7. Climate policy in China: an overview

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CHINA’S CARBON EMISSIONS AND DECARBONIZATION: A BACKGROUND FOR CLIMATE CHANGE POLICY

Carbon emissions in China have undergone a continuous increase since the 1980s and experienced a particular surge during the 2000s, in large part due to its accession to the World Trade Organization (Figure 7.1). In 2006, for the first time in history, China exceeded the United States to become the world’s largest greenhouse gas emitter. In 2018, China’s carbon emissions amounted to 9.4 Gt, approximately 28.5 percent of the world’s total and exceeding emissions of all member countries of the Organisation for Economic Co-operation and Development (OECD) (BP, 2019). Manufacturing, buildings, and transportation are the three primary sectors responsible for carbon emissions in China, accounting for 64.3 percent, 18.7 percent, and 11.9 percent of total

Source: Calculated based on BP Energy Outlook (2019).

Figure 7.1 Carbon emissions in China (1980–2018)

Table 7.1 Breakdown of end-use CO₂ emissions in China by sector (2016)

	Emissions (Mt CO ₂)	% in total
Energy industry	286	3.3
Agriculture	159	1.8
Manufacturing	5578	64.3
Transportation	1033	11.9
Buildings	1618	18.7
Total	8674	100.0

Source: Table 11-15 in Liu and Li (2018).

end-use CO₂ emissions in 2016 (Table 7.1). The predominance of manufacturing-related emissions shows the urgency and significance of a structural change from the emissions-intensive, manufacturing-based economy toward a high-tech-driven, service-based one. Despite a relatively small share of the national total, the high speed at which transport-related carbon emissions (10.3 percent annual growth rate) have grown in the 2005–18 period is particularly worth noting: transport-related carbon emissions in China more than tripled from 0.40 Gt in 2005 to 1.04 Gt in 2018, its share within the national total carbon emissions increasing from 6.1 percent to 12.1 percent over the same period (Tsinghua University, 2020a). International experiences suggest that transport-related emissions will become an increasingly important driver of emissions in China with the acceleration of urbanization.

As the world's largest energy consumer and carbon emitter, China has increasingly recognized the urgency and necessity of addressing global climate change. It has become a general consensus among Chinese policy-makers that clean growth is the growth story of the twenty-first century. China's Nationally Determined Contribution (NDC) aims to peak carbon emissions around 2030, lower CO₂ emissions per unit of GDP in 2030 by 60 percent to 65 percent from 2005 levels, and increase the share of non-fossil fuels in primary energy consumption to around 20 percent by 2030, among other targets. Fulfilling these pledges is integral to global climate change mitigation in general, and to meeting the Paris Agreement objective of limiting average global temperature increase to below 2°C, while pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels. The past decade witnessed China's rapid decarbonization of its energy system. The backbone of this decarbonization trend is the decelerated growth of coal consumption and fast development of renewable energy. The share of coal in China's total energy consumption decreased from 76.2 percent in 1990 to 61.8 percent in 2016, while the share of non-fossil fuels increased from 5.1 percent to 13.0 percent in the same period

Source: Table 11-1 in Liu and Li (2018).

Figure 7.2 Change in China's energy structure (1990–2016)

(Figure 7.2). China's coal use dropped to 2.8 billion tons of coal equivalent (tce), a decrease of 0.77 percent, in 2014, with another 1.48 percent decrease in 2015, and a further 1.69 percent decrease in 2016, all while gross domestic product (GDP) continued to grow (Figure 7.3). Despite the slight reversal of the trend in 2017 and subsequently in 2018 when coal consumption increased by 0.13 percent and 0.86 percent, respectively, China has shown signs of entering the era of post-coal growth. In other words, China's economic growth has started to decouple from coal use (Qi & Lu, 2018; Qi et al., 2016).

Today, China leads the world in renewable energy installation and investment. In 2015, China's investment in renewable energy contributed to more than one-third of the global total (Dong et al., 2018). Although this share slightly decreased in 2016, China continued to lead the world in renewable energy investment in 2017 and even further increased its share in the global market. Domestic investment in renewable energy reached 126.6 billion USD, approximately 45 percent of global total (Qi, 2018). In 2017, renewable energy (excluding large hydro) accounted for 21.9 percent of China's total power installation (Figure 7.4). Of China's new installed capacity in 2017, 58.4 percent was contributed by renewable energy, of which 43 percent was from solar photovoltaic and 13 percent from wind. New installation of photovoltaic systems amounted to 53 GW, more than 50 percent of the global total, and 15 GW of wind capacity was installed, approximately one-quarter of the global

Source: Calculated based on BP Energy Outlook (2019).

Figure 7.3 Coal consumption in China (1980–2018)

Source: Calculated based on Table 6-2 in Dong et al. (2018).

Figure 7.4 New installed capacity for electric power generation (2000–2017) in China

total. Meanwhile, the share of investment in renewables increased from 13 percent in 2005 to 77 percent in 2017 (Figure 7.5).

This chapter is organized around four themes: an overview of China's climate change policy, climate policy-making, climate policy implementation, and climate policy and its role in global governance. Together the four sections aim to present a comprehensive picture of climate policy in China.

Source: Table 6-3 in Dong et al. (2018).

Figure 7.5 Share of investment in renewable energy in China (2005–17)

AN EVOLVING SYSTEM OF POLICIES FOR CLIMATE CHANGE

Climate policy has been a key component of China’s environmental policy and environmental diplomacy since the early 1990s. China was among the first ten parties that signed the primary international agreement on climate change, the United Nations Framework Convention on Climate Change (UNFCCC), at the Earth Summit in Rio de Janeiro in 1992. Six years later, China signed the Kyoto Protocol to the UNFCCC, which was ratified in August 2002 and entered into force on February 16, 2005. During the 15th session of the Conference of the Parties (COP15) in Copenhagen in 2009, the Chinese government put forward an independent emissions reduction target to reduce national carbon intensity by 40–45 percent compared to 2005 levels by 2020; to increase the share of non-fossil energy in China’s primary energy mix to 15 percent; and to increase forest stocks by 1.3 billion m³ compared to 2005 levels. Both the carbon intensity and the forest stocks targets had been overfulfilled by 2018: the carbon intensity was reduced by 45.8 percent, and forest stocks increased by 1.51 billion m³. China is also on track to reach the non-fossil energy target of 15 percent: the share of non-fossil energy in China’s primary energy mix increased from 7.4 percent in 2005 to 14.3 percent in 2018 (Ministry of Ecology and Environment, 2019; Tsinghua University, 2020a). In 2016, China submitted its NDC mitigation pledges under the 2015 Paris Agreement of the

UNFCCC, pledging to reduce CO₂ intensity by 60–65 percent compared to 2005 levels by 2030, to increase the share of non-fossil energy in the national primary energy consumption to 20 percent and to reach peak CO₂ emissions around 2030 or earlier. Fulfilling these pledges is integral to global climate change mitigation in general, and to meeting the Paris Agreement objective of limiting the average global temperature increase to below 2°C, while pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels.

Looking back, it is clear that China has pursued an evolving strategy for climate change since the 1990s. Two key features emerge from China's climate change strategy, which are worth particular attention. First, the central government views climate policy as part of its sustainable development policy, especially part of its energy consumption and economic development policy (Qi & Ma, 2007). This means that climate change is not treated as a separate issue by the Chinese government, but as a component of its overall development strategy. Although such a strategy recognizes the linkages between climate change and other developmental issues, which allows for policy coordination and co-governance, it also reveals insufficient recognition of the distinctive significance of climate change. This has in a large part led to the lack of specific climate change mitigation and adaptation policy for a long period of time. The 12th Five-Year-Plan (FYP) dedicated a whole chapter to climate change. Prior to that, it is hard to find any distinctive climate policies. Instead, climate mitigation was only implicitly embedded in China's energy-saving policies, which reduce carbon emissions as a result. The 12th FYP officially included policies specifically targeting climate change such as the mandatory national carbon intensity target, low-carbon city pilot, carbon trading pilots, and the national carbon market.

Second, China insists on the principle of “common but differentiated responsibilities” and actively participates in international activities related to climate change. China treats climate change as a key part of its environmental diplomacy. By complying with international climate agreements, China hopes to play a role in international climate governance as an environmentally responsible country while protecting its national interest. Given that a stable climate is a global public good, the Chinese government emphasizes the importance of international cooperation on climate change. This position shows that China views climate change as an international problem triggered by international pressure initially (e.g., following the release of the Fourth Assessment Report by the Intergovernmental Panel on Climate Change [IPCC] in February 2007, Chinese embassies and consulates worldwide received, for the first time, numerous calls and questions regarding Chinese actions on climate change), and then as a domestic sustainable development problem when climate change impacts become more clear and profound (Qi & Ma, 2007; Qi & Wu, 2013). In recent years, China has realized that low-carbon economic development

will contribute to its economic transition towards a green economy. President Xi Jinping made it clear during his meeting with former US Secretary of State John Kerry in 2014, that addressing climate change “is not at others’ demand but our own will. We have already taken many measures and will do more in the future.”

As of 2020, China has created a relatively comprehensive policy framework for climate change with broad coverage, including administrative mandates, economic incentives (including price policies, carbon cap and trade, and fiscal subsidies), regulatory measures (e.g., laws, regulations, and standards), and low-carbon pilots, in addition to policies closely related to climate policy such as power sector reform and taxation reform, and research and development policy. Climate policies in China can be classified into seven broad categories, as follows.

Adjusting the Industrial Structure to Limit Energy-intensive Industry

China’s industrial policy promotes transformation and upgrade of energy-intensive industries towards energy-saving ones. This includes increasing the share of service industry and lowering the share of mining and manufacturing industry. Among the so-called strategic emerging industries,¹ information and communication technology, green manufacturing, and biotechnology are emphasized. While meeting other targets for industrial and economic development, the new and high-tech industries tend to consume less energy, and emit less greenhouse gases for every dollar of production, as compared to the traditional industry. In addition, a key initiative for upgrading traditional industries is the elimination of obsolete production capacity in energy-intensive industries. During the 11th FYP period (2006–10) alone, the Ministry of Finance provided 21.91 billion renminbi (RMB) of subsidies to enterprises in less-developed regions to encourage their phase-out activities (Zhao et al., 2014).

Promoting Energy Saving and Improving Energy Efficiency

Energy saving and energy efficiency has been the bedrock of China’s climate mitigation policy. In fact, the energy-saving policy started in the late 1970s to address a severe shortage of energy when China made a deliberate decision to shift the focus of the country from political campaigns to economic growth. The national government makes an explicit target for energy intensity (defined as energy use per unit of economic production) for every five-year plan period. Since the inception of the energy-saving policy, China’s energy intensity has been declining at about 5 percent a year on average with the only exception for the 10th FYP (2000–05) when no energy intensity target was made in the

FYP. Since 2005, China has resumed the energy intensity target and created a series of tough measures to promote energy saving, including prominently the Top 1000 Enterprises Program for the 11th FYP period, the Top 10 000 Enterprises Program for the 12th FYP period, and the Top 100–1000–10 000 Enterprises Program for the 13th FYP period. The national government launched the Top 1000 Enterprise Program in 2006 to achieve energy savings of 100 Mtce by 2010. The program originally covered the 1008 most energy-intensive enterprises in nine major energy-consuming industries, each consuming a minimum of 180 000 tce annually. In the 12th FYP period, the national government replaced the Top 1000 Enterprises Program with the Top 10 000 Enterprises Program. The Top 10 000 Enterprises Program aims to achieve an energy-saving target of 250 Mtce for the so-called Top 10 000 Enterprises.² There were approximately 16 078 Top 10 000 Enterprises in 2010, altogether accounting for 60 percent of total energy consumption in China. During the 13th FYP period, the Top 10 000 Enterprises Program was again replaced by the Top 100–1000–10 000 Enterprises Program. The Program classifies key energy-consuming entities in the country into three categories: (1) the “Top 100” Enterprises (there are 100 such enterprises, hence Top 100), whose annual energy consumption exceeded 3 Mtce in 2015; (2) Top 1000 Enterprises (there are 1000 such enterprises, hence Top 1000), whose annual energy consumption exceeded 0.5 Mtce in 2015; and (3) all other key energy-consuming entities. In addition to these programs targeting industrial enterprises, the Chinese government launched the Energy-Saving Key Projects, reformed energy-saving standards and labels, promoted energy-saving technologies and products, and refined fiscal policies and market instruments related to energy saving.

Decarbonizing the Energy System by Limiting Total Energy Consumption and Promoting Renewable Energy

China has endeavored to decarbonize the energy system by developing renewable energy and limiting the total energy consumption, particularly its fossil fuel use. As one of the few countries in the world that ever implemented a nationwide energy consumption cap (Qi, 2018), China set a limit on the amount of total coal consumption for ten eastern provinces. In particular, Beijing, Tianjin, Hebei and Shandong were together required to cut their coal consumption by 83 million tons from 2012 to 2017, a reduction greater than the total coal consumption of the UK (Qi et al., 2016).

Substitution of coal by non-fossil fuels has proceeded rapidly in the power-generation sector. In 2007, 83 percent of electricity was generated with coal, but that share fell to 72 percent in 2015. At the same time, there has been a rapid growth of solar, wind, nuclear and hydropower generation

(ibid.). The amount of electric power generated from renewable sources has tripled and wind and solar power capacity grew 25 times in the decade from 2008 to 2018. Currently, 30 percent of all electricity comes from non-fossil fuels (United Nations Environment Programme [UNEP], 2019). China has committed significant financial resources to the development of renewable energy, especially through preferential policies and fiscal subsidies for solar photovoltaic and wind equipment manufacturing, power plant construction, and power transmission provided by both central and local governments at all levels. The Chinese government's support to boost renewable energy in terms of land use, taxation, and loan issuance is unparalleled by any other country in the world (Qi, 2018).

Increasing Carbon Sinks

China's carbon sink policy targets forest, cropland, grassland, and wetland. In terms of forest carbon sink, China has implemented the Special Action Plan for Forestry for Addressing Climate Change, which aims to accelerate afforestation on barren hills and promote urban landscape construction as well as continuing to implement forest ecological projects such as the conversion of cropland to forest, rocky desertification treatment, and shelter forest construction. China has continued to implement grassland ecosystem remediation projects such as returning grazing land and cultivated land to grassland. In 2018, the central government allocated a 300 million RMB budget for wetland protection projects and set up a wetland fiscal subsidy of 1.6 billion RMB (Ministry of Ecology and Environment, 2019). In addition to a nature-based solutions to promote carbon sinks, China takes seriously the promotion of carbon capture and sequestration (CCS) technology. The International Energy Agency (IEA) (2015) estimates that to limit global average temperature rise to below 2°C, CCS could contribute to 11 percent of emissions reduction in China. The theoretical geological storage reserve in China is estimated to be on the scale of teratons (Administrative Center for China's Agenda 21, 2019). On August 31, 2018, a CCS demonstration facility in Jilin Province reached a carbon storage capacity of 0.6 Mt. There are a number of other facilities (e.g., Sinopec Qilu Chemical CCS Project, Shaanxi Yanchang Petroleum Shaanbei Coal Chemical CCS Project) with storage capacities of approximately 0.4 Mt. According to data from the Global CCS Institute, by 2020 the existing CCS facilities in China have a total capture capacity of 4.78 Mt/year, much less than the CCS deployment goal set in Asian Development Bank's (2015) CCS Roadmap, that is, 10 Mt/year. The gap is largely due to the immaturity of the technology and high capital and operation cost (Tsinghua University, 2020b).

Controlling GHG Emissions from Sources Other than Fossil Fuel Combustion

China has addressed the issue of hydrofluorocarbons (HFCs) in the industrial sector. In 2018, the Ministry of Ecology and Environment (MEE) issued the Notice on Launching Relevant Work on the Disposal of Hydrofluorocarbons, arranged for the disposal verification of HFCs, published the auditing results of a total of 11 enterprises in 49 provinces, and provided enterprises that destroyed HFCs with a subsidy amounting to over 200 million RMB (Ministry of Ecology and Environment, 2019). In order to promote the recycling of renewable resources and comprehensive utilization of renewable resources such as scrap iron and steel, the Ministry of Industry and Information Technology published six batches of enterprises that meet the entry requirements for the scrap iron and steel processing industry.

China has made efforts to control greenhouse gas (GHG) emissions from the agricultural sector with the intention to reduce chemical fertilizer use, which was 328.5 kg/ha for crops in 2015, much greater than global average of 120 kg/ha, 2.6 times its counterpart in the United States, and 2.5 times its counterpart in the European Union (Ministry of Agriculture, 2015). In 2015, the Ministry of Agriculture launched the Action Plan to Achieve Zero Growth of Fertilizer by 2020, mainly through formulated fertilizer use based on soil testing (*cetu peifang shifei*). Demonstration projects for reducing the quantity of and improving the efficiency of chemical fertilizers were launched in 300 counties. Despite the still high per hectare chemical fertilizer use, fertilizer intake has gradually improved. For instance, fertilizer intake of the three major grain crops in China (i.e., rice, corn, and wheat) increased from 35.2 percent in 2015 to 37.8 percent in 2017 (Ministry of Ecology and Environment, 2019). Fertilizer use growth rate declined from 2.8 percent in 2005 to 1.3 percent in 2013 and reached zero growth by 2017, three years in advance of the target (Ministry of Agriculture, 2015; Ministry of Ecology and Environment, 2019). Livestock and poultry excrement resource utilization was promoted in 585 major counties for animal husbandry, and support was given for the construction of facilities for collection, storage, treatment, and utilization of excrement resources. China has also implemented pilot projects for the comprehensive utilization of straw. Since 2018, China has started to control GHG emissions from the waste disposal sector by promoting the classification of waste in residential areas.

Building a National Carbon Market

Market-based instruments for enforcing and incentivizing climate governance have gradually evolved. In October 2011, China launched its pilot carbon

Table 7.2 Overview of the seven carbon-trading pilots in China

	Launch Date	Accumulated Transaction Amount, July 31, 2019 (Mt)	Accumulated Transaction Turnover, July 31, 2019 (million RMB)
Guangdong Province	December 2013	112.30	1588.80
Hubei Province	April 2014	322.19	7452.12
Beijing	November 2013	29.69	642.02
Chongqing	June 2014	8.91	32.99
Shanghai	November 2013	36.76	443.21
Shenzhen	June 2013	62.50	1795.60
Tianjin	December 2013	6.83	89.90

Source: UNEP (2019).

market in two provinces, that is, Guangdong and Hubei Provinces, and five cities, namely Beijing, Chongqing, Shanghai, Shenzhen, and Tianjin. These seven pilot regions have been trading on the market since June 2013 (Table 7.2). As of May 2019, trading in these seven pilots had covered more than 20 industries, including power generation, cement, iron and steel, and chemical production. Nearly 3000 key emitting entities participated in trading, with an accumulated turnover of almost 580 million tons of CO₂ or just more than 12 billion RMB (UNEP, 2019).

The carbon trading pilot program has generated co-benefits of enhancing local economic growth, promoting energy conservation and emissions reductions, raising awareness of low-carbon transformation, improving carbon-asset management capacity, and expanding financing channels for research and development in low-carbon technology and low-carbon projects. Meanwhile, the carbon market has incentivized the development of supporting services such as emissions verification, carbon accounting, carbon auditing, carbon-assets management, carbon financing, and carbon trading, all of which have created new employment opportunities.

In December 2017, the National Development Reform Commission (NDRC) issued the Scheme for Building a National Carbon Emissions Trading Market for the Electric Power Industry, which marks the official start of a national carbon cap-and-trade system. The Interim Regulations on the Administration of Carbon Emissions Trading have been drafted to solicit comments in 2019. The national carbon-trading program is expected to reach an estimated trading volume of more than 3 billion tons of CO₂, making China the largest carbon market in the world. The national carbon market takes the fossil fuel-based power generation industry as a starting point and will expand to others, including the chemical, petrochemical, iron and steel, non-ferrous metals, building

materials, paper and aviation industries (facilities with an annual energy consumption >10 ktce or emissions 26 ktCO_2) step by step. More than 1700 power plants are covered by the national carbon trading program so far, responsible for more than 3 GtCO_2 , nearly one-third of China's national emissions. The estimated trading volume will account for approximately 45 percent of the country's CO_2 emissions in the fossil fuel-based power generation industry.

National Low-carbon Development Pilots

Local pilots are often conducted by the central government as a key approach to policy innovation, to identify good practices that can be dispersed to other municipalities and provinces. Three pilot programs are of particular relevance to addressing climate challenges in China, namely the national pilots for low-carbon development, renewable energy pilots and the sponge city³ pilots (UNEP, 2019). The low-carbon pilot program was first initiated in 2010 and then augmented in 2012 and 2017. A total of 78 cities of various sizes are included in the three batches of the pilot program. Seventy-two of them declared to peak their CO_2 emissions five to ten years earlier than the national commitment under the Paris Agreement. All pilot cities achieved reductions in CO_2 emissions between 2010 and 2015.

CLIMATE POLICY-MAKING

An Initial Learning Process for China's Climate Policy-making (1990s–2003)

Climate change did not immediately emerge as a priority issue on the national agenda in China. It was initially treated by the central government as a scientific issue with international significance. In 1990, the National Coordination Group on Climate Change (NCGCC) was established as the first official institution on climate change, deputed under the State Council's Environmental Protection Committee (SCEPC). Then State Councilor Song Jian, the Chairman of SCEPC, was designated to lead the NCGCC, with its secretariat set up in the State Meteorological Administration (now China Meteorological Administration). NCGCC played a key role in developing China's position on the UNFCCC and the Kyoto Protocol. China's early efforts focused on learning and fact-finding, developing a coherent and comprehensive understanding of the processes and the likely consequences of climate change. The personnel behind the efforts were aptly suited to the task: Chairman Song Jian was an experienced scientist, and the State Meteorological Administration boasted a cadre of accomplished climatologists. The learning and fact-finding process was used to support key decisions taken on the UNFCCC and the Kyoto

Protocol. The process also contributed to the realization that climate change was much more than a scientific issue, as it was caused by economic activities, particularly fossil fuel burning. Thus, China's climate change actions have consequently been oriented around economic development. As a result, the scientific issue of climate change has become a strategic issue.

This new understanding of the climate change issue led to an important reorganization of the top institutions, beginning with fundamental reforms at NCGCC in 1998. First, it was renamed the National Coordination Group on Climate Change Strategy (NCGCCS). The newly added word "strategy" highlighted the shift of the group's function from fact-finding to the development of strategies, both domestically and internationally. Second, the secretariat was relocated from the State Meteorological Administration to the State Development Planning Commission (SDPC), which was later further reorganized into the National Development and Reform Commission (NDRC). This was a significant change because SDPC was not only responsible for policy-making, program development, and funding allocation on sustainable development; it was also the most powerful general policy-making agency in the central government. With the State Council's Environmental Protection Committee dissolved in 1998, the newly established NCGCCS was put under the direct leadership of the SDPC Chairman, Mr. Zeng Peiyan, who soon became a vice-premier of the country. This institutional arrangement continued under the new administration of President Hu Jintao and Premier Wen Jiabao, with SDPC reorganized into the current National Development and Reform Commission (NDRC). Mr. Ma Kai, Chairman of NDRC, took the leadership of the NCGCCS in 2003.

From an International Issue to a Priority Policy Agenda (2003–12)

During the Chinese leadership under President Hu Jintao and Premier Wen Jiabao (2003–12), a wave of popular interest and international pressure motivated the central government to formally elevate the priority of climate change in China's domestic policy agenda and in top-level diplomacy. The emphasis on development and the strategic nature of climate change were further highlighted by the central government when NCGCCS was reorganized again and elevated into the National Leading Group on Climate Change (NLGCC), led by Premier Wen Jiabao in June 2007. Members of this group include almost all ministers of the central government, representing 20 ministries. It is useful to note that NLGCC also serves as the State Council Leading Group on Energy Saving and Pollution Reduction, which means the central government officially coupled climate change and energy-saving policies. Specifically, the NLGCC is charged with formulating key national climate change strategies, making arrangements for domestic and international climate change efforts

and coordinating key problems in national climate change efforts. Only one month after the creation of the NLGCC, Premier Wen Jiabao presided over the first meeting of the NLGCC. During Wen's six-year term as the head of the NLGCC (2007–13), he convened four meetings of the NLGCC, in 2007, 2009, 2010, and 2011, respectively, which shows the level of priority attached to climate change by China's leadership.

On June 27, 2008, the Politburo, the top policy-making body of the Chinese government, organized the sixth collective learning of the term around the theme of global climate change and capacity building on climate change in China. Two scientists were invited to present their professional views and advice on addressing climate change in China. President Hu Jintao took this opportunity to stress the significance and urgency of climate change and emphasize that China will strengthen climate change capacity building and make continuous efforts in domestic and global sustainable development. In July 2008, the NDRC established the Department of Climate Change to take formal charge of policy formulation, international negotiation, and capacity building, and the creation of the carbon cap-and-trade market. The creation of the Department of Climate Change within the NDRC marked the formal establishment of an implementing agency of climate policy at the national level. Many provinces and municipalities followed the step of the central government by creating agencies in charge of climate change within their respective jurisdictions.

In June 2012, the National Center for Climate Change Strategy and International Cooperation (NCSC) was created as a research institution under the direct supervision of the NDRC. The NCSC was intended to provide strategic research support to climate policy-making at the national level as well as facilitating international cooperation on climate change. The NCSC mainly engages in research in the fields of strategic plans, policies and regulations, international policy, carbon market, and climate information consultation.

Not only did the Hu–Wen administration strengthen the policy-making institutions for climate change by creating the NLGCC and subsequently the Department of Climate Change within the NDRC, the administration also started formal formulation of climate policy during this period. The State Council released China's National Climate Change Program in June 2007, immediately following the creation of the NLGCC. The Program laid out China's efforts in combatting climate change, government understanding of climate change impact on China, the guiding principles the government takes, national objectives and measures, and China's position on international cooperation on climate change. The Program also set out the target of “reducing national average energy consumption per unit of GDP by 20 percent by 2020 compared to 2005 level, and correspondingly mitigating carbon dioxide emissions.” This target again shows that climate change is not treated a distinct

policy field, but closely intertwined with energy and environmental policies. The National Climate Change Program became the fundamental reference for climate policy-making in China. In addition to the Program, the Chinese government has consecutively released the annual reports entitled *China's Policies and Actions for Addressing Climate Change* since 2008, which introduces China's efforts and strategy for addressing climate change.

China's FYPs show the weights assigned to different issues on the Chinese policy agenda. The 12th FYP is a landmark in China's national policy-making on climate change. It marked the first national legislation on climate in China. Although China released its first policy document on climate change in 2007, that is, the National Climate Change Program, it was not until the adoption of 12th FYP that climate change was made an explicit component of national objectives. A whole chapter was dedicated in the 12th FYP to detailing national plans for concrete action on low-carbon development and set out a specific target of reducing carbon dioxide emissions per unit of GDP by 17 percent. Since FYPs are reviewed, debated, and voted on in the National People's Congress, they are effectively part of the national legislation (Qi & Wu, 2013).

Elevated Leadership for Climate Policy-making (2013–present)

With the advent of the new leadership under President Xi Jinping, China's climate policy-making entered a new era where climate change came under the direct supervision of President Xi Jinping, despite NLGCC's official status as the climate decision-making institution. In 2013, Premier Li Keqiang took over the leadership of the NLGCC, whose member ministries expanded from 20 to 26. In the past six years (2013–19), Premier Li convened two meetings for the NLGCC, in 2015 and in 2019, compared to four meetings convened by Wen Jiabao during his six-year term (2007–13) leading the NLGCC. On the other hand, President Xi took the leadership on both the domestic and international fronts related to climate change policy-making. When the US Secretary of State John Kerry was visiting Beijing early in 2014, it was Xi who met with him and made it clear that climate change is a national priority on China's policy agenda. Later in the year, Xi directly talked with US President Obama, and made the China–US Joint Announcement on Climate Change, which set an important foundation for the Paris Agreement in 2015. The Announcement was later adapted to become the Joint Presidential Statement on Climate Change between Xi and Obama in September 2015. During his state visit in Washington, Xi also announced the establishment of China's national carbon market for eight sectors of the economy, the largest carbon market in the world. In the same week, Xi attended the United Nations Climate Change Summit in New York, the first time the Head of State of China attended an

international gathering on climate change. It used to be that the premier, head of the National Leading Group on Climate Change, appeared on such occasions. A few weeks later, Xi once again attended the Paris Conference on Climate Change and stated China's national position on the issue and called for strengthened cooperation among all nations. Xi's visible leadership on climate policy-making in China is also shown in his effort to make the issue an opportunity for China to play a bigger role in global governance in general. This will be discussed in the next section. It is clear that the leadership on climate change policy-making in China shifted from the NLGCC to the head of state during the Xi era.

Elevating the leadership for climate policy-making to the top level has important implications. First, it accelerated international negotiation. In 2014, the climate negotiation between the world's two largest emitters was between two heads of state and the decision was a political one, while five years before that the negotiations remained primarily at a technical level. Even the premier's involvement and position were largely based on recommendations from the technocrats. Second, all levels of government become more serious about climate change policy implementation. Development of the national carbon market has been accelerated since Xi made the announcement. Since 2013, President Xi Jinping has reinforced China's commitment to addressing climate change. For the first time, China issued a series of mid- to long-term strategic plans for climate change, including the National Climate Change Adaptation Strategy (2013–20) and the National Climate Change Plan (2014–20). These strategic plans put forward China's main objectives and key tasks to address climate change mitigation and adaptation before 2020. The 13th FYP dedicates a whole chapter to climate change entitled "Employing a proactive approach to climate change," expanding the number of planning target indicators for natural resources and the environment from seven to ten, including: most prominently, reducing energy consumption per unit of GDP by 15 percent within the FYP period; increasing the share of non-fossil fuels in China's primary energy consumption by 3 percent; and reducing carbon dioxide emissions per unit of GDP by 18 percent. In the 2015 Paris Conference on Climate Change, China submitted its Intended Nationally Determined Contribution (INDC) to the Secretariat of UNFCCC, outlining its objectives including achieving the peaking of carbon dioxide emissions around 2030 and making best efforts to peak early, and proposing policy measures to ensure their implementation.

The elevation of policy-making leadership also helped with the reorganization of the climate change agency. In 2018, the functions of climate change and emissions mitigation within the NDRC were merged into the newly established MEE, which was considered the most significant institutional rearrangement in the history of climate change governance in China. The NLGCC was reorganized shortly after, with the addition of four ministries including the Ministry

of Culture, the People's Bank of China, and the newly created Ministry of Justice and China International Development Cooperation Agency. A general consensus is that moving the functions of climate change and emissions mitigation from the NDRC to the MEE is conducive to co-governance of the environment and climate change, since many energy-saving and carbon mitigation actions can generate co-benefits for air pollution control and GHG reduction. However, there are also concerns that this government reorganization may weaken the previously improving status of climate governance on China's policy agenda. After all, climate change governance requires coordination and collaboration among different agencies, particularly those related to economic and industrial policy. As the most powerful general policy-making agency in the central government, the NDRC oversees China's economic policy-making on a macro level and can coordinate the actions of departments that matter for climate change, which can facilitate the making of a unified, coordinated strategy for the transition toward a green, low-carbon economy. On the other hand, the ministry/agency in charge of the environment has been historically weak in terms of de facto power among all ministries at the central level. Most significant of all, due to the stereotype about environmental issues being in tension with economic growth, moving the function of climate governance to MEE might leave a false impression that the ministry would push forward climate initiatives at the cost of growth, which would dampen the existing ambitions around climate action.

CLIMATE POLICY IMPLEMENTATION

Target Responsibility System: Government Hierarchy as the Primary Apparatus for Climate Policy Implementation

The core institutional arrangement for ensuring the fulfillment of China's carbon reduction targets is the Target Responsibility System (TRS), based primarily on the five-level government hierarchy from the central level at the top to the county and township levels at the bottom. Under such a system, the central government makes energy intensity or carbon intensity targets, disaggregates the targets among all provinces, and then each province, in turn, disaggregates its own targets among all municipalities, until all the targets are assigned to all governments. Each government assigns targets to all relevant enterprises within its jurisdiction. The agreed target will then be monitored and verified as part of the key performance indicators to evaluate each government and enterprise. Reward and penalty are given based on the fulfillment of the requirements (Zhao & Wu, 2016). TRS is a typical policy implementation mechanism employed by the Chinese government to ensure policy performance and has been applied to a wide range of policy arenas

Table 7.3   *National ministries in charge of different industries prior to 2000*

Industry	Corresponding Ministry in Charge of the Industry
Iron and steel	Ministry of Metallurgical Industry (1982–98)
Non-ferrous metal	Ministry of Metallurgical Industry (1982–98)
Petroleum and petroleum engineering	Ministry of Petroleum Industry (1982–88) Ministry of Energy (1988–93)
Chemical engineering	Ministry of Chemical Industry (1982–98)
Construction materials	National Construction Materials Bureau (1982–2001)
Coal	Ministry of Coal Industry (1982–88; 1993–98) Ministry of Energy (1988–93)
Electric power	Ministry of Hydropower and Electric Power (1982–88) Ministry of Energy (1988–93) Ministry of Electric Power Industry (1993–98)
Papermaking	Ministry of Light Industry (1982–93) China Light Industry Association (1993–98)
Textiles	Ministry of Textile Industry (1982–93) China Textile Association (1993–98)

Source: Zhao et al. (2014).

including economic growth, family planning, and land use management (Li et al., 2013). TRS was first introduced to the field of energy saving and pollution emissions reduction during the 11th FYP period (2006–10) and subsequently to climate change mitigation, more specifically to enforce the national carbon intensity reduction target.

The key to the TRS is division of responsibilities among different administrative regions, or “blocks” (*kuai* in Chinese), while the previous system relied on responsible ministries and their lower-tiered agencies at various levels, or through “lines” (*tiao* in Chinese) (Qi & Wu, 2013). From 1980 to 1998, when most of the plants and factories were administered through responsible ministries, energy management was also put under ministerial control (Table 7.3). For example, energy saving in the iron and steel industry was administered by the Ministry of Metallurgical Industry, power plants by the Ministry of Electric Power, chemical industry by Ministry of Chemical Industry, and so on. Since 1998, these ministries have been reorganized into state-owned companies or industry associations, with their regulation responsibilities being essentially dissolved. Most of the enterprises previously administered by the ministries were either transformed into share-issuing corporations or into purely privatized companies, regulated by local governments under the principle of localized management. However, during this process of reform, the function of energy-saving regulation was not automatically transferred, leaving a gap

in energy-saving governance from 1998 through 2007. As a result, energy intensity reversed its 22-year decreasing trend.

In 2007, TRS was established as the basic energy policy implementation mechanism in China. It reinforced the role of the local government as the main implementer of energy policies, which marked the transition of China's energy-saving governance structure from a line-based system to a block-based one (Qi & Wu, 2013). Under the TRS, the national energy intensity reduction target was to be met using "responsibility contracts," which assigns energy-saving targets to lower levels of government and key energy-consuming enterprises, and then keeps track of and evaluates target performance through the Statistics Indicators, Monitoring, and Examination (SME) system (Li et al., 2013, 2016). The shift from a line-based approach to a block-based approach to energy saving not only changed the ways of implementing the policies but also changed the politics of local and central interactions. This change is expected to have a profound impact on climate change politics in China.

While TRS was only applied to energy-saving targets in the 11th FYP period, starting with the 12th FYP period, the TRS expanded to deliver the carbon intensity target set in the 12th FYP. The carbon mitigation TRS differs from the energy-saving TRS in terms of both the scope of target and the disaggregation paths. While the energy-saving target is both disaggregated to subnational governments and to enterprises, the carbon intensity target so far has only been disaggregated to provincial governments.

The transfer of pressure for saving energy and reducing carbon intensity from higher-level governments to lower-level governments (and key energy-consuming enterprises in the case of energy saving) is the basic characteristic of China's policy implementation system for reducing energy and carbon intensity. Although the TRS has proved effective in bringing down the national energy and carbon intensity, the mandatory targets and the associated performance evaluations have increased the tension and the chances of gaming between central and local governments. Compliance and enforcement were under pressure from the top, and self-enforcement by local governments and self-compliance by enterprises were less proactive, as the benefits are not as obvious as the immediate costs. Local governments and enterprises felt that they were paying to benefit the global environment, even as they struggled to meet their own economic targets. This, of course, is one of the pressing challenges of climate change policy implementation in the hierarchical structure of the Chinese government.

Since county governments and township governments are located at the bottom of the political hierarchy, they are the ultimate bearer of the pressure for saving energy and reducing carbon intensity. However, their ability to carry out energy-saving and carbon mitigation activities, which is a function of

human capital, institutional arrangement, financial resources and the authority of policy-making, does not match the amount of pressure that they bear (Li et al., 2013). First, compared to municipal and provincial governments, county and township governments possess much less capital that they can mobilize to support energy-saving and low-carbon activities. Moreover, although local governments are authorized to regulate all energy-consuming enterprises within their jurisdiction, in practice it is very difficult for lower-level governments to regulate large-scale state-owned enterprises, which have higher ranking in the political hierarchy. Last but not least, county and lower levels of government lack the technical capacity needed to meet local enterprises' demand for energy-saving technical services.

The asymmetry between pressure and capacity forces lower levels of government to more heavily rely on administrative measures when meeting their energy-saving targets, which could negatively impact society (Li et al., 2016; Zhao & Qi, 2020; Zhao et al., 2020). As previously mentioned, in the second half of 2010, that is, as the 11th FYP period came to an end, a number of local governments took extreme actions, such as power rationing, to ensure that their 11th FYP energy-saving targets were met. Some of these governments even restricted residential use of electricity. For example, Anping County, Hebei Province implemented county-wide power rationing in three batches, each lasting for 22 hours. During the period of power rationing, power supply was cut off for all households, hospitals as well as traffic lights. Although power rationing to some extent contributed to the goal of saving energy, such savings sometimes came at the expense of the normal functioning of society.

Visible and Invisible Hands for Renewable Energy Development

While energy-saving policy is not self-implementing and has to rely on pressure transfer down the government hierarchy, through the target responsibility system, renewable energy policy creates incentives to attract businesses into the playing field and it results in “win-win” situations between climate mitigation and economic growth. Developing renewable energy helps promote new industries through research and development, equipment manufacturing, deployment, and services. Such incentives may filter down to policy implementers at lower levels of government, presenting a means to improve both climate compliance and real economic growth. Large government assistance funds have helped China establish significant market shares in renewables by exploiting economies of scale. Investments in green power will continue to play an important role in development strategy in coming years, as the central government retains the renewable energy sector as a focal point of industrial policy (e.g., 12th FYP).

The National People's Congress passed the first Renewable Energy Law in 2005. The legislation encouraged the use of renewable sources for power generation, buildings and transportation by providing mandates and financial incentives. According to the legislation, major power generation companies were given quotas for renewable power similar to the Renewable Portfolio Standards (RPS) in the United States. The feed-in tariff to power grids was carefully set to ensure the profitability of power generation. Wind power installation capacity increased by more than 40-fold in the five years from 2005 to 2010, four times the target set by the central government.

Major state-owned banks were the main sources of financing for wind power equipment and installation, accounting for 80 percent of total project cost, and power companies only needed to come up with the remaining 20 percent of equity (Qi & Wu, 2013, Zhu et al., 2019). The financiers had little risk to worry about because most projects were financed against the balance sheets of the power generators companies, which are large, profitable, and state-owned. Local governments were also enthusiastic about wind power deployment in their territories, because the projects tended to bring investment and jobs. More importantly, local governments often required or persuaded the project developers to invest in equipment manufacturing in their regions under the "resource for industry" principle. This, too, made business sense because the long-distance transportation of wind turbines was a major concern in the industry. As a result, China now has not only the largest installed capacity of wind power generation but has also become the largest manufacturer of wind power generators.

The real politics in the wind energy business has been between the state and the state-owned power grid companies. As a mandate, the grids must take all electricity generated from the wind towers. Because of the remote locations and the intermittence problem of wind-generated electricity, grid companies considered this type of power as "garbage electricity" that creates more trouble than profit. Consequently, they tried vigorously to avoid the obligations imposed by the legal mandates. The amendment of the renewable energy law in 2009 required that power grids must take all power generated from wind. This new requirement seems to have taken the fight away from the politicians and moved it into the wider field, where the interests of the power generators and the grid companies need to be better aligned. However, implementation of the new law has been irregular because of the resistance from the grid companies.

Under the resource and policy support of central and local governments, large state-owned wind power developers and major state-owned banks worked together to form the unique wind power developing model in China. The implementation mechanisms for wind power developing can be summarized as: the central government creates policy and an institutional environ-

ment that is conducive to market development; the local government willingly cooperates with the central government; and project developers and financial institutions also proactively respond to government policies at all levels. Such a policy implementation model is hence characterized by a positive feedback mechanism and is self-implementing.

While wind power development in China is a central government-led process, solar power development took full advantage of market creation and development. The solar power industry had an unexpected, spectacular opportunity to grow. In 2005 when China passed the renewable energy legislation, the Kyoto Protocol took effect. Under the Protocol, the developed countries were required to cut their greenhouse gas emissions by a few percent by 2008–12, which created a demand for emissions reduction technology. In particular, solar power deployment in Europe created a sizable market worldwide for solar panels. The Chinese businesses seized the opportunity and developed into the largest suppliers of these panels, with the benefit of technology transfer from Europe and other developed countries. The invisible hand was a major pulling force for the renewable energy industry in China.

To the local governments who may not understand the importance of addressing climate change and GHG reduction, solar panel manufacturing is a perfect opportunity for industrial development. It means jobs, growth, and revenue. These local governments are so willing to promote this industry that they compete against each other to offer all possible assistance to solar panel manufacturing businesses, ranging from zero-cost land, to subsidized loans and tax refunds. The visible hand became a huge pushing hand for the industry. Local governments have not only promoted the manufacturing of solar PV panels, but also pushed the central government for preferential policies of deployment. For instance, the province of Jiangsu persuaded the NDRC to develop a high on-grid policy for solar PV generation.

CLIMATE POLICY AND GLOBAL GOVERNANCE

A Contributor and Leader in Global Climate Governance: China's Newfound Role

China has assumed an increasingly active role in global governance in recent years. At the center of President Xi's diplomatic philosophy is the concept of "a community of shared future for mankind" (*renlei mingyun gongtongti*), an idea culturally rooted in the Confucian concept of "*tianxia*," meaning "all under heaven" and emphasizing win-win cooperation rather than confrontation. Through the Belt and Road Initiative and the Asian Infrastructure Investment Bank, China is seeking to reshape global governance and transform the existing international system to address the global challenges. In

the process, China attempts to transform its role from a rule-taker that “keeps a low profile” (*taoguang yanghui*) to a rule-maker that “strives for achievement” (*yousuo zuowei*) (Yan, 2014).

The country’s growing leadership in global climate governance is illustrative. As President Xi Jinping said in his speech made at the 19th CPC Congress, “taking a driving seat in international cooperation to respond to climate change, China has become an important participant, contributor, and torchbearer in the global endeavor for ecological civilization.” In the Joint Presidential Statement between Xi and Obama in 2015, it is stated that climate change is the greatest threat to humanity. Despite divergent national interests, all nations in the world share a common interest in climate change, hence are more willing to cooperate in global climate governance than in other world affairs such as security, trade, arms, and geopolitics. China therefore views joint efforts in global climate change as a key testing field and a demonstration case for the philosophy of building a community of shared future for humankind.

China’s climate policy will have a major impact on global climate change governance given its role as the world’s largest net exporter of embodied carbon (Liu et al., 2016). The past three decades have witnessed low-cost, emissions-intensive manufacturing moving to developing countries, particularly China, which has been producing emissions-intensive products for consumption in developed countries. The net emissions transfer via international trade from developing to developed countries increased from 0.4Gt CO₂ in 1990 to 1.6 Gt CO₂ in 2008 (Peters et al., 2011). Embodied carbon flow is considered a primary factor behind the slowdown of carbon emissions in developed countries and the rapid growth of emissions in developing countries (Jiang et al., 2019; Long et al., 2018; Weber et al., 2008). In 2007, emissions in China were 7.3 GtCO₂ (production-based emissions), of which 1.7 Gt (23 percent) were related to goods exported and ultimately consumed in other countries (Feng et al., 2013; Weber et al., 2008). Since manufacturing in developing countries such as China is more carbon intensive than in developed countries, international trade increases global CO₂ emissions, that is, the carbon leakage problem. China’s efforts to improve production technologies and decarbonize the underlying energy systems will, to a great extent, reduce global trade-related emissions.

While China tries to reshape global governance through the Belt and Road Initiative, the potential carbon footprint of this global initiative can hardly be overlooked and may potentially put the Paris Agreement at risk. The infrastructure projects as planned in Belt and Road countries not only require substantial energy consumption, but also create carbon lock-in in the next few decades since a large proportion of the construction infrastructure is energy facilities, particularly fossil fuel-fired power plants (Qi et al., 2019). Extending

China's supply chain by streamlining exports to Belt and Road countries also leads to the growth of China's energy-intensive industries, which further increases global carbon emissions. It is therefore strongly recommended that development financial institutions in China establish or adopt guidelines and specifications for financing green, climate-friendly projects in the Belt and Road Initiative, such as the Green Investment Principles (Green Finance Committee [GFC], 2018).

International Climate Collaboration

China has worked closely with major economies in the world to address global climate change through bilateral and multilateral platforms. In 2015 alone, China made joint announcements on climate change: with the European Union in June, with the United States in September, and with France in November. China also played a critical role in facilitating climate collaborations on multilateral platforms such as the Group of Twenty (G20) Summit, BRICS (an association of five major emerging national economies: Brazil, Russia, India, China and South Africa) Meetings, and the Major Economies Forum on Energy and Climate. Take the G20 Summit as an example. As the host state of the G20 Summit in 2016, China effectively advanced the multilateral process on climate change under the G20 framework. China, along with the US, submitted its ratification document for the Paris Agreement to Ban Ki-moon, then Secretary General of the United Nations, launched a Climate Finance Study Group (CFSG) in addition to the Green Finance Study Group (GFSG), as well as announcing the Presidency Statement on Climate Change at the G20 Sherpa Meeting.

Moreover, China has been a supporter and practitioner of South–South cooperation on climate change, mainly in the forms of a climate fund, material donation, and capacity building. In June 2012, then Premier Wen Jiabao announced at the UN Conference on Sustainable Development (Rio+20) that China would provide 200 million RMB to support South–South cooperation on climate change in the next three years. In September 2014, Vice-Premier Zhang Gaoli, who was also President Xi Jinping's special representative, announced during the UN Climate Summit that China would increase its support to and create a fund for South–South cooperation. In September 2015, the China–US Joint Announcement on Climate Change specified the size of the climate fund: 20 billion RMB. In December 2015, President Xi Jinping announced the “Ten-Hundred-Thousand” program: launching ten low-carbon demonstration zones and 100 mitigation and adaptation projects in developing countries and training 1000 officials for climate change. As of October 2019, China has signed material donation memoranda with more than 20 countries and regions, deploying designated funds worth over 720 million RMB, donat-

ing large amounts of energy-saving products to developing countries, and providing them with over 4000 training opportunities.

To summarize, China has developed a system of climate policy over a course of three decades. The policy-making and implementation system has gone through several stages of evolution. It started by treating the issue of climate change as a natural phenomenon to be addressed by scientists, and then as an international issue handled by diplomats, and finally as a strategic issue related to economic development and global governance and thus to be led by the top leadership. Increasingly climate policy-making has moved up to become a national priority on the policy agenda and take a unique place in China's strategic planning and the FYPs. Climate policy implementation initially relied primarily on the government hierarchy and the government's dominating influence on businesses. Gradually, economic incentives are added to the mechanisms of implementation. Currently, the carbon market is given high hopes and expectations as a major instrument for climate policy implementation in China. It is worth noting that China's national low-carbon development pilot program spanning the whole decade since 2010 has played a significant role in policy learning, design and diffusion. Under the current administration, climate policy-making has not only moved up to the top leadership, but also been given unprecedented significance as China's opportunity to help reshape global governance. With concerted international efforts, this may also develop into a real opportunity for the world.

NOTES

1. China's nine strategic emerging industries include next-generation information technology (IT), high-end equipment manufacturing, new materials, biotechnology, new-energy vehicles (NEVs), new-energy, energy-efficient and environmental technologies, digital innovation, and related services.
2. The legal term for the Top 10 000 Enterprises, as defined in the 2008 China Energy Conservation Law, is key energy-consuming entities (*zhongdian yong-neng danwei*), which refers to two categories of energy-consuming entities: (1) organizations whose annual energy consumption exceeds 10 000 tce; and (2) organizations whose annual energy consumption ranges between 5000 tce and 10 000 tce but are designated by the relevant national agencies of the State Council or provincial-level government agencies in charge of energy saving to be key energy-consuming entities.
3. "Sponge cities are designed to absorb large quantities of water and disperse it back into the environment in a slow manner...[utilizing][p]ermeable roads and sidewalks, green roofs, wetlands and natural vegetation absorb, infiltrate, store, purify, drain and manage rainwater" (Fuldauer, 2019).

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