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Three Decades of Climate Policymaking in China: A View of Learning

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Abstract: Climate policymaking in China has gone through three major phases over the course of three decades. This paper applies the concept of policy learning to an analysis of what the Chinese government has learned about climate policymaking during this period. Our analysis shows that this thirty-year history of climate policymaking can be viewed as a conceptual learning process because the Chinese government has continuously adjusted the problem definition of climate change, redefined climate policy goals, and updated climate strategies. First, the Chinese leadership has redefined climate change from a scientific and diplomatic problem, to a developmental and strategic issue, and finally to an overarching grand strategy guiding national development in the next forty years. Second, the Chinese government has fundamentally redefined its climate policy goal from avoiding climate action so as to foster economic development to reinvigorating economic development through climate action. Third, the Chinese government has updated its climate change strategy from solely emphasizing climate mitigation to a more balanced consideration of mitigation and adaptation, and from state-dominant governance processes to more diversified governance processes that involve the participation of the corporate sector and a greater role of the law.



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1. Introduction

When it comes to climate change, no single country has attracted more attention than China, the world's largest energy consumer and carbon emitter. China's carbon emissions have been continuously growing since the Open and Reform Era and went through a period of rapid acceleration during the early 2000s with the country's accession to the World Trade Organization. China replaced the United States as the world's No.1 carbon emitter in 2007. By 2012, China's emissions had already exceeded those of the United States and Europe combined [1]. Today, China accounts for approximately 28% of global total emissions [2].

The Chinese leadership have long recognized the importance of climate control mitigation and started engaging in climate policymaking as early as in the 1990s. China's climate mitigation policies have focused on energy conservation, renewable energy development, and low-carbon pilots [3]. By implementing these mitigation policies, China achieved a 48.4% reduction in carbon intensity by 2020 compared to 2005 levels, exceeding the 40–45% Nationally Appropriate Mitigation Actions (NAMAs) targets created in Copenhagen in 2009 [4]. During the same period, the percentage of non-fossil fuels in total energy consumption increased to 15.9%, also exceeding the Copenhagen target of 15%.

On 22 September 2020, President Xi Jinping made the commitments that “China will aim to hit peak emissions before 2030 and for carbon neutrality by 2060” [5]. The so-called “dual carbon targets” (carbon peak and carbon neutrality) are arguably the most ambitious climate commitments in the history of climate policymaking in China given that China only

has 30 years to reach carbon neutrality following its carbon peak, compared to 60 years for the European Union and 45 years for the United States. The targets demonstrate China's determination to not only play a part in but also to lead the world in climate change governance. In the lead up to the COP26 in October 2021, China updated its Nationally Determined Contributions (NDC) targets for 2030 by increasing the carbon intensity reduction target from 60–65% to 65%, the non-fossil share in primary energy mix from 20% to 25%, the forest volume increase from 4.5 billion m³ to 6 billion m³, as well as setting a specific wind and solar power generating capacity of over 1200 GW. Whether or not China can turn its carbon neutrality pledge into reality is integral to meeting the global 1.5 °C target [6].

This paper attempts to contribute to the existing literature on climate governance in China by applying the concept of policy learning to an analysis of what the Chinese government has learned about climate policymaking during the past three decades. Ever since Hecló's *Modern Social Politics in Britain and Sweden* [7], policy learning has proven a useful way to understand policy change to complement the traditional conflict-centered approaches to policy change. Policy learning can be broadly understood as alteration in behavior based on experience to better achieve the goal of governance [8]. A central question in policy learning research is the object of learning, i.e., what is being learnt [9]. Researchers have differentiated between two levels of learning achieved by policymakers: a lower-level learning named instrumental learning, i.e., searching for new means or instruments of policy only, and a higher-level learning named conceptual learning, i.e., redefining policy goals and adjusting problem definitions and strategies [10]. Following the conventions in policy learning research [9,11,12], this paper attempts to detect the learning processes in Chinese government's climate policymaking by finding evidence of enhanced cognition and increased intelligence behind the changes in policymaking. Identifying the learning processes then allows us to draw conclusions about the level of learning achieved by the Chinese government in climate policymaking.

As the ancient Chinese saying goes, "with history as a mirror, one can understand the rise and fall of a state". Understanding the learning behind climate policymaking in China not only helps domestic decision makers better anchor the way forward, but also provides key references for other developing countries struggling with multiple socioeconomic challenges, including climate change and economic development. In formulating answers to the research question, the authors pool the insights arising from our prior research in the past 15 years as well as discussions with domestic and international colleagues. In particular, this article builds on our earlier research on the history of climate governance in China, primarily for the early periods of climate policymaking, i.e., the first 2 phases as defined in Section 2 [13–15]. While our earlier research has a broader scope on the content of climate policy as well as the process of climate policymaking and implementation, this paper exclusively focuses on the process of policymaking. Section 2 provides new factual details about the history of climate policymaking beyond those introduced in our previous research [13–15], particularly the latest developments since the adoption of the dual carbon targets in 2020, as well as adding our original insights about the evolution. Most importantly, Section 3 interprets the history of climate policymaking in China as a multidimensional conceptual learning process: learning about the nature of climate policy, learning about the relationship between climate change and economic development, learning to elevate the status of climate adaptation relative to mitigation, and finally learning to diversify climate governance processes. Section 4 summarizes the findings and raises a few caveats.

2. Evolution of Climate Change Policymaking in China

2.1. Fact-Finding about Climate Change (1990s–2007)

China's encounter with climate change started with scientific research [16]. The central government initially did not regard climate change as an issue of policy relevance, but primarily as a scientific problem, more specifically a natural science problem [17]. Since

the First World Climate Conference (WCC-1) in 1979, scientific research on climate change became increasingly active. The WCC-1 endorsed plans to establish a World Climate Program (WCP) under the joint responsibility of the World Meteorological Organization (WMO), the United Nations Environment Program (UNEP), and the International Council of Scientific Unions (ICSU). In 1987, the State Science and Technology Commission (later reorganized into the Ministry of Science and Technology in 1998) established the China National Climate Commission (CNCC). Following the setup of the WCP, the CNCC also established different sub-commissions on climate research, climate applications, climate impact, and climate documentation.

In 1990, China established the National Coordination Group on Climate Change (NCGCC) under the State Council's Environmental Protection Committee (SCEPC). The NCGCC set up four working groups, namely scientific appraisal, impact assessment, strategy, and international agreements [16]. This setup shows that the primary functions of the NCGCC were to enhance understanding of the science behind and the impacts of climate change and to help China with both domestic climate strategy and the strategy for international negotiations [18,19]. The NCGCC was chaired by Mr. Song Jian, who was a renowned scientist and an academician (Academician is the highest academic title in science and technology in China. Academicians are elected through either the Chinese Academy of Sciences or the Chinese Academy of Engineering.) and served as the Chairman of SCEPC and the State Councilor. The secretariat of the NCGCC was located in the State Meteorological Administration (SMA, later the China Meteorological Administration (CMA)), which houses some of the country's best meteorologists.

This early learning process suggests that climate change was not just a scientific problem for meteorologists, but an issue of strategic importance since economic activities powered by fossil fuels are major anthropogenic causes of climate change [20]. In other words, China's future development strategy and path will determine its emissions and the consequent impact on climate change. As a result, the NCGCC was renamed the National Coordination Group on Climate Change Strategy (NCGCCS) in 1998. Meanwhile, the secretariat was relocated from the SMA to the State Development Planning Commission (SDPC), the single most powerful macro-policymaking agency in the central government [21]. The NCGCCS was chaired by Mr. Zeng Peiyan, who was then the SDPC Chairman. After the SDPC was reorganized into the current National Development and Reform Commission (NDRC) in 2003, the leadership of the NCGCCS was shifted to Mr. Ma Kai, Chairman of the NDRC. It is important to note that despite its key role as an interagency coordination group, NCGCCS's policymaking authority was very limited. This means that there was a lack of climate policymaking institutions at the national level.

In addition to the NDRC, 2 other ministries, namely the Ministry of Foreign Affairs (MFA) and the Ministry of Science and Technology (MOST), played key roles in this earliest period of climate policymaking. While the MFA led China's climate negotiations, the MOST, particularly the Administrative Center for China's Agenda 21 affiliated with MOST, was mainly in charge of commissioning, organizing, and conducting scientific research on climate change [17]. As the issue of climate change later moved from the scientific to the political arena, however, the role of MOST was gradually marginalized [16].

In recognition of the necessity of facilitating scientific research on climate change that could provide the basis for policymaking, in 2005, academician Qin Dahe, then director of the CMA, convened 8 other academicians and suggested the establishment of a "think tank" on climate change in China. At the tenth meeting of the NCGCCS in August 2006, the China National Expert Committee on Climate Change (CNECCC) was established. Known as "the brain" of climate change policymaking in China, the CNECCC has remained the highest-level think tank on climate change in China and a major technical support to scientific research and policymaking of climate change since 2007 [22]. The first CNECCC committee was composed of 12 experts, including eight academicians. (Specifically, these 12 experts are Sun Honglie from the Chinese Academy of Sciences, Ding Yihui from the CMA, He Jiankun from Tsinghua University, Chao Jiping from the State Oceanic Administration,

Lang Siwei from the Chinese Academy of Building Research, Li Lierong from the Ministry of Land and Resources, Lin Erda from Chinese Academy of Agricultural Sciences, Pan Jiahua from Chinese Academy of Social Sciences, Wu Guoxiong from the Chinese Academy of Sciences, Yin Gai from the State Environmental Protection Administration, Jiang Youxu from the Chinese Academy of Forestry, and Zhou Dadi from the Energy Research Institute of the NDRC. Academician Sun Honglie, former vice president of the Chinese Academy of Sciences, was the founding chairman, and academician Ding Yihui, special advisor on climate change in the CMA, and Professor HE Jiankun, former vice president of Tsinghua University, were the founding vice chairmen). The committee members had expertise in a wide range of climate-related areas, but mostly in natural science and engineering (such as atmospheric science, oceanography, hydrology, geology, ecology, forestry, energy, transport, and buildings), whereas He Jiankun and Pan Jiahua were the only two members with social sciences background in energy economics and climate policy. This unbalanced make-up of the CNECCC again confirms that at this earlier period, climate change was primarily regarded as a scientific problem to be addressed by natural scientists. The CNECCC administrative office is located within the CMA, which provides support and coordination to CNECCC and acts as a liaison between the CNECCC and the National Leading Group on Climate Change, which was reorganized from the NCGCCS and has hence remained the highest-level climate policymaking institution in China. This means that the CNECCC has direct channels through which to feed their scientific research and policy recommendations to the national policymakers. One of the core tasks of the think tank is to “deliver weapons and ammunition to those at the negotiating table” [23]. During the Copenhagen Conference, the CNECCC provided key advice to the negotiators in the Chinese delegation.

2.2. Making Climate Change a Priority Policy Agenda (2007–2013)

The first turning point in the history of climate policymaking in China occurred in 2007, when the country was about to exceed the United States to become the world’s largest carbon emitter and when the Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report forecasted dramatic effects of climate change on China. Confronted with unprecedented international pressures, the central government started to attach unprecedented importance to climate change [24]. For the first time of history, in June 2008, the leadership attended collective learning around climate change organized by the Politburo where 2 scientists, Professor He Jiankun of Tsinghua University and Professor Luo Yong of the National Center for Climate Research, gave lectures on the science and potential strategy for global climate change.

The Hu-Wen administration took a series of actions to strengthen the institutional building for climate change [22]. First, the NCGCCS was reorganized into the National Leading Group on Climate Change (NLGCC) as China’s first climate policymaking institution, led by Premier Wen Jiabao. This reorganization marked substantive change in the function of the group from coordination to decision making. Since then, the NLGCC has remained (at least in principle) the highest policymaking institution in China. In addition, the NDRC established the Department of Climate Change as the agency in charge of climate policy implementation at the national level. With the establishment of both policymaking and policy implementation institutions, China started formal policy formulation of climate change, starting with the releasing of the National Climate Change Program in June 2007, which served as the reference for other climate policies in China. The National Climate Change Program set China’s first explicit target for climate change: by 2010, the energy consumption per unit of GDP will be reduced by about 20% compared with 2005, and carbon dioxide emissions will be reduced accordingly. Since 2008, the State Council has been publishing the annual “climate change white papers”, i.e., China’s Policies and Actions for Addressing Climate Change.

On the international front, the MFA established a Leading Group for International Work on Climate Change (LGIWCC) led by then Minister Yang Jiechi in September 2007. At the same time, the MFA decided to set up a special representative for climate change

negotiations. The MFA established the Climate Change Office based on the International Environmental Law Division of the Department of Treaty and Law, which is mainly responsible for the daily affairs and related coordination and research work of the LGIWCC. The establishment of the LGIWCC confirms that climate change was first and foremost treated as an international problem triggered by international pressures, and then as a domestic issue of sustainable development.

Whereas climate policies in the 11th Five-Year-Plan period (2005–2010) were mostly embedded in energy saving policies or comprehensive socioeconomic policies, during the 12th Five-Year-Plan period (2010–2015), China began to launch policies and programs specifically targeting climate change such as the low-carbon cities pilot (first batch launched in 2010) and the carbon trading pilot at the municipal and provincial levels (first batch launched in 2012), instead of as an integral part of comprehensive energy consumption or economic development policy [25]. The 12th Five-Year-Plan (FYP) dedicated a whole chapter—the first chapter of Part Six on “Green development”—to low-carbon development and set out the first mandatory target of reducing carbon intensity, i.e., carbon dioxide emissions per unit of GDP, by 17% (the targets in the Five-Year-Plans in China are grouped into 2 categories: anticipatory targets and mandatory targets. Anticipatory targets are the development goals set by the national government and expected to be achieved by local governments. These targets are mainly achieved by the autonomous behavior of market entities. Mandatory targets are the work requirements of the central government on local governments and relevant departments of the central government in the fields of public services and public interests. The local governments and relevant departments of the central government are held accountable by the central government and must ensure that these mandatory targets are achieved through the rational allocation of public resources and the effective use of administrative power).

2.3. Elevating the Leadership on Climate Change Policymaking to the Head of State (2014–Present)

Since 2014, China has entered a new era of proactive climate policymaking under the direct leadership of President Xi Jinping, even though the NLGCC has remained the official policymaking agency at the national level. President Xi regards climate change as an opportunity for China to establish a leading role in global climate governance or in global governance in general [26]. Indeed, the landmark China-US Joint Announcement on Climate Change promoted and accelerated the process of ratification of the Paris Agreement on Climate Change in 2015. President Xi’s announcement on September 22, 2020 that “China would aim to hit peak emissions before 2030 and for carbon neutrality by 2060” marks a new, and arguably the most important, milestone in China’s 30-year history of climate policymaking (see Figure 1 for important milestones in climate policymaking in China in the past three decades). China was the first developing country to commit to carbon neutrality, and the target was generally aligned with the global 1.5 °C target [27]. That China committed to the “dual carbon targets” before Biden won the US presidential election in November 2020 demonstrates China’s independent, resolute climate policymaking [28]. In the lead-up to the COP26 in October 2021, China updated its NDC targets for 2030 by increasing the carbon intensity reduction target to 65%, the non-fossil share in primary energy mix to 25%, forest volume increase to 6 billion m³, as well as a specific wind and solar power generating capacity of over 1200 GW. In September 2021, China showed further determination to honor its commitment when President Xi announced that China would stop constructing any new coal-fired power plants abroad, joining Japan and Korea who had both made the same commitments earlier.

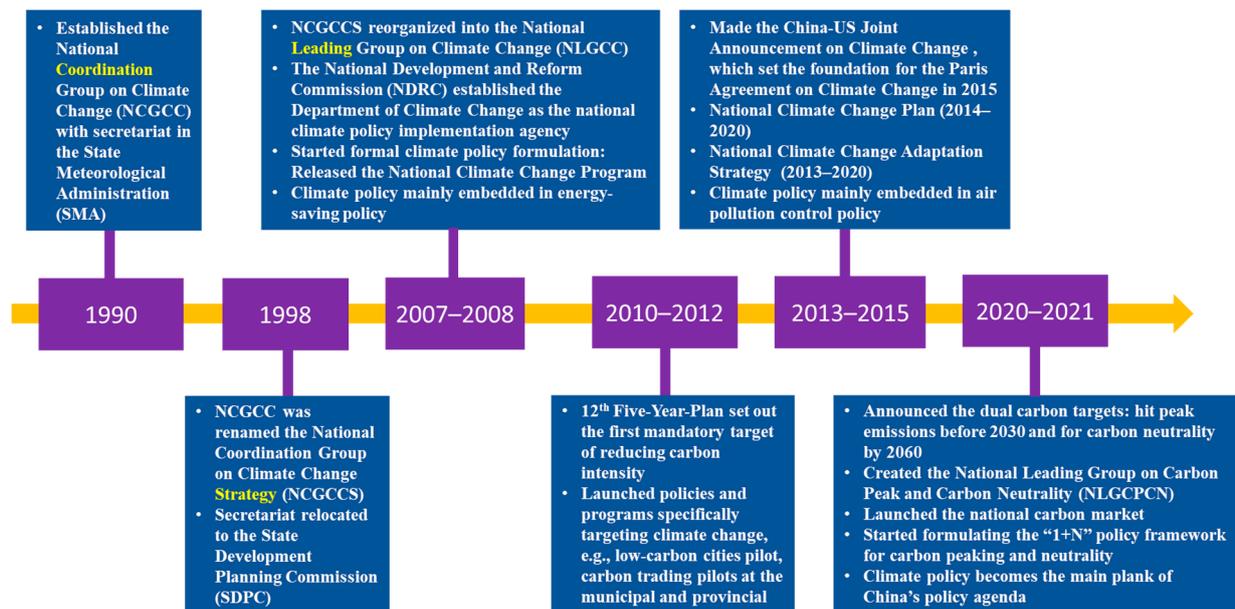


Figure 1. Important Milestones in Climate Change Policymaking in China (1990–2021).

Since the announcement of the dual carbon targets, a series of institutional arrangements and re-arrangements have taken place. In May 2021, the State Council created the “National Leading Group on Carbon Peak and Carbon Neutrality” (NLGCPCN) responsible for macro-strategic planning, organization, and coordination for the dual carbon targets, with vice premier Han Zheng as the leader and an office set up within the NDRC. The group held its first meeting on 26 May 2021, with participants including vice premier Liu He, State Councilor Wang Yong, State Councilor and Minister of Foreign Affairs Wang Yi, Director of NDRC He Lifeng, Minister of Finance Liu Kun, Minister of Science and Technology Wang Zhigang, Deputy Director of NDRC Tang Dengjie, Minister of Ecology and Environment Huang Runqiu, as well as ministers and directors from other relevant agencies (other participants included the Minister of Housing and Urban-Rural Development Wang Menghui, Minister of Industry and Information Technology Xiao Yaqing, Minister of Natural Resources Lu Hao, Minister of Transport Li Xiaopeng, Minister of Commerce Wang Wentao, Director of the State Administration for Market Regulation Zhang Gong, Director of the State-Owned Assets Supervision and Administration Commission Hao Peng, Deputy Director of the Population, Resources and Environment Committee of the National Committee of the Chinese People’s Political Consultative Conference Xie Zhenhua, Director of the National Bureau of Statistics Ning Jizhe, Director of the State Administration of Taxation Wang Jun, People’s Bank of China President Yi Gang; Chairman of China Banking and Insurance Regulatory Commission Guo Shuqing, Vice Minister of Education Sun Yao, Director of the National Energy Administration Zhang Jianhua, Director of the China Meteorological Administration Zhuang Guotai, Director of the State Forestry and Grassland Administration Guan Zhiou). The NLGCPCN directly reports to the Central Committee of the Chinese Communist Party instead of the State Council, which shows the increasing level of priority attached to climate change in China [22]. In August 2021, recognizing the critical role of data accuracy for achieving carbon neutrality and the challenges for data reporting, the NLGCPCN created a carbon emissions statistical accounting working group, headed by senior officials from the Department of Resource Conservation and Environmental Protection (DRCEP) of NDRC and the Energy Accounting Division of the National Bureau of Statistics. This working group is in charge of organizing and coordinating carbon emission statistics and accounting work across different regions and industries.

Although the function of climate policy implementation at the national level officially shifted from the NDRC to the newly established Ministry of Ecology and Environment (MEE) in 2018, the NDRC has regained its primacy as the highest-level climate policy agency in China since 2020, as it takes overall charge of carbon peaking and neutrality (more specifically, the DRCEP within the NDRC). The MEE, on the other hand, is now playing the role as the implementer of specific policies and programs such as supervising the national carbon market launched in July 2021. At present, the NDRC is formulating the so-called “1+N” policy framework for carbon peaking and neutrality, where the “1” indicates the overarching “dual carbon strategy” released on September 22, 2021 in the “Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy”. The Working Guidance plays the leading role in the “1+N” policy system and envisions a fully established green, low-carbon, circular economy by 2060. Key indicators of this new economy include but are not limited to an 80% share of non-fossil energy consumption by 2060. “N” in the “1+N” policy framework indicates the implementation plans for key areas and sectors such as energy, industry, transportation, and urban-rural construction, and supporting measures in terms of technological support, energy security, carbon sink capacity, fiscal and financial price policies, standard measurement systems, and supervision and evaluation. The first implementation plan came out on 26 October 2021 in the form of the “Action Plan for Carbon Dioxide Peaking before 2030”. Sector-specific implementation plans are being released by relevant industries. Almost all provinces and over 70 cities have proposed their carbon peaking targets, among which 4 provincial targets and 55 municipal targets are no later than 2025.

3. Climate Policymaking as a Learning Process

3.1. Learning about the Strategic Nature of Climate Policy

Over the course of thirty years, the Chinese government has increasingly recognized the strategic nature of climate policy. Climate change was initially treated as a purely scientific problem to be solved by natural scientists, which can be seen from the heavy focus on research as a primary function of the NCGCC, the leading role of the SMA as the governing body for climate change, and the establishment of the CNECCC mainly composed of natural scientists. As China experienced more pressures from the international community during climate negotiations, climate change also became a diplomatic issue. China initially employed a reactive strategy for climate change, especially manifested in its defensive, conservative attitude about making any commitments for carbon mitigation in international negotiations and its adamant opposition to any imposed obligations [19,29]. However, the Chinese leadership soon recognized that climate change was much more than a scientific and diplomatic problem. Instead, it concerns long-term domestic economic development, since China’s emissions pathway very much depends on its pattern of economic development, particularly its industrial structure. As a result, China started formal climate policymaking and institutional building after 2007. With the advent of the Xi Administration, the strategic status of climate change was further elevated. Especially since the announcement of the dual carbon targets, climate change has become an overarching grand strategy guiding national development in the next forty years. This marks the second time that Chinese leadership ever made such a long-term grand strategy in the history of contemporary China—the last time was the 3-step development strategy put forward in 1987 (the Three-Step Development Strategy sets concrete objectives in 3 steps: The first step is to double the 1980 GNP and ensure that the people have enough food and clothing, which was attained by the end of the 1980s. The second step is to quadruple the 1980 GNP by the end of the 20th century, which was achieved in 1995, ahead of time. The third step is to increase the per-capita GNP to the level of the medium-developed countries by the mid-21st century). The Xi Jinping administration has pinned hopes on climate action as China’s opportunity to transform its socioeconomic system as well as to establish its leadership in global governance.

The deeper understanding of the nature of climate change contributed to the independent, rising status of climate policy on domestic policy agenda. Historically, climate change was achieved as co-benefits of other policies—first energy-saving policy and then air pollution policy. In the early period of climate policymaking (before 2010), the central government officially bundled climate change policy with energy-saving policy [20,30]. While energy saving was indeed key to climate change, this “bundling” approach downplayed the distinctive nature of climate change and resulted in the absence of clear policies for climate change mitigation and adaptation [13]. China’s earliest climate change target, which appeared in the National Climate Change Program in 2007, took the form of an energy intensity reduction target. More evidently, the full name of the NLGCC was the National Leading Group on Climate Change and Energy Saving and Pollution Reduction (this phenomenon is commonly known as “one organization, two names”. In the Chinese government system, an organization may have two separate names, either of which can be used depending on the needs of the work). Similar to the national governments, the provincial governments also took a “bundling” approach to address climate change [31]. Within one year after the establishment of the NLGCC, almost all provinces created their leading groups. Interestingly, the majority of the provinces named their leading groups as “energy saving and pollution reduction” or “energy saving” only, even though they also clearly stated that climate change is included in the leading groups’ scope of responsibility. On the other hand, only eight provinces combined their leading groups on energy saving and pollution reduction with leading groups on climate change. Among the eight provinces, Qinghai Province, part of the Qinghai-Tibetan plateau, is the only province that did not make any association between climate change and energy saving, i.e., it set up a leading group on climate change only. This is largely due to the province’s special vulnerability to climate change impact. The mixed reactions of the provinces again confirm that the provincial governments—similarly to the national government—did not treat climate change and energy saving separately, and prioritized energy saving to climate change since the former would lower the cost of economic growth. However, the provinces were willing to take on the responsibility for climate mitigation since they could reap the climate co-benefits by saving energy and did not have to do additional work for climate change alone.

During the 12th FYP period, climate mitigation was largely achieved as co-benefits of air pollution control, in response to rising domestic concerns about air pollution, particularly among China’s middle class [32–35]. It was estimated that PM2.5 exposure resulted in over 2 million deaths in China in 2015 [36]. A signal event that triggered Chinese people’s health concerns about air pollution occurred during the so-called PM2.5 crisis in November 2011, with a heated debate on social media over the drastically different characterizations of PM2.5 levels reported by the American Embassy (hazardous) and the Beijing Municipal Environmental Protection Bureau (light pollution). This crisis changed the problem definition of PM2.5 pollution from an environmental accident due to delinquency of environmental agencies to a political issue where environmental information distortion led to distrust for the ruling party and had the potential to impact social stability [37]. Realizing the political nature of the problem, the then Ministry of Environmental Protection drafted an Air Pollution Prevention and Control Action Plan for the 2013–2017 period, the toughest-ever clean air policy in the country [38]. The plan was enforced through policies that aim to limit the use of fossil fuel by promoting an optimized energy structure, clean energy, and energy efficiency as well as recent coal-cap policies, which had co-benefits of air pollution control and climate mitigation [22]. Since then, co-governance of air pollution and climate change has become the primary approach used by China to tackle climate change [25]. In particular, the medium to long-term strategy is that “the blue sky drives carbon mitigation before 2030, and carbon mitigation drives the blue sky after 2030” [39]. The shifting of climate change function from the NDRC to the MEE in 2018 solidified and facilitated this co-governance approach.

With the advent of the dual carbon targets, for the first time in history, climate change finally earns its own distinctive identity and is no longer nested with energy conservation,

air pollution, or any other policy. Instead, climate policy, particularly the dual carbon targets, have become the main plank of China's policy agenda and now drive policies in virtually all sectors, instead of acting as a "free-rider" of related policies previously. The hope is that carbon neutrality will become the ultimate driving force for an economic and social revolution in China.

3.2. Learning about the Win-Win Relationship between Climate Actions and Economic Development

Not only has the Chinese government adjusted the problem definition of climate change from a scientific problem to a strategic one, the Chinese leadership has also redefined its policy goal as its mindsets regarding the relationship between climate action and economic development went through dramatic changes. For a long period in history, climate mitigation efforts were believed to work against China's economic interests [21]. After all, China's thirty-year double-digit economic growth was closely coupled with growth in coal consumption [40]. There were concerns among prominent Chinese scholars that taking climate mitigation action not only creates near-term economic losses, but also imposes a constraint on the scale and level of long-term economic development [41,42].

As the understanding of the adverse impacts and strategic importance of climate policy deepened, the leadership developed new perspectives on the relationship between climate action and economy: the costs of climate inaction are actually higher than the costs of action [43]. This new understanding was strengthened by the PM2.5 crisis in 2012, when the country's leaders realized that environmental pollution would take toll on the Chinese economy by costing human lives and driving domestic talents and foreign investment away to environmentally safer places [44]. As a result, the government decided to set up a green agenda to avoid substantial economic costs of further deterioration, starting with reducing fossil fuel use, which address both air pollution and climate change.

As time progressed, this understanding was further updated, as manifested in Xi Jinping's regular pronouncement that "clear waters and green mountains are as valuable as mountains of gold and silver", also known as the "Theory of Two Mountains". This theory indicates Xi's belief that the relationship between environmental action and economic growth is not an "either or" question: China may achieve lasting economic growth at the same time as addressing environmental problems, including climate change, i.e., the so-called "green and high quality development" [45]. The Theory of Two Mountains was written into the report delivered by President Xi Jinping at the 19th National Congress of the CPC in 2017 and included in the revised Constitution of the CPC.

As the whole world confronts the twin challenges of COVID-19 pandemic and climate change today, the Chinese leadership has decided to simultaneously address the twin threats through a green, low-carbon recovery of the economy [46]. In the aftermath of the 2007–2008 financial crisis, the Chinese government launched the 4 trillion yuan (US\$559 billion) fiscal stimulus packages, which resulted in the overinvestment in high-carbon infrastructure and locked in emissions for decades to come. This time around, the post-pandemic stimulus package, which will likely top 10 trillion yuan, centers around the so-called "new infrastructure", ranging from 5G, AI, and data infrastructure to electric vehicles, ultra-high voltage (UHV) power lines, and "smart" solution for cities, such as traffic and education. A study commissioned by Greenpeace East Asia and CANGO [47] found that investment in new infrastructure would cut down carbon dioxide emissions during the production process by 7.24% compared with the traditional infrastructure, while significantly boosting the economy and employment. China's commitment to a green, low-carbon economic recovery demonstrates new understandings of the relationship between climate action and economic development: climate action does not hurt the economy, but can drive and save the economy. The new policy goal has become to reboot the economy through climate action.

3.3. Learning to Elevate Adaptation Action onto an Equal Footing with Mitigation Action

As the Chinese government adjusts the problem definition of climate change and refines its climate policy goals, it is also updating its strategies on climate change. Climate adaptation and risk management was historically a much lower priority on the domestic policy agenda in China compared to climate mitigation [48–50]. In recent years, Chinese scientists have launched several systematic studies on climate risk assessment and management. These studies have deepened the Chinese leadership's understanding of the impacts of climate change and thus fostered a stronger belief in the imperative of climate adaptation [26]. In 2015, China released the first comprehensive analysis on climate adaptation and risk management in China, i.e., the National Assessment Report on Extreme Weather and Climate Events and Disaster Risk Management and Adaptation [51]. The research project was led by academician Dr. Qin Dahe and co-produced by over one hundred scientists in China. Since 2018, the CMA has been publishing annual Blue Book on Climate Change in China, which evaluates the latest impact of climate change on China. The fourth National Assessment Report of Climate Change in China (the Chinese equivalent of the IPCC assessment report), which is commissioned by the MOST and expected to be released in 2022, includes a special report on climate risk assessment. Altogether, these research results show that China is highly susceptible to the adverse effect of climate change. Since the mid-20th century, China's surface temperature warmed at a rate of 0.26 °C per decade between 1951 and 2020, significantly higher than the global average of the same period, which measured at 0.15 °C per decade [52]. Moreover, as the climate warms, extreme weather events will become more frequent and intense and have greater impacts on society.

Since 2013, the Chinese government has been continuously elevating the status of adaptation action within the landscape of climate policy in China by strengthening adaptation policymaking [53]. The National Adaptation Strategy for Climate Change issued by the NDRC in 2013 marks the very first policy solely devoted to adaptation, whereas previous adaptation policy was usually embedded in comprehensive climate policy. The 2013 Adaptation Strategy clarifies the guidelines and principles of national climate change adaptation, and the key targets, tasks, and safeguard measures for the period of 2013–2020. In 2015, the NDRC issued the Urban Action Plan for Climate Adaptation, guiding cities to work on planning, infrastructure, buildings, water systems, urban greening, and disaster risk management to strengthen their capacity to adapt to climate change. In 2017, China launched the climate-resilient cities pilot program, which covered 28 pilot cities. In 2021, the concept of resilient cities was written into 14th Five-Year-Plan (2020–2025), for the first time in history. Currently, the MEE is organizing the preparation of the National Adaptation Strategy for Climate Change 2035 to replace the 2013 version. Although overall there are still very few policies that specifically target climate change adaptation, more and more comprehensive as well as sectoral policies are taking into account the need for climate change adaptation, i.e., the mainstreaming of climate adaptation policy [54]. Despite recent progress, climate adaptation actions are still at a preliminary stage in China [54]. A survey among 85 administrative and management personnel from provincial government agencies in charge of climate change adaptation in 5 provinces in China show that more than 20% of them had little or no understanding of drought and flood emergency system, and about half of them knew nothing about climate change adaptation measures in urban construction [55]. Even the 28 climate-resilient pilot cities fall short of their capacity for climate adaptation and risk management [56].

Similarly, there have been limited actions on climate risk mitigation, which has mainly relied on the traditional disaster prevention and mitigation system [54]. Although China is quite adept at managing conventional meteorological hazards, the system has yet to adapt to the fast-changing climate. The disastrous impact of the flood that happened in Zhengzhou, Henan Province on 20 July 2021 provides a case in point [57]. Compared to coastal cities in Southern China with higher precipitation and more experience with flood control, inland cities in Northern China are much less prepared for extreme rainstorm

events [58]. To rise to the challenge of growing risks of climate change, China must step up its efforts for climate risk management [59].

3.4. Learning to Diversify Climate Governance Processes

Previous research suggests that the dominant environmental governance processes in China are top-down, state-led processes characterized by plans, policies, and leadership directives put into effects through campaigns, which contrast the law-centered practices in the US [60]. Despite the strong path dependence of the state-led governance processes, current developments in voluntary climate action of corporate actors and the reinvigorated climate legislation process suggest that China is trying to diversify its governance processes, which provides evidence for conceptual learning. Following the announcement of the dual carbon targets, the entire Chinese society, particularly the corporate sector, seems to be mobilized to pursue carbon mitigation. For example, before the central and/or local government announce any regulatory requirements associated with carbon neutrality for any specific industry, let alone for individual firms, quite a few Chinese firms have already made plans for and commitments to carbon neutrality to various degrees. In other words, businesses went “beyond compliance” when pledging to achieve carbon neutrality by a certain date. For example, the “Big Three” Chinese oil companies, namely PetroChina, Sinopec, and China National Offshore Oil Corporation (CNOOC), information technology giant Tencent, world-leading electric vehicle manufacturer BYD Auto, China’s third largest steelmaker Shagang Group, and the State Grid—the second largest corporation in the world by revenue—have either completed or are working on their roadmaps or actions plans for carbon neutrality, but have not yet announced detailed timetables. Meanwhile, some of the largest steelmakers in China, major power generator China Three Gorges Corporation, fintech giant Ant Group, cloud computing and data center provider Chindata Group, and China’s largest SUV and pickup manufacturer Great Wall Auto went one step further by announcing specified dates by which they would achieve carbon neutrality, mostly falling in the range of 2030 and 2060. The emerging phenomenon of Chinese businesses’ voluntary responsiveness to carbon neutrality forms a sharp contrast with the stereotype of Chinese businesses as environmental laggards depicted in the “implementation gap” theory, according to which local protectionism allows polluting firms to ignore or only symbolically comply with environmental policy [61]. However, it is still too early to conclude that a shared belief in a low-carbon or carbon-neutral economy has taken shape in China, since it is likely that some of these carbon neutrality commitments only represent symbolic “political gestures” given the importance and challenge of maintaining government-business relations in China [62–64]. Indeed, the CPC Politburo meeting on 30 July 2021 proposed to rectify the emerging phenomenon of “campaign-style emissions reduction” characterized by many industries/businesses and local governments’ “shouting slogans”, “riding the wave”, and “acting excessively”. In other words, many of the carbon neutrality targets proposed by industries, businesses, and local governments were lacking scientific basis and might be out of reach.

Another promising sign of potential diversification of climate governance processes in China is the reinvigorated climate change legislation process (the evidence presented in this paragraph is mainly drawn from a workshop on climate change legislation held on 30 April 2021 attended by the authors. Participants of the workshop were law scholars from various universities in China, including but not limited to the Chinese University of Political Science and Law, the National Center for Climate Change Strategy and International Cooperation (NCSC), Wuhan University, and Tsinghua University). Climate change legislation has been under discussion in China since as early as 2009, when the “Resolution of the Standing Committee of the National People’s Congress on Actively Addressing Climate Change” proposed that climate change be included in the legislative agenda. However, in reality climate change legislation virtually stagnated for a decade. A few unprecedented signs indicate that the legislation process in China is likely to pick up in the near future. In March 2021, Vice Premier Han Zheng gave specific instructions that “it is recommended to enact

a climate change law". During the "two sessions" (the meeting of the National People's Congress (NPC), the country's legislature, and the Chinese People's Political Consultative Conference (CPPCC), the top political advisory body) in March 2021, which is the most important political gathering in China, eight delegates to the NPC submitted motions on climate change legislation and two CPPCC members offered proposals on the same topic. In April 2021, a group of researchers from the National Center for Climate Change Strategy and International Cooperation (NCSC) delivered a seminar on climate change legislation to Shen Yueyue, Vice-Chairwoman of the NPC Standing Committee. At least ten members of the Standing Committee as well as all members of the Environmental Protection and Resources Conservation Committee of the NPC attended the event (the Environmental Protection and Resources Conservation Committee of the NPC is one of the ten special committees of the NPC which is in charge of researching, deliberating, and drawing up bills or proposals in the field of environmental protection and resources conservation, including climate change). The series of actions sent hopeful signals that climate legislation process has been reactivated in China.

4. Discussion and Conclusions

Climate policymaking in China has gone through three major phases over a course of three decades. This thirty-year history of climate policymaking can be viewed as a conceptual learning process because the Chinese government has continuously adjusted the problem definition of climate change, redefined climate policy goals, and updated its strategies [10]. First, the Chinese leadership has redefined climate change from a scientific and diplomatic problem, to a developmental and strategic issue, and finally to an overarching grand strategy guiding national development in the next forty years. The Xi Jinping administration has pinned hopes on climate change as China's opportunity to transform domestic economy as well as to establish its leadership in global governance. Second, the Chinese government has redefined climate policy goals as its mindsets regarding the relationship between climate action and economic growth evolve over time. While the earliest mindset focused on how climate action may hurt the economy, the leadership gradually realized that costs of climate inaction would be much higher than climate actions, as climate change takes toll on the economy and endangers political legitimacy. More recently, new mindsets have emerged that China may embrace better climate and better economy simultaneously and even let climate action drive future economic growth in the post-COVID era. As a result, the Chinese government has fundamentally redefined its policy goal from avoiding climate action to foster economic development to reinvigorating economic development through climate action. Third, the Chinese government has updated its climate change strategy from emphasizing climate mitigation solely to a more balanced consideration of mitigation and adaptation, and from state-dominant governance processes to more diversified governance processes that involve the participation of the corporate sector and a greater a role of the law.

The 2020 announcement about peaking emissions before 2030 and reaching carbon neutrality before 2060 marks a new milestone in China's history of climate policymaking. There are positive signs that a shared belief in a low-carbon or even carbon-neutral economy is taking shape in the Chinese society, particularly as shown by corporate enthusiasm about carbon neutrality and the reinvigorated climate legislation process. However, China certainly still has a long way to go. The vicissitude in China's energy policy for coal versus renewables after 2018 provides a case in point. Against the backdrop of deteriorating US-China trade relations and increasing dependency on energy imports, energy security and coal utilization made a comeback on China's policy agenda [65,66]. During the meeting of the National Energy Commission (NEC) (a top body for coordinating energy policy in China) held on 11 October 2019, Premier Li Keqiang called on the government to "promote safe and green mining of coal, clean and efficient development of coal power, and effective development and utilization of coalbed methane". Meanwhile, the low-carbon energy transition was much toned down, which contrasted with the plan to "accelerate" the

transition during the same meeting in 2016. The outbreak of COVID-19 in early 2020 created rising anxieties over economic growth and revealed domestic infrastructure bottlenecks, further contributing to concerns about energy security [67]. The 2020 government work report emphasized the term “energy security” for the first time since 2016. In April 2020, the Politburo of the CPC held a meeting to analyze and study the current economic situation and economic work, during which energy security was identified as one of the six key areas where the government needs to maintain security (*liubao*). The concern about energy security was certainly positive for coal. As of July 2020, China’s coal-fired power installation continued to rise, with 98 GW of coal-fired power plants under construction and an additional 53 GW permitted [68]. As a result of the loosened curbs on coal, China’s coal consumption reversed the falling trend from 2013 to 2016 and kept rising for 4 years in a row after 2016 and hit a historical peak in 2020, although the share of coal consumption within the energy mix continued to decrease.

Both challenges and opportunities abound as China forges ahead with its dual carbon targets in the post-COVID era [3]. The leadership will continue to struggle with the perennial problem of balancing short-term economic gains with long-term strategic goals. In order to create a shared belief in carbon neutrality at the societal level, the government must first establish an internal consensus on climate policymaking by upholding the priority attached to climate policy and ensuring consistency among climate, energy, industrial, and other socioeconomic policies. Moreover, the government must speed up the formulation of the implementation plans for key areas and sectors within the “1+N” policy framework. By November 2021, only the carbon peaking and neutrality implementation plans for industry, transportation, urban and rural construction sectors, and the “Science and Technology Support Carbon Peak Carbon Neutral Action Plan” had been formulated and submitted for deliberation in accordance with procedures. After deliberation and approval, they will be formally issued and implemented. A lot more implementation plans need to be prepared for other key sectors and areas. If the post-COVID stimulus packages are indeed directed to high-tech, low-carbon areas, this may present a real opportunity for China to finally embrace green, sustainable, high-quality economic development.

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References

1. Guan, D.; Meng, J.; Reiner, D.M.; Zhang, N.; Shan, Y.; Mi, Z.; Shao, S.; Liu, Z.; Zhang, Q.; Davis, S.J. Structural decline in China’s CO₂ emissions through transitions in industry and energy systems. *Nat. Geosci.* **2018**, *11*, 551–555. [CrossRef]
2. Friedlingstein, P.; O’sullivan, M.; Jones, M.W.; Andrew, R.M.; Hauck, J.; Olsen, A.; Peters, G.P.; Peters, W.; Pongratz, J.; Sitch, S.; et al. Global carbon budget 2020. *Earth Syst. Sci. Data* **2020**, *12*, 3269–3340. [CrossRef]
3. Liu, Z.; Zhu, D.; He, G.; Wang, H.; Zhang, X.; Lin, J.; Qi, Y.; Liang, X. Challenges and opportunities for carbon neutrality in China. *Nat. Rev. Earth Environ.* **2021**, *3*, 141–155. [CrossRef]
4. *Responding to Climate Change: China’s Policies and Actions*; State Council of China: Beijing, China, October 2021. Available online: <http://www.scio.gov.cn/zfbps/32832/Document/1715506/1715506.htm> (accessed on 26 December 2021).
5. Ministry of Foreign Affairs (MFA). Statement by H.E. Xi Jinping President of the People’s Republic of China at the General Debate of the 75th Session of the United States General Assembly. 22 September 2020. Available online: http://is.china-embassy.org/eng/zgwj/202009/t20200922_10114928.htm (accessed on 26 December 2021).

6. Chen, J.; Cui, H.; Xu, Y.; Ge, Q. Long-term temperature and sea-level rise stabilization before and beyond 2100: Estimating the additional climate mitigation contribution from China's recent 2060 carbon neutrality pledge. *Environ. Res. Lett.* **2021**, *16*, 074032. [[CrossRef](#)]
7. Hecló, H. *Modern Social Politics in Britain and Sweden: From Relief to Income Maintenance*; Yale University Press: New Haven, CT, USA, 1974.
8. Zhao, X.; Wu, L. Interpreting the evolution of the energy-saving target allocation system in China (2006–2013): A view of policy learning. *World Dev.* **2016**, *82*, 83–94. [[CrossRef](#)]
9. Bennett, C.J.; Howlett, M. The lessons of learning: Reconciling theories of policy learning and policy change. *Policy Sci.* **1992**, *25*, 275–294. [[CrossRef](#)]
10. Fiorino, D.J. Environmental policy as learning: A new view of an old landscape. *Public Adm. Rev.* **2001**, *61*, 322–334. [[CrossRef](#)]
11. Etheredge, L.S.; Short, J. Thinking about government learning. *J. Manag. Stud.* **1983**, *20*, 41–58. [[CrossRef](#)]
12. Dekker, S.; Hansén, D. Learning under pressure: The effects of politicization on organizational learning in public bureaucracies. *J. Public Adm. Res. Theory* **2004**, *14*, 211–230. [[CrossRef](#)]
13. Qi, Y.; Ma, L. Towards proactive climate change policy. *China Popul. Resour. Environ.* **2007**, *17*, 8–12. (In Chinese) [[CrossRef](#)]
14. Qi, Y.; Wu, T. The politics of climate change in China. *Wiley Interdiscip. Rev. Clim. Change* **2013**, *4*, 301–313. [[CrossRef](#)]
15. Qi, Y.; Zhao, X.; Stern, N. Climate policy in China: An overview. In *Standing up for a Sustainable World: Voices of Change*; Henry, C., Rockstrom, J., Stern, N., Eds.; Cheltenham Edward Elgar Publishing: Cheltenham, UK, 2020; pp. 76–102. [[CrossRef](#)]
16. Hatch, M.T. Chinese Politics, Energy Policy, and the International Climate Change Negotiations. In *Global Warming and East Asia: The Domestic and International Politics of Climate Change*; Harris, P.G., Ed.; Routledge: London, UK, 2003; pp. 43–65.
17. Economy, E. The Impact of International Regimes on Chinese Foreign Policy Making: Broadening Perspectives and Policies ... But only to a Point. In *The Making of Chinese Foreign and Security Policy in the Era of Reform*; Lampton, D.M., Ed.; Stanford University Press: Stanford, CA, USA, 2001; pp. 230–253.
18. Chayes, A.; Kim, C. China and the United Nations Framework Convention on Climate Change. In *Energizing China: Reconciling Environmental Protection and Economic Growth*; Elroy, M.B., Nielsen, C.P., Lydon, P., Eds.; Harvard University Press: Newton, MA, USA, 1998; pp. 503–540.
19. Bjørkum, I. *China in the International Politics of Climate Change*; Fridtjof Nansen Institute: Lysaker, Norway, 2005; Volume 12.
20. Heggelund, G. China's climate change policy: Domestic and international developments. *Asian Perspect.* **2007**, *31*, 155–191. [[CrossRef](#)]
21. Tangen, K.; Gørild, H.; Jørund, B. China's Climate Change Positions: At a Turning Point? *Energy Environ.* **2001**, *12*, 237–252. [[CrossRef](#)]
22. Teng, F.; Wang, P. The evolution of climate governance in China: Drivers, features, and effectiveness. *Environ. Politics* **2021**, *30*, 141–161. [[CrossRef](#)]
23. Zhou, Y. Demystifying China's Climate Change Think Tank: Advising Negotiating Officials. *Bund* **2009**. Available online: <http://news.sina.com.cn/c/sd/2009-12-23/112319321281.shtml> (accessed on 26 December 2021). (In Chinese)
24. Oberheitmann, A.; Sternfeld, E. Climate Change in China—The Development of China's Climate Policy and Its Integration into a New International Post-Kyoto Climate Regime. *J. Curr. Chin. Aff.* **2009**, *38*, 135–164. [[CrossRef](#)]
25. He, J.; Wang, H.; Zhao, X. Chapter 10: Strategic Linchpins and Policy Safeguards. In *China's Long-Term Low-Carbon Development Strategies and Pathways*; Springer: Singapore, 2021; pp. 255–283. [[CrossRef](#)]
26. Gao, Y. China's response to climate change issues after Paris Climate Change Conference. *Adv. Clim. Change Res.* **2016**, *7*, 235–240. [[CrossRef](#)]
27. Duan, H.; Zhou, S.; Jiang, K.; Bertram, C.; Harmsen, M.; Kriegler, E.; Vuuren, D.P.V.; Wang, S.; Fujimori, S.; Tavoni, M.; et al. Assessing China's efforts to pursue the 1.5C warming limit. *Science* **2021**, *372*, 378–385. [[CrossRef](#)]
28. Rudd, K. *The New Geopolitics of China's Climate Leadership*; Asia Society Policy Institute: New York, NY, USA, 2020.
29. Zhang, Z. The forces behind China's climate change policy: Interests, sovereignty, and prestige. In *Global Warming and East Asia: The Domestic and International Politics of Climate Change*; Harris, P.G., Ed.; Routledge: London, UK; New York, NY, USA, 2003; pp. 43–65.
30. Richerzhagen, C.; Scholz, I. China's capacities for mitigating climate change. *World Dev.* **2008**, *36*, 308–324. [[CrossRef](#)]
31. Qi, Y.; Ma, L.; Zhang, H.; Li, H. Translating a global issue into local priority: China's local government response to climate change. *J. Environ. Dev.* **2008**, *17*, 379–400. [[CrossRef](#)]
32. Qi, Y.; Zhao, X. Ten Drivers of Climate Policy Making in China. In *Subnational Climate Change Policy in China*; Stavins, R.N., Stowe, R.C., Eds.; Harvard Project on Climate Agreements: Cambridge, MA, USA, February 2020; Available online: <https://www.belfercenter.org/publication/subnational-climate-change-policy-china> (accessed on 26 December 2021).
33. McMullen-Laird, L.; Zhao, X.; Gong, M.; McMullen, S.J. Air pollution governance as a driver of recent climate policies in China. *Carbon Clim. Law Rev.* **2015**, *9*, 243–255.
34. Li, X.; Tilt, B. Perceptions of Quality of life and pollution among China's urban middle class: The case of smog in Tangshan. *China Q.* **2018**, *234*, 340–356. [[CrossRef](#)]
35. Tilt, B. China's air pollution crisis: Science and policy perspectives. *Environ. Sci. Policy* **2019**, *92*, 275–280. [[CrossRef](#)]

36. Burnett, R.; Chen, H.; Szyszkowicz, M.; Fann, N.; Hubbell, B.; Pope III, C.A.; Apte, J.S.; Brauer, M.; Cohen, A.; Weichenthal, S.; et al. Global estimates of mortality associated with long-term exposure to outdoor fine particulate matter. *Proc. Natl. Acad. Sci. USA* **2018**, *115*, 9592–9597. [CrossRef] [PubMed]
37. Flatø, H. Trust is in the air: Pollution and Chinese citizens' attitudes towards local, regional and central levels of government. *J. Chin. Gov.* **2021**, 1–31. [CrossRef]
38. Zhang, Q.; Zheng, Y.; Tong, D.; Shao, M.; Wang, S.; Zhang, Y.; Xu, X.; Wang, J.; He, H.; Liu, W.; et al. Drivers of improved PM 2.5 air quality in China from 2013 to 2017. *Proc. Natl. Acad. Sci. USA* **2019**, *116*, 24463–24469. [CrossRef]
39. United Nations Environment Program (UNEP). *Synergizing Action on the Environment and Climate: Good Practice in China and Around the Globe*; United Nations Environment Program (UNEP): Nairobi, Kenya, 2019.
40. Qi, Y.; Stern, N.; Wu, T.; Lu, J.; Green, F. China's post-coal growth. *Nat. Geosci.* **2016**, *9*, 564–566. [CrossRef]
41. Zhang, Z. Can China afford to commit itself an emissions cap? An economic and political analysis. *Energy Econ.* **2000**, *22*, 587–614. [CrossRef]
42. Pan, J. The impact of a deceleration of climatic change on the economies and politics of different regions. *World Econ. Politics* **2003**, *6*, 66–71. (In Chinese)
43. Wiener, J.B. Climate change policy and policy change in China. *UCLA Law Rev.* **2007**, *55*, 1805–1826.
44. Qi, Y. China's Commitment to a Green Agenda. *McKinsey Q.* 1 June 2013. Available online: <https://www.mckinsey.com/featured-insights/asia-pacific/chinas-commitment-to-a-green-agenda> (accessed on 26 December 2021).
45. Green, F.; Stern, N. China's changing economy: Implications for its carbon dioxide emissions. *Clim. Policy* **2017**, *17*, 423–442. [CrossRef]
46. Tian, J.; Yu, L.; Xue, R.; Zhuang, S.; Shan, Y. Global low-carbon energy transition in the post-COVID-19 era. *Appl. Energy* **2021**, 118205. [CrossRef] [PubMed]
47. Greenpeace East Asia, China Association for NGO Cooperation (CANGO). *Real Impact of Investment in New Infrastructure: Comprehensive Benefits Assessment Based on a Green, Inclusive Recovery Framework*; China Association for NGO Cooperation (CANGO): Beijing, China, 2021.
48. Gemmer, M.; Wilkes, A.; Vaucel, L.M. Governing climate change adaptation in the EU and China: An analysis of formal institutions. *Adv. Clim. Change Res.* **2011**, *2*, 1–11. [CrossRef]
49. Li, B. Governing Urban Climate Change Adaptation in China. *Environ. Urban.* **2013**, *25*, 413–427. [CrossRef]
50. He, X. Legal and policy pathways of climate change adaptation: Comparative analysis of the adaptation practices in the United States, Australia and China. *Transnatl. Environ. Law* **2018**, *7*, 347–373. [CrossRef]
51. China's National Assessment. *Report on Extreme Weather and Climate Events and Disaster Risk Management and Adaptation*; Qin, D., Zhang, J., Shan, C., Song, L., Eds.; Science Press: Beijing, China, 2015. (In Chinese)
52. China Meteorological Administration (CMA). *Blue Book on Climate Change in China*; Science Press: Beijing, China, 2021.
53. He, X.; Zhang, X. *Research on Climate Change Adaptation: International Negotiation Issues and Domestic Action Strategies*; Science Press: Beijing, China, 2020. (In Chinese)
54. Qi, Y.; Zhou, D.; Zhao, X.; Li, H.; Wang, Y.; Wang, B. Enhancing Climate Risk Governance in China. UK-China Collaboration on Climate Risk Assessment (Phase III). 2021. Available online: <http://www.3e.tsinghua.edu.cn/storage/app/media/uploaded-files/download/202112/WS4%20report%20EN.pdf> (accessed on 26 December 2021).
55. Liu, T.; Ma, Z.; Huffman, T.; Ma, L.; Jiang, H.; Xie, H. Gaps in provincial decision-maker's perception and knowledge of climate change adaptation in China. *Environ. Sci. Policy* **2016**, *58*, 41–51. [CrossRef]
56. Fu, L.; Yang, X.; Zhang, D.; Cao, Y. Assessment of Climate-Resilient City Pilots in China. *Chin. J. Urban Environ. Stud.* **2021**, *9*, 2150005. [CrossRef]
57. Zhao, X.; Li, H.; Qi, Y. Are Chinese Cities Prepared for Managing the Risks of Extreme Weather Events? Evidence from the 2021.07.20 Flood in Zhengzhou, Henan Province. Unpublished manuscript (available upon request).
58. Zou, S.; Duan, W.; Christidis, N.; Nover, D.; Abuduwaili, J.; Maeyer, P.D.; Voorde, T.V.D. An extreme rainstorm event in summer 2018 of Hami city in eastern Xinjiang, China. *Adv. Clim. Change Res.* **2021**, *12*, 795–803. [CrossRef]
59. Zhao, X.; Qin, C. Better Risk Management. *China Dly. Glob.* **2021**. Available online: <https://www.chinadaily.com.cn/a/202112/07/WS61aea1a8a310cdd39bc79b62.html> (accessed on 26 December 2021).
60. Zhao, X.; Young, O.; Qi, Y.; Guttman, D. Back to the Future: Can Chinese Doubling Down and American Muddling Through Fulfill 21st Century Needs for Environmental Governance? *Environ. Policy Gov.* **2020**, *30*, 59–70. [CrossRef]
61. Qi, Y.; Zhang, L. Local environmental enforcement constrained by central–local relations in China. *Environ. Policy Gov.* **2014**, *24*, 216–232. [CrossRef]
62. Zhao, X.; Qi, Y. Why do firms obey?: The state of regulatory compliance research in China. *J. Chin. Political Sci.* **2020**, *25*, 339–352. [CrossRef]
63. Zhao, X. Pervasive Threat and Regulatory Compliance: Evidence from China's Energy-Saving Regulations. Ph.D. Thesis, Tsinghua University, Beijing, China, 2018.
64. Marquis, C.; Qian, C. Corporate social responsibility reporting in China: Symbol or substance? *Organ. Sci.* **2014**, *25*, 127–148. [CrossRef]
65. Sandalow, D. *China's Response to Climate Change: A Study in Contrasts and a Policy at a Crossroads*; Asia Society Policy Institute: New York, NY, USA, 2020.

-
66. Meidan, M. *COVID-19 and the Electrification of the Chinese Economy*; The Oxford Institute for Energy Studies: Oxford, UK, 2020.
 67. Tu, K.J. *COVID-19 Pandemic's Impacts on China's Energy Sector: A Preliminary Analysis*; Center on Global Energy Policy, Columbia University: New York, NY, USA, 2020.
 68. Cui, R.; Song, J.; Hultman, N.; Cui, D.; Edwards, M.; McJeon, H. *Implications of Continued Coal Builds in the 14th FYP of China*; Center for Global Sustainability: College Park, MD, USA, 2020.