

On Accelerating the Green and Low-Carbon Transition for an Ecological Civilization with Chinese Characteristics

Chen Shiyi^{1*} and Chen Dengke²

¹ Anhui University, Hefei, China

^{1,2} School of Economics, Fudan University, Shanghai, China

Abstract: *The Report to the 19th National Congress of the Communist Party of China (CPC) called for steadfastly implementing the new philosophy of “innovative, coordinated, green, open, and shared” development, for expediting China’s green and low-carbon economic transition, and for developing a so-called “ecological civilization with Chinese characteristics.” As an extensive and profound socio-economic transformation in building a strong, modern nation, the green and low-carbon transition is viewed as an essential requirement for creating an ecological civilization in line with Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era. The transition reflects the commitment of the CPC to its original aspirations to increase the welfare of the people and the principle of putting the people first as well as China’s resolve and ambition to confront climate change issues.*

Keywords: *Ecological civilization, new development philosophy, green and low-carbon transition, carbon peak, carbon neutrality*

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The year 2021 marked of the 100th anniversary of the founding of the Communist Party of China (CPC) and also marked the beginning of China’s 14th Five-year Plan period. Presently, the CPC Central Committee has set a goal to implement the new philosophy of “innovative, coordinated, green, open, and shared” development and has declared that “China will scale up [its] intended, nationally determined contributions to decrease the global warm gas emission and enact more vigorous policies and measures that aim to have carbon dioxide emissions peak before 2030 and to achieve carbon neutrality before 2060.”¹ In leading the whole nation toward an “ecological civilization with Chinese characteristics,” the CPC faces a big test in the form of carrying out the proposed greening of China’s economy and achieving its carbon peak and carbon neutrality goals. As an extensive and profound socio-economic transformation deemed vital to the sustained development of the Chinese nation, the green and low-carbon transition is an explicit requirement of implementing General Secretary Xi Jinping’s “Thought on Ecological Civilization for a New Era” and manifests the CPC’s commitment to its original aspirations to increase the welfare of the people and development philosophy of putting the people first, as well as the nation’s resolve and ambition to confront climate change issues.

* CONTACT: Chen Shiyi, email: shiyichen@fudan.edu.cn.

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¹ Statement by Xi Jinping at the General Debate of the 75th Session of The United Nations General Assembly, 2020.

1. China's Green and Low-Carbon Transition: An Explicit Requirement of Implementing Xi Jinping's "Thought on Ecological Civilization for a New Era"

Since the 18th CPC National Congress, General Secretary Xi Jinping has systematically elaborated a series of theoretical and practical issues on "why ecological civilization matters, what type of ecological civilization should be pursued, and how and who should build an ecological civilization" that form what have become known as Xi Jinping's "Thought on Ecological Civilization." As a key component of Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era and the latest result of the sinicization of Marxist theory on the symbiosis between mankind and nature, his thought on ecological civilization has become fundamental guidance for China to advance the green and low-carbon transition of its economic system and build an ecological civilization for a new era. Since the economic reform policies enacted in 1978, China has seen its economy grow by close to 40 times to become the world's second-largest economy after the United States. China's annual GDP per capita has also grown by over 30 times from around 300 US dollars at the inception of the reforms to approximately 10,000 US dollars, a key stepping stone towards becoming an upper-middle-income country. However, China has paid a heavy price in terms of environmental damage in order to accomplish this, which underscores the urgency to transition to a green and low-carbon economy.

Traditional Chinese concepts of economic development have often antagonized economic development with a green and low-carbon transition or even an ecological civilization, believing the latter would come at the expense of curtailing China's economic growth to a sub-optimal level, especially in light of China's coal-dominated natural resource endowment (in 2020, coal consumption accounted for 57% of all energy production). Based on his notion that "a civilization may thrive if its natural surroundings thrive, and will suffer if its natural surroundings suffer," General Secretary Xi further put forth his concept of green development that "lucid waters and lush mountains are invaluable assets" that now forms the theoretical basis for China's green and low-carbon transition and guides the direction for future economic development.

With rising living standards, people crave for a better ecological environment, and "lucid waters" and "lush mountains" would become scarce amid economic development (Yang, 2021). Similar to goods and services available in the market, lucid waters and lush mountains are also goods that bring utility to people. In this sense, green and low-carbon transition can create economic benefits by improving the ecological environment and increasing the level of these types of goods that people can enjoy. Moreover, existing empirical studies have shown that physical and psychological damage of environmental pollution (Greenstone and Hanna, 2014; Zhang et al., 2018) can impair workers' efficiency (Chang et al., 2014). Based on China's industrial sector data, Chen (2009) found that CO₂ emissions contributed negatively to economic growth for a considerable portion of industrial sectors, and based on empirical research on data from China's prefectural cities, Chen and Chen (2018) further found that an increase in the smog-inducing PM_{2.5} concentration by one microgram/m³ caused annual GDP per capita to fall by about 100 yuan. Hence, by greening its economy, China stands not only to benefit its people and ecological environment but also to increase its economic output. This proposed extensive socio-economic transformation may revolutionize the existing modes of production that are inconsistent with the "new development philosophy" and transform every aspect of China's socio-economic development. Such a transition may induce technological innovation, propel industrial upgrades, and optimize resource allocation, giving rise to a new development paradigm.

2. China's Green and Low-Carbon Transition Reflects the CPC's Commitment to Its Original Aspirations and People-Centered Development

As noted in the Report to the 19th CPC National Congress, in the new development era of socialism with Chinese characteristics, China's primary social contradiction between the growing material and cultural needs of the people and the backward social production has evolved into one between unbalanced and inadequate development and its people's ever-growing demands for a better life. People's desire for a better life is manifested not only in material and cultural aspects but in yearning for a beautiful environment as well. Indeed, General Secretary Xi has stressed that China should pursue modernization in which people live in harmony with nature, and a key aspect of China's green and low-carbon transition is to provide its people with desirable ecological goods. Since the 18th CPC National Congress, the CPC Central Committee with Xi at the core has already enacted a series of strategic initiatives to green China's economy and to build ecological civilization with Chinese characteristics.

For example, in order to cope with extensive pollution, the Organization Department of the CPC Central Committee restructured its performance evaluation system for government officials, prioritizing environmental protection over GDP growth. In May 2015, the CPC Central Committee adopted its *Opinions on Accelerating the Development of Ecological Civilization*, which called for all-round arrangements on China's ecological civilization and green and low-carbon development in the new development era. The *Opinions* identified green, circular, and low-carbon development as the basic pathway toward an ecological civilization and put forth targets on CO₂ emissions intensity (CO₂ emissions per unit of GDP). In September 2015, the CPC Central Committee and the State Council released their *Master Plan for Institutional Reform Towards Ecological Civilization (Master Plan)*, which is the second top-down design document issued by the Party and the State in the same year related to China's ecological civilization and green and low-carbon transition. The *Master Plan* called for improving the performance evaluation and accountability systems for ecological civilization, for adopting practical green development indicators, and for implementing off-office auditing of natural resource assets for government officials in leadership positions, as well as governments and officials' lifelong environmental accountability system. From the dimension of government accountability, the *Master Plan* offers national-level institutional guidance for China's green and low-carbon transition.

In 2020, the CPC Central Committee released its *Proposal on the 14th Five-Year Plan for National Economic and Social Development and Long-Range Objectives for 2035*. This document gives prominence to accelerating green and low-carbon development and calls for reducing carbon intensity, supporting localities with appropriate conditions to take the lead to peak their carbon emissions, and formulating an action plan for achieving carbon peak by 2030. In 2021, the State Council released its *Guiding Opinions on Establishing a Sound Economic System for Green and Low-Carbon Circular Development*, which made specific arrangements on the low-carbon transition of China's economic system in the six aspects of production, distribution, and consumption systems for green and low-carbon circular development, the green upgrade of infrastructure, a market-based green technology innovation system, and an improved legal and regulatory system. As a result of this, the launch of China's national emissions trading scheme (ETS) in July 2021 was a first step in China's green and low-carbon transition.

3. The Role of China's Green and Low-Carbon Transition in the Global Economy

Global climate change induced by a spike in man-made greenhouse gas emissions, primarily CO₂ emissions, poses a serious threat to worldwide socio-economic development and the entire global ecosystem (IPCC). Lin and Jiang (2009) argue that short of actions to reverse the energy-intensive and

pollution-heavy modes of economic development, global temperature may rise by 2°C to 3°C by the end of this century, which may cause global GDP to fall by 5% to 10% and GDP in poor countries in particular to decrease by over 10%. According to a research report by the Intergovernmental Panel on Climate Change (IPCC), an increase in global mean temperature by 2.5°C may cause negative effects in all regions of the world and an increase in global mean temperature by over 4°C may irreversibly damage the global ecosystem and wreak havoc on the global economy, especially in the developing world. Aside from possibly upending mankind's socio-economic development, climate change may also lead to ecological catastrophes and increase the frequency of extreme weather events. Advancing the green and low-carbon transition of the China's economic system and building an ecological civilization with Chinese characteristics have become a natural choice for sustainable development in China in the context of climate change (Pan et al., 2010). As noted in the Report to the 19th CPC National Congress, "The CPC is a political party that seeks happiness for the people and progress for humanity. The CPC always takes [it] upon itself to make new and greater contributions to humanity."

3.1 Past and Present Levels of CO₂ Emissions from China and Other Major Countries

A review of the past and present level of CO₂ emissions from China and other major countries can help to frame China's strategy for coping with climate change and greening its economy. First, we discuss annual total CO₂ emissions. Figure 1 shows the temporal trend of annual total CO₂ emissions from major countries from 1850 to 2020. Here we see that China's CO₂ emissions have been dwarfed by other major countries for most of the time since 1850 until their relatively rapid rise that began in 1978. Since the founding of the People's Republic of China in 1949 and especially reform and opening up in 1978, China's CO₂ emissions have spiked with economic growth. Following its WTO entry in 2001, China's CO₂ emissions have been increasing at an accelerating pace, replacing the United States as the world's largest CO₂ emitter ever since 2006. After the global financial crisis of 2008, China's CO₂ emissions briefly decreased before rising again at a much slower pace compared with the previous decade. In 2020, China's CO₂ emissions stood at 10.1 billion tons, which were two and four times those of the United States (the second largest emitter) and India (the third largest emitter), respectively. On the path to becoming the world's largest CO₂ emitter ever since 1978, China also dramatically reduced absolute poverty, lifted 660 million people out of poverty over this time period. Another salient fact that can be seen from Figure 1 is that while CO₂ emissions appear to have peaked in major developed countries like the United States, Japan, and Germany, CO₂ emissions in developing countries like China,

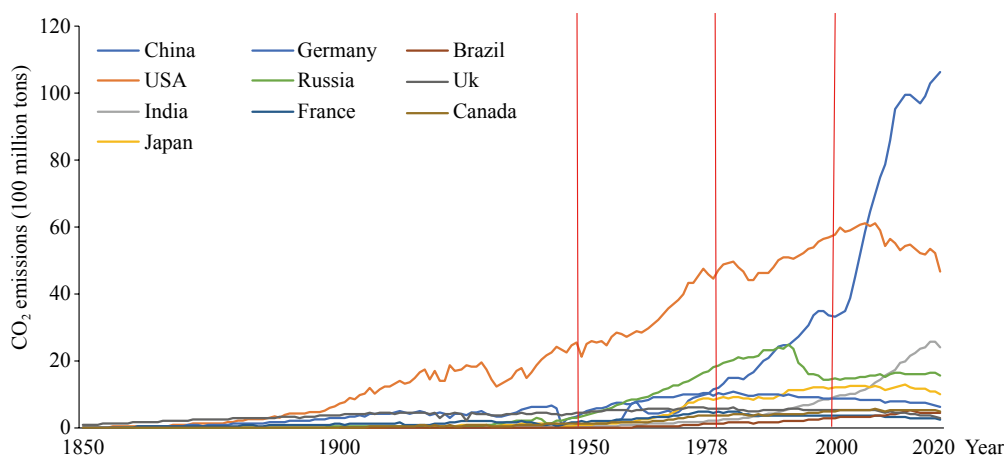


Figure 1: Annual CO₂ Emissions of Major Countries from 1850 to 2020

Source: <https://ourworldindata.org/>.

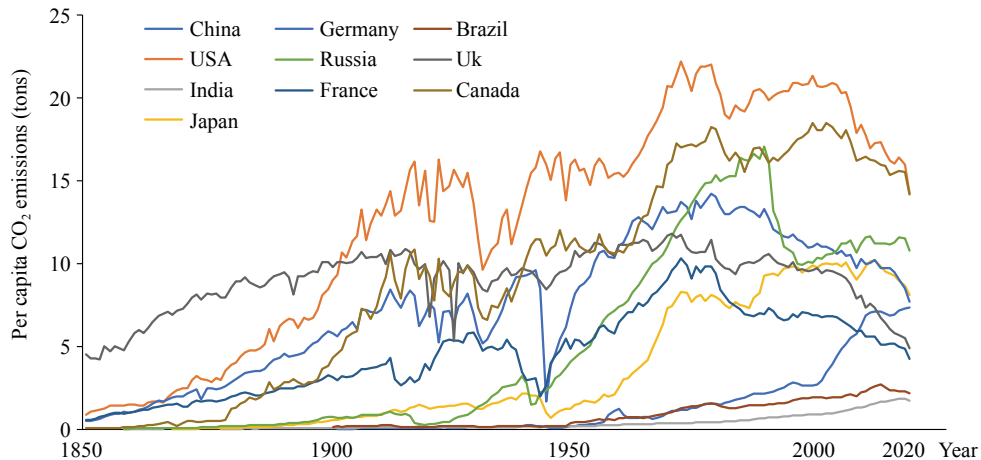


Figure 2: Annual Per Capita Carbon Emissions of Major Countries from 1850 to 2020

Source: <https://ourworldindata.org/>.

India, and Brazil have continued to grow. For China as the world's largest CO₂ emitter with emissions yet to peak, the question is whether China should assume the primary responsibility for global CO₂ emissions reduction? Our answer is no, and the reason is that apart from annual total CO₂ emissions, we believe that there are other, more important dimensions to the problem of CO₂ emissions such as CO₂ emissions on a per capita and historical cumulative basis and emissions embodied in trade, in dividing international responsibilities for reducing carbon emissions.

We believe that per capita emissions are equally, if not more, important as aggregate emissions. Although China has become the world's largest CO₂ emitter, it is far behind developed countries like the United States on a per capita level. Figure 2 shows the temporal trend of per capita CO₂ emissions from 1850 to 2020. Here we see that, China's per capita annual CO₂ emissions have been far smaller compared with other major countries for most of the time since 1850. Unlike the aggregate volume of CO₂, China's per capita CO₂ emissions have been significantly smaller compared with countries like the United States and Canada even in recent years as well. In 2020, China's annual per capita CO₂ emissions stood at 7.4 tons per person, which was only half the level of the United States and Canada and equivalent to those of Japan and Germany. Despite a period of rapid increase in China's per capita CO₂ emissions at the dawn of the 21st century, this trend has significantly diminished since the 18th CPC National Congress held in 2012.

As a major greenhouse gas, CO₂ can stay in the atmosphere several centuries. While developed countries have experienced centuries of industrialization, China's industrial development started just a few decades ago. Ever since the Industrial Revolution, hydrocarbon combustion in the developed world has been the key cause of today's global warming (Fan et al., 2010). Therefore, we believe that one should look not only at aggregate volume but also, historical emissions. Figure 3 shows the temporal trend of historical cumulative annual per capita CO₂ emissions from 1850 to 2020. From this we see that China's cumulative per capita CO₂ emissions are higher than those of India and Brazil, two other developing countries, but far below the levels of major developed countries. In the 270 years from 1850 to 2020, China's cumulative per capita CO₂ emissions only stood at 189 tons, which was less than one tenth that of the United States and equivalent to one eighth the level of the United Kingdom and one third the level of Japan.

Today's international trade is characterized by the relocation of polluting industries to developing or less developed countries with lax environmental regulation through international division of labor with more-developed countries at the top of industrial chains (Copeland and Taylor, 2004). Many

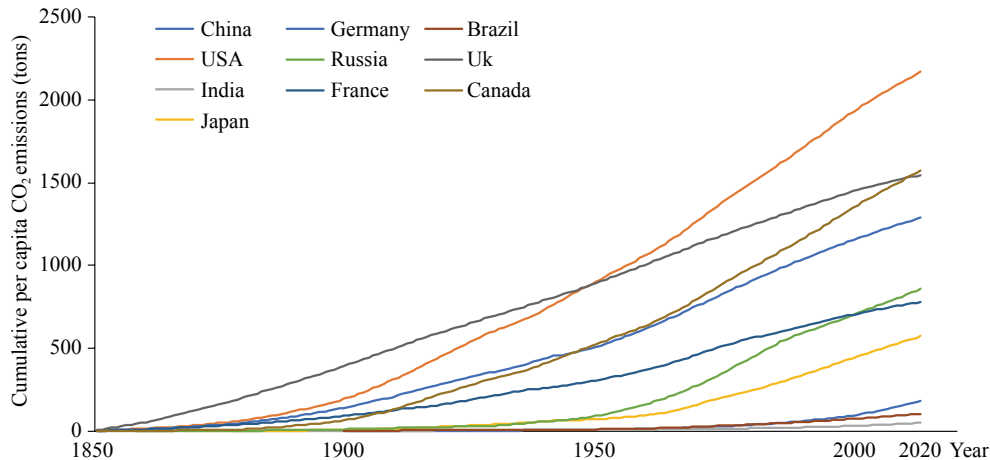


Figure 3: Cumulative Per Capita CO₂ Emissions of Major Countries from 1850 to 2020

Source: <https://ourworldindata.org/>.

countries have thus become reduced into “pollution havens.” In reality, greenhouse gas emissions in some countries, usually developing ones, derive from the production of goods that are exported to other countries mostly in the developed world rather than those used in domestic consumption. Hence we believe that one should look not only at production but at consumption as well. According to data from the “Our World in Data” website, CO₂ emissions embodied in China’s net exports accounted for an average of 14% of total CO₂ emissions from the manufacturing of all goods from 2000 to 2020. In 2006, this figure jumped to 22%. That is to say, a considerable portion of China’s CO₂ emissions were induced by consumption demand in other countries. Based on the above analysis, although China is the world’s largest CO₂ emitter, we believe that it is not primarily responsible for global climate woes when viewed from the dimensions of per capita and cumulative emissions, and even less responsible when further observed from the standpoint of international trade relationships.

3.2 China’s Plans for Green and Low-Carbon Development

As the world’s largest developing country, China has attached great importance to global climate issues, formulated a sustainable development strategy, identified green and low-carbon development as a key aspect of an ecological civilization, and sought improved cooperation on climate change. China has also made important contributions to keeping greenhouse gas concentration to a steady level and reducing the climate impact of human activity. For example, in 1992, the United Nations General Assembly adopted the United Nations Framework Convention on Climate Change (UNFCCC) based on the principle of “common but differentiated responsibilities,” to which China is one of the earliest signatories, and in 1998, China signed the Kyoto Protocol aiming at containing global warming, which is the first-ever international climate agreement in human history. In line with the Kyoto Protocol requirements, China enacted its National Climate Change Program in 2007, which marks the elevation of the green and low-carbon transition of its economic system into a national strategy, and in 2009, China made a commitment to the international community to slash its CO₂ emissions per unit of GDP by 40% to 45% by 2020 from the level of 2005.

Since the 18th CPC National Congress in 2012, China has evolved from a mere participant in global climate change response to an active proponent and trailblazer. Domestically, China has carried out nationwide actions for climate change adaptation. In November 2013, China’s National Development and Reform Commission (NDRC), the Ministry of Finance, and seven other ministerial agencies jointly released the *National Strategy for Climate Change Adaptation* to formalize China’s climate change

adaptation initiatives, and regionally, China has released the *Guiding Opinions on Advancing the Belt and Road Initiative (BRI) Development* to assist BRI countries in achieving their 2030 sustainable development targets. Internationally, China began to play an active role in facilitating the Paris Agreement in 2015, another international climate deal after the Kyoto Protocol that represents the overwhelming trend of global green and low-carbon transition among many countries of the world.

Finally, in 2016, China signed the Paris agreement and made plans to implement the various measures contained therein.

In September 2020, President Xi Jinping declared to the world at the General Debate of the 75th Session of the United Nations General Assembly that “China will scale up its nationally determined contributions and adopt more vigorous policies and measures. We aim to peak carbon dioxide emissions before 2030 and achieve carbon neutrality before 2060.” That is to say, China, as the world’s largest developing country, aims to complete the world’s highest carbon intensity reduction and transition from carbon peak to carbon neutrality in quite a short amount of time. In April 2021, President Xi reaffirmed at the Leaders Summit on Climate that China would embark upon a path of prioritizing ecological protection and green and low-carbon development, and in November 2021, he further stressed in his written speech at the World Leaders Summit at UNFCCC COP 26 that, “We will aim to achieve greener economic and social development in all aspects, with a special focus on developing green and low-carbon energy. We will continue to prioritize ecological conservation and pursue a green and low-carbon path to development.”

4. The Implementation of New Development Concepts to Facilitate China’s Green and Low-Carbon Economic Transition

Having explored the importance of green and low-carbon transition and ecological civilization, we now turn to the question of how to expedite the process effectively. As claimed in the Report to the 19th CPC National Congress, development holds the key to resolving all the problems that confront China. However, we believe that this development must be science-based and stick to the new philosophy of innovative, coordinated, green, open, and shared development. In this section, we discuss a few pathways for expediting the green and low-carbon transition of China’s economic system under this philosophy.

4.1 The Promotion of Technological Innovation for China’s Green and Low-Carbon Economic Transition

Technological innovation is the primary force for national development in China, and Green and low-carbon technological innovations in particular are essential in addressing resource and environmental constraints. In the post-reform era since 1978, China’s CO₂ emissions per unit of GDP have decreased sharply, down 97% from 40.58 tons per 10,000 yuan of GDP in 1978 to 1.05 tons per 10,000 yuan in 2020, but China stated in 2009 that it intended to slash carbon intensity by 40% to 45% by 2020 from its 2005 level. However, China’s CO₂ emissions per unit of GDP actually fell by 67%, far more than its intention made in 2009, from 3.14 tons per 10,000 yuan of GDP in 2005 to 1.05 tons per 10,000 yuan of GDP in 2020.

Since 1978, China has made many achievements in green and low-carbon technologies. However, we believe that China should further focus on the following aspects in advancing green and low-carbon technology innovations. First, similar to core technologies in other critical areas, China cannot expect merely to acquire or wait for the transfer of green and low-carbon core technologies. Instead, it should aim at the frontier of green and low-carbon technologies, improve its support system for green and low-carbon fundamental research, and scale up homegrown innovation to make up for existing weaknesses in its green and low-carbon technologies and reduce foreign dependence. Apart from greening existing

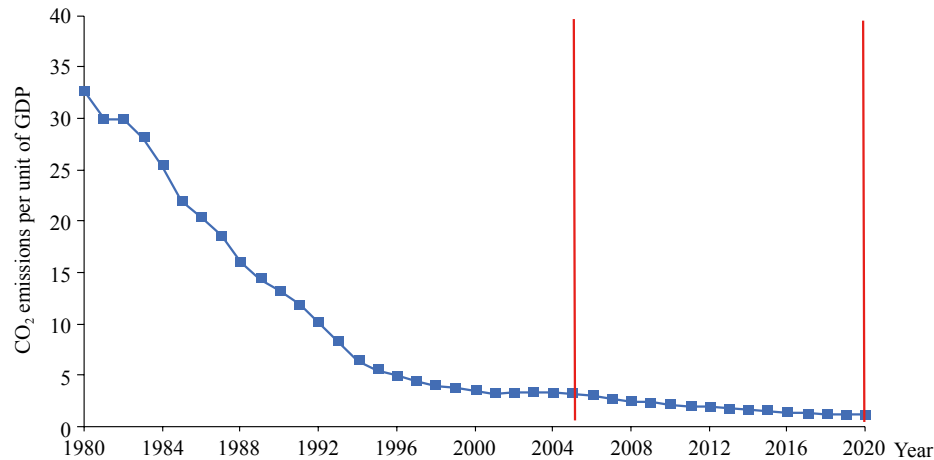


Figure 4: China's CO₂ Emissions per Unit of GDP from 1978 to 2020 (CO₂ Emissions Intensity)

Source: *China Statistical Yearbook*.

industries, green and low-carbon technological breakthroughs may engender a host of strategic green emerging industries as well.

Second, the market is the ultimate touchstone of the value of green and low-carbon technologies. We therefore believe that the market should play a decisive role in steering the development of green industries and picking technology pathways. Businesses should serve as the backbone of innovations under the market-based allocation of innovation resources. Finally, groundbreaking innovations can often be investment-intensive and risky with a length time until realized returns, and the same is true for research on green and low-carbon core technologies. However, in China currently, market entities and especially individual enterprises lack sufficient incentives for green and low-carbon innovations. As such, we believe that the government of China should step in to steer and support such innovations and establish administrative and operational systems for developing eco-friendly technologies.

4.2 Optimizing Resource Allocation to Facilitate China's Green and Low-Carbon Transition

Improving resource allocation is another key aspect of green and low-carbon economic transition along the dimension of "coordinated development." Green and low-carbon transition can be driven by either innovations that propel progress at the technology frontier or more efficient resource allocation without change to the technology frontier. The underlying logic is that macroeconomic efficiency is the weighted average of disparate efficiencies of various production entities, among which the reallocation of production factors from less efficient to more efficient ones will boost macroeconomic efficiency and environmental performance without incurring additional factor inputs or altering their technology frontier. Despite significant improvements in resource allocation efficiency since 1978, China's economic development remains fraught with distortions (Chen and Chen, 2017). In their influential study, Hsieh and Klenow (2009) found that resource allocation distortions had reduced China's economic efficiency by 30% to 50%. With greater economic efficiency, China can become better positioned to curb pollution and green its economy.

Among various dimensions of improving resource allocation, we focus on industrial and energy restructuring. Figure 5 shows the changing shares of China's primary, secondary, and tertiary industries from 1978 to 2020, which reflects the redistribution of economic resources among these sectors. Here we see that China's primary industry had been declining as a share of the economy, down from around 30% in 1978 to about 7% by 2020. During this time, the tertiary industry as a share of the economy had been rising steadily from 20% at the beginning of 1978 to 55% by 2020, and the secondary industry as a share

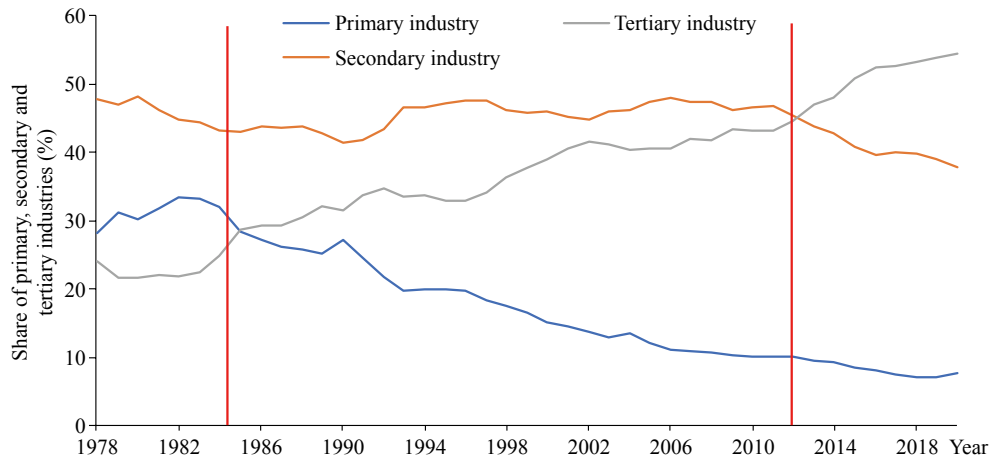


Figure 5: The Change in China's Industrial Structure from 1978 to 2020

Source: *China Statistical Yearbook*.

of the economy decreased slightly and stayed in the range of 40% to 50% with a significant downward trend since the 18th CPC National Congress in 2012. Compared with the tertiary industry, the secondary industry is much more energy intensive. In this sense, the falling share of the secondary industry and the rising share of the tertiary industry (resource reallocation from the secondary industry to the tertiary industry) help reduce emissions. Yet we still believe that China's green and low-carbon transition should be driven by endogenous industrial forces rather than inter-industry resource allocation. Our reasons are threefold. First, China's secondary industry as a share of the economy has dipped below 40%, leaving little room for further decrease. After all, the secondary industry, especially advanced manufacturing, serves as the backbone of the real economy. What matters more for the future is to allocate resources to more efficient economic entities in their respective industrial sectors by phasing out obsolete, nongreen industrial capacity.

In addition, energy mix improvement requires the reallocation of energy factors. Figure 6 shows the trend of China's energy consumption and energy mix from 1978 to 2020. Here we see that China's energy mix became transformed amid a spike in energy consumption. Coal as a share of total energy consumption fell by one fifth from about 70% in 1978 to 56% in 2020, and crude oil, natural gas, and other energy sources as a share of China's energy mix increased from about 30% in 1978 to 44% by 2020. Coal consumption as a major contributor to greenhouse gas and other pollutant emissions has decreased in China's energy mix in recent years, therefore reducing emissions. Less coal consumption means a greener economy, yet given its coal-dominated resource endowment, we feel it is unwise for China to jettison coal energy completely. From an energy security point of view, as the world's largest developing country with 1.4-billion population, China cannot and should not rely mainly on energy imports. This points directly to the importance of developing clean coal technology for greener and lower-carbon development. However, we believe that any potential future decrease in coal consumption should be a natural result of industrial upgrade. As the economy shifts from low-end to high-end manufacturing, for instance, the share of coal consumption may decrease with diminishing coal demand.

4.3 Creating a New Paradigm of Open and Shared Development

Openness and shared benefits are two important dimensions of China's development philosophy and are of great significance to its green and low-carbon economic transition. In the post-reform era since 1978 and especially since the 18th CPC National Congress in 2012, China has achieved many breakthroughs in green and low-carbon technologies. However, China still trails developed countries in

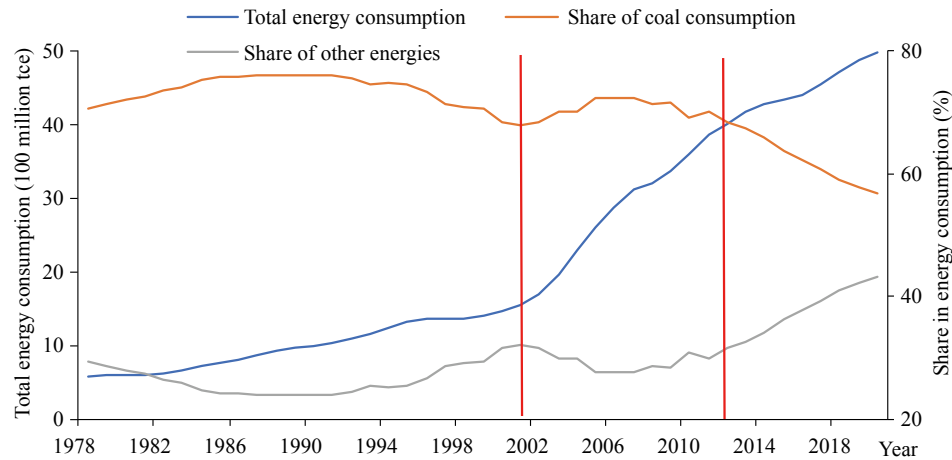


Figure 6: China's Energy Consumption and Mix in 1978-2020

Source: *China Statistical Yearbook*.

critical green and low-carbon frontier technologies. Along the dimension of openness, therefore, we believe that China should pursue a higher level of openness on the basis of “domestic circulation as the mainstay mutually reinforced with international circulation” and draw upon the technologies, concepts, and experiences of developed countries in the service of its own green and low-carbon innovations. Along the dimension of shared development, an important aspect of the green and low-carbon transition is to foster green and low-carbon lifestyles, oppose waste, and vigorously develop the circular economy. ■

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