (also known as environmentally-adjusted total factor productivity, which refers to economic growth not explained by human capital, productive capital, and natural capital inputs) has contributed less than 30% to China's economic growth, while the rate has reached 60% in OECD

countries. This implies that the dependence of China's economic growth on human capital, productive capital, and natural capital inputs is significantly higher than that of OECD countries.

Third, it is an arduous task to adjust the economic structure and upgrade industrial value chains. Over forty years of reform and opening-up, China's economic structure has seen great changes. Specifically, the share of the service sector rose from 24.6% in 1978 to 52.2% in 2018, which, however, is still lower than that in other emerging market economies such as Brazil, Russia, India, Indonesia, and South Africa. In contrast, the share of the industrial sector has long remained above 40%. Despite the downward trend since 2011, it was still as high as 40.7% in 2018, much higher than that in other emerging market economies. Following Germany, Japan, and the U.S., China became the world's largest manufacturer in 2010. According to data from the National Bureau of Statistics of China, in 2017, China produced about half of the world's crude steel (832 million tons), coal (3.52 billion tons), and cement (2.34 billion tons) and nearly a quarter of the world's automobiles (29.02 million). In 2018, the added value of China's manufacturing accounted for over a quarter of the global total. In recent years, China has accelerated the upgrade of the manufacturing value chain, with its exports from low-end products to middle and high-end products. However, there are still major gaps between China and industrialized countries in basic manufacturing capabilities, such as R&D of core technologies, process innovation, and digital management. In other words, industrial transformation and upgrading will remain a long haul.

Fourth, China is under great pressure to tackle environmental issues. Although the discharges of some pollutants have showed a downward trend in recent years, the amount of discharges has remained enormous, placing huge pressure on the environment. According to statistics, if China's urbanization rate rises by 1%, domestic sewage will increase by 1.15 billion tons, household waste by 12 million tons, construction land by 1000 square kilometres, domestic water consumption by 1.2 billion tons, and energy consumption by 80 million tons of stand coal equivalent. Overall, China's air quality has improved, but the situation remains severe. Since 2013, the annual average concentration of PM 2.5 in Chinese cities has been on the decline, but seasonal fluctuations are notable. The water quality has improved on the whole. While the water quality of main river basins has turned for the better, eutrophication is a major problem affecting the water quality of lakes, and ground-water pollution is also a great concern. By and large, the soil quality is not optimistic, as reflected in serious soil pollution in some regions and acute soil problems in abandoned industrial areas and mining lands.

3 Outlook for China's Green Transformation

For years to come, China will push forward its industrialization and urbanization endeavors and remain at a turning point of the Environmental Kuznets Curve. Pollutant emissions, carbon dioxide emissions, and energy and resource consumption will

see a turning point one after another, but China will still face huge resource and environmental pressure. The 14th Five-Year Plan period will be a critical period for green transformation. China must work hard to further reduce energy intensity and carbon intensity, improve the use efficiency of resources, solidify the decoupling of emissions of major pollutants and economic growth, and speed up the development of a resource-conserving and environmentally friendly green development system, thus blazing a new trail of green transformation with Chinese characteristics.

1. Resource and environmental pressure will reach a peak in the coming years

Energy demand is expected to peak between 2030 and 2040, while fossil fuel energy consumption and carbon emissions around 2030. China's peak energy demand is estimated at 6–8 billion tons of standard coal equivalent, and per capital peak energy consumption may account for 32–42% of that in the U.S. and 65–84% of that in Japan. In terms of energy mix, China's coal consumption has reached a plateau since 2014, but coal will remain a major source of energy for a long time and still account for more than 50% of China's total primary energy consumption after 2030. Oil demand will see a slow increase and is expected to exceed 8 million tons in 2030. Natural gas consumption will grow steadily at an annual average rate of about 5%, and its share in total primary energy consumption will rise from 7.8% in 2018 to 15% in 2030. Demand for wind energy, solar energy, and other renewable energy sources will increase substantially, and non-fossil energy consumption is expected to surpass that of oil by 2025.

Discharges of major pollutants have reached a turning point. Sulfur dioxide and nitrogen oxide emissions have successively peaked and entered a downward trend, while volatile organic compounds and ammonia emissions are expected to reach their peaks before 2020. The combined emissions of major air pollutants may peak around 2020. Due to the influence of nonpoint source pollution from agriculture, emissions of water pollutants may peak between 2020 and 2025 and then stay more-or-less flat.

It is still uncertain when environmental quality will meet the standard in every aspect. The overall air quality has improved. It is expected that by 2025, 50% of cities will meet the air quality standard, the proportion of days with good air quality in 338 cities at and above the prefecture level will further increase, and the annual average concentration of PM 2.5 will continue to decline, while ozone may become a new major pollutant. There is still uncertainty about the improvement of the overall water quality given the considerable differences in the progress in the water quality of main rivers, lakes, groundwater, and oceans. Compared with air and water quality, to fundamentally improve the soil quality is an even more arduous task.

2. Greater efforts should be made in green transformation during the 14th five-year plan period

Following China's success in building a moderately prosperous society in all respects, the 14th Five-Year Plan period will mark the beginning of a new journey of comprehensively building a modern socialist country. During the 14th Five-Year Plan period,

we must green transformation, step up efforts to build a resource-conserving and environmentally friendly green development system and a new modernization pattern featuring harmony between human and nature.

First, we will foster a green industry development system. We will promote the transformation and upgrading of green industries, develop new business models of the green economy, boost green technology innovation, and cultivate new entities for the green economy. We will develop green industries such as energy conservation and environmental protection industries, clean production, and clean energy, green agriculture including ecological circular agriculture, and green service industries such as energy performance contracting, water-saving management contracting, and green technology services, while encouraging technological transformation for green production and energy conservation and emission reduction. We will push for transformation in energy production and consumption and build a clean, low-carbon, safe, and efficient energy system. We will upgrade the entire industry chain for key products where conditions permit, strengthen collaboration between relevant entities in technical cooperation, production and use, service, and other areas, and strive to build a green industry development system.

Second, we will put in place a green scientific and technological innovation system. We will increase inputs in the R&D of green technology and fortify connectivity between all parts of the innovation chain; strengthen basic research and carry out research on pollution and its impacts to provide a scientific basis for improving the technical route of environmental management. We will increase investment in the R&D of general green technology, especially green processes and equipment, and beef up the capacity to provide equipment for green technological transformation of enterprises. We will promote collaboration between enterprises, universities, research institutes, and end-users, encourage large enterprises and research institutes to establish technological innovation alliances, and speed up the industrialization of green technology. We will reinforce the protection of intellectual property rights of green technology, increase the enthusiasm of enterprises for green technology and business model innovation, give full play to the decisive role of the market in green technology innovation, route selection, and allocation of innovation resources, and develop a market-oriented green technology innovation system.

Third, we will refine the resource conservation and recycling system. We will promote enterprises to shift towards circular production and implement whole life-cycle management; advocate the rules of 3R (reducing, reusing, and recycling) and develop a circular enterprise evaluation system for key industries; carry out green transformation of industrial parks, push for circular industry chains, high-efficiency resource use, and centralized pollutant treatment, optimize the industry chains of the circular economy, and raise the level of industry linkage and recycling. We will improve the resource recycling system, promote the extended producer responsibility system, put in place the recycled products and materials promotion and use system, and fine-tune the system restricting the use of disposal consumer items. We will improve the circular economy assessment system, tighten circular economy standards and certification, and push forward the implementation of the green credit management system.

Fourth, we will put in place the spatial development and protection system. We will advance the implementation of the system of functional zoning, establish and enforce a unified spatial planning system as soon as possible, improve the spatial governance system, and stick to a single blueprint until the end. We will carry out the campaign on comprehensive management of territorial spaces covering urban areas, rural areas, ecological functional zones, mineral resources development zones, and coastal zones, establish the nature reserve system centred on national parks, and build national ecological security shields.

Fifth, we will develop the green development market service system. We will further boost green finance and experiment with green finance tools such as green loans, green bonds, green insurance, green funds, and green certificate trading. We will improve the carbon trading market, including the information disclosure system, and increase the transparency of allocation of carbon emission quotas; carry out pilot programs with diversified products and ways of trading, draw up relevant regulatory rules, establish accounting rules for carbon assets and carbon trading, and strengthen supervision over carbon trading with overseas entities. We will promote the pollutant discharge rights trading system, extend the pilot programs on paid use and trading of pollutant discharge rights to more regions where conditions permit, and improve the mechanism that allows enterprises to benefit more from emission reduction through pollutant discharge rights trading. In addition, we will promote pollutant discharge rights trading across different administrative regions in key river basins and key regions of the air pollution prevention and control initiative.

Sixth, we will promote green lifestyles and consumption. We will advocate simple, moderate, green, and low-carbon lifestyles, encourage the use of green products, and provide more effective incentives for green mobility. We will establish dedicated circulation channels for green products, support the establishment of green wholesale markets, green malls, energy-saving supermarkets, water-saving supermarkets, and so forth, and encourage marketplaces, malls, supermarkets, souvenir shops, and other businesses to set up dedicated zones for green products. We will promote green consumption through the “Internet Plus” initiative, encourage ecommerce enterprises to sell green products and services independently or in partnership with brick-and-mortar enterprises, and boost online trading of green products and second-hand items to meet the diverse needs of different groups for green products.

Finally, we will improve the green development regulatory system. We will reform the evaluation system and put in place relevant institutions as soon as possible. Specifically, we will deepen the environmental regulation system reform, improve environmental laws and regulations, optimize the regulatory structure, and enhance professional regulatory capabilities to make environmental regulation more effective. We will reform the resource and environmental management system and cultivate an environmental governance system where the government takes a leadership role, enterprises play a major role, and social organizations and the public participate.

The 14th Five-Year Plan period will be a critical period for China to shift towards green development. Only by accelerating green transformation can we lay the groundwork for making a fundamental improvement in the environment and basically

attaining the goal of building a beautiful China by 2035 when socialist modernization is basically realized. In addition, China's exploration in green transformation will provide a new option for developing countries to adopt the green development model and contribute China's wisdom and solution to the building of a sustainable community with a shared future for mankind.