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Towards a Deep Climate Collaboration

Module 2: China

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Resource Economists

EAERE Magazine serves as an outlet for new research, projects, and other professional news, featuring articles that can contribute to recent policy discussions and developments in the field of environmental and natural resource economics. It is published quarterly in the Winter, Spring, Summer, and Fall. Contributions from the wider EAERE community, especially senior level researchers and practitioners, and EAERE Country Representatives, are included in the magazine.

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Table of contents

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Dear Colleagues and Friends,

We are devoting a section of all four issues of our EAERE Magazine in 2021 to establishing a baseline for the world's four largest emitters of greenhouse gasses – China, European Union, India, and the U.S. as a first step under the EAERE banner towards encouraging a Deep Climate Collaboration (DCC4).

In each case, the baseline comprises four papers: Climate Policy Architecture; Domestic Climate Policy – Looking Back; Domestic Climate Policy – Looking Forward; Climate Diplomacy – Past Performance and New Opportunities. Issue 11 (Winter 2021) addressed these four themes for the U.S., with the package orchestrated by Ricky Revesz (New York University).

This Issue 12 (Spring 2021) addresses the same four narratives for China. To organize and deliver this issue we turned first to Xilang Zhang, Institute for Energy, Environment and Economy, Tsinghua University who convinced his colleague Fei Teng to take on the task. The outcome of the latter's endeavours is four excellent papers: Maosheng Duan, Tsinghua University (Policy Architecture); Songli Zhu, China Academy of Macroeconomic Research (Domestic Policy – Looking Back); Qimin Chai, National Center for Climate Change Strategy and International Collaboration (Domestic Policy – Looking Forward); Fei Teng, Tsinghua University (Diplomacy). We are deeply grateful to this team for taking on these assignments when their in-trays are already bulging with demands on their time and attention. I salute them all.

Issue 13 will be devoted to the European Union (led by Professor Jos Delbeke, European University Institute) and Issue 14 will be devoted to India (led by E. Somanathan, India Statistical Institute). The full package will be available as an input to COP 26 (November 2021). Each paper is downloadable as a PDF, and I am told by readers that, in addition to their value as research content, they are terrific ballast as teaching materials.

In Issue 11, in addition to the US Module of DCC4, we celebrated EAERE's doctoral awardees. In this issue, in addition to the China Module of DCC4, we celebrate the life and achievements of Artur Runge-Metzger, our most recent winner of the EAERE Practitioner Achievement Award. The art of working in a bureaucracy is to shed one's illusions while keeping one's faith intact. He more than mastered this art in the European Commission where he spent most of his professional life. Throughout this life, his true north was to reduce greenhouse gas emissions and store carbon at scale, and his talent was to find ways that work to do so in Europe. Muhammad Ali observed that: "The fight is won or lost far away from the witnesses - beyond the lines, in the gym and out on the road, long before the dance under those lights." This has always been Artur's style – keep doing the hard work behind the scenes that will some day enable great success, and (unlike Ali) let others dance under the lights when there is credit to be garnered. A recent contribution has been the incubation of the European Green Deal. Many of us feel a degree of comfort and security living and working in siloes. He does not. He is a product of the University of Göttingen, which was founded in the Age of Enlightenment (1737) and which continues to encourage its students and staff to reach out across barriers and frontiers. His life and work embodies that spirit of inclusiveness, reaching out and challenging the status quo. You will get a flavour of his ways of thinking and doing in "From Kyoto to Paris: Aligning EU Greenhouse Gas Emissions Reductions Policies".

Frank J. Convery

Section I

The China Module

Climate Policy Architecture in China

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Introduction

China's climate policy system is shaped by various authorities at different levels, consistent with the specific governance structure of the country. At the national level, the Communist Party of China (CPC) Central Committee, the National People's Congress (NPC) and its Standing Committee, the State Council (the central government) and relevant ministry-level governmental authorities play different roles in the formulation of China's climate strategies, policies and measures in accordance with their respective functions. At the local level, a very similar system exists. Besides the national and local level authorities, some industry associations also affect through various means climate policy formulation and implementation in China (National Development and Reform Commission, 2013).

The CPC Central Committee

The CPC Central Committee plays a central role in the overall governance of China, including providing guidance on the climate policy direction in China. However, it usually does not establish specific climate policy targets, but guides the policy formation process mainly through issuing opinions or suggestions, sometimes together with the State Council, on social and economic development and some specific areas. The proposals of the CPC Central Committee will then be translated into laws and specific policies of relevant authorities at all levels. For example, China's key mitigation targets such as carbon emissions peaking and the GDP carbon intensity target proposed at the fifth plenary session of the 19th CPC Central Committee were later confirmed in the Outline of the 14th Five-Year Plan (2021-2025) for National Economic and Social Development and the Long-range Objectives through the Year 2035 adopted by the NPC (National People's Congress, 2021).

The NPC and its Standing Committee

The NPC is the highest state organ of power of China and its permanent organ is the NPC Standing Committee, both of which exercise the legislative power of the state. Although the idea of formulating a climate law has been advocated by many for years in China, no significant process has been made up to now, due to reasons such as difficulties in drawing a clear line between the proposed climate law and other existing laws such as the Renewable Energy Law. The NPC exercises its power on climate policy mainly through the adoption of the country's Five-Year Plans for National Economic and Social Development which contain binding mitigation targets, and the NPC Standing Committee ratifies international treaties on climate, adopts laws that affect the country's climate actions such as the Renewable Energy Law and the Energy Conservation Law, and issues sometimes decisions on climate change, guiding the climate strategies, policies, measures and actions of the country (NPC Standing Committee, 2009).

State Council

State Council, the central government of China, is the executive organ of the highest state organ of power and the highest state administrative organ. Up to now, most of China's very important climate strategies, policies and measures have been approved and issued by the State Council, including for example China's Nationally Appropriate Mitigation Actions for 2020, China's Nationally Determined Contribution for 2030, and the Work Programs on GHG Emissions Control

during the 12th and 13th Five-Year Periods (State Council, 2011, 2016).

In order to promote and enhance the coordination of climate actions among various ministry-level authorities, the State Council Leading Group on Climate Change has been established, headed by the Premier and with members from the State Council and about 30 ministry-level authorities.

State Council Climate Authority

The State Council climate authority plays a crucial role in China's climate policy architecture. The Ministry of Ecology and Environment is now the climate authority under the State Council, responsible for drafting China's important climate strategies, programs and policies, leading in cooperation with Ministry of Foreign Affairs the international climate negotiations and overseeing that China's commitments under the United Nations Framework Convention on Climate Change are honored. In practice, all of China's major climate strategies, policies and programs, e.g., GDP carbon intensity reduction targets for the country during the Five-Year Plan Periods, 2030 carbon emissions peaking target and 2050 Low GHG Emissions Development Strategy, are initiated and drafted by the climate authority. A dedicated department (Climate Change Department) has been established in the climate authority.

The Office of State Council Leading Group on Climate Change is staffed by the climate authority, highlighting its important role in coordinating China's climate policies, especially those that are of cross-ministry nature. Some crucial strategies and policies, e.g., mandatory mitigation targets for the provinces, will be approved and issued by the State Council, to make them more binding, while some others, e.g., basic rules for assessing whether the provinces have achieved the mitigation targets assigned to them, are discussed and determined by the Office of the Leading Group or even by the climate authority itself.

In early 2021, the post of China's special envoy on climate change was created, and the climate authority, Foreign Affairs Ministry and the National Development and Reform Commission will assist jointly the special envoy in performing his or her functions.

Economic, Energy and other Authorities under the State Council

The National Development and Reform Commission, China's national economic authority and the former climate authority before March 2018, when the governmental reshuffle was conducted, plays a critical role in the social and economic development of China through, e.g., the formulation and implementation of the state's development strategies, middle- and long-term development programs, annual development plans, comprehensive industrial policies, and fixed asset investment scale, structure and policy. It is fair to say that, without its active involvement, it is not possible to effectively implement China's crucial low carbon development policies, e.g., improvement of the economic and industrial structure and construction of low carbon key infrastructure and industry projects.

Carbon emissions from fossil fuel consumption account for more than 70% of China's total GHG emissions. The National Energy Administration, China's national energy authority, plays a key role in the decarbonization of China's energy system through, e.g., the formulation and implementation of the state's energy development strategy, programs and policies as well as energy industrial policies, and approval of key energy projects.

Industrial sectors account for a significant part of China's GHG emissions, and the Ministry of Industry and Information Technology, through for example the issuance of the development plan of the industrial sector, industry development policies, technical standards for the industrial sector, especially requirements on energy conservation and saving in the industrial sectors, will affect significantly the emissions trajectory in China's industries. For the industrial sectors to make an active contribution to the achievement of China's carbon emissions peaking target, action plans will be formulated for such sectors as iron and steel and the ministry will play an important role in the formulation process.

Housing, transportation and rural authorities are responsible for formulating and implementing policies aimed at controlling GHG emissions in

the housing and transportation sectors and enhancing sinks in the rural sector.

Banking, insurance and securities authorities have become very active in recent years in shaping China's climate policies and actions through providing regulatory requirements on banks as well as insurance and securities companies. In 2020, the climate authority issued, jointly with the economic, banking, insurance and securities authorities, a guidance on promoting climate financing in China, laying out clear requirements on climate financing and thus avoiding greenwashing normal commercial financing activities (Ministry Ecology and Environment et al., 2020).

Reliable data is key for assessing whether the assigned climate targets, both national and regional, have been achieved or not, so the National Statistical Bureau, the State Council statistics authority, is very crucial in the determination and implementation of China's climate policies. In 2013, the then climate authority and the statistical authority issued jointly a notice on enhancing statistical work related to climate change (National Development and Reform Commission and National Statistical Bureau, 2013).

National Climate Change Expert Group

The National Climate Change Expert Group is a think tank established by the China Meteorological Administration, with representatives from all relevant areas, to provide expert advice to authorities at all levels, from the CPC Central Committee, State Council to various ministerial authorities. Although this group is not part of the formal decision-making process, it may have great impacts on policy formulation by informing the process.

Local Authorities

According to China's Constitution, provincial people's congresses are provincial state organs of power. They shall, within their administrative areas, ensure the observance and enforcement of the Constitution, laws and administrative regulations, and they and their standing committees may, provided there is no conflict with the Constitution, laws or administrative regulations, formulate local regulations. Provincial governments are the executive organs of the local state organs of power at the provincial level and the provincial state administrative organs.

At the provincial level, a climate architecture very similar to that at the central level exists, involving mainly the CPC provincial committees, provincial legislatures, provincial governments and provincial governmental authorities.

The CPC provincial committees and provincial governments are jointly responsible for the implementation of the climate polices formulated by the central authorities and achievement of the climate targets assigned by the central authorities through formulation and implementation of locally appropriate policies and measures. The central authorities assess periodically the performance of the provinces and publish the assessment outcome, creating incentives to and pressures on the provinces. At each province, a leading group on climate change has also been established to coordinate climate actions among different governmental authorities.

Compared to the lengthy legislation process at the national level, progress at the provincial level can sometimes be easier. For example, the process of formulating a State Council regulation on China's national emissions trading system was initiated in 2014 and is still under way; the Standing Committees of the Beijing Municipal People's Congress, the local legislature, passed a decision on an emissions trading system within 2 years after the development process was initiated, laying a solid legal basis for the operation of the local carbon market.

Industry Associations

Industry associations know very well the development status and are usually one of the major stakeholders of the industries that will be consulted during China's national climate policy formulation process. They represent the interests of the underlying industries and thus do not favor ambitious climate targets, but when the targets are determined, they may become a positive factor facilitating climate actions in the industries.

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Chinese Domestic Climate Policy – Looking Back

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Dedicated national climate policies have been formally integrated into China's Marco-economic system since its 10th five-year plan (FYP, covering 2006-2010). Ten years later, a complete portfolio of policies has been put in place and evolved over time, leading to China's achievement of its National Appropriate Mitigation Actions (NAMAs) under the United Nations Framework Convention on Climate Change (UNFCCC), progressing to National Determined Contributions (NDC) under the Paris Climate Agreement, and moving towards the carbon peak and carbon neutral announcement. In this essay, an overview on progresses made since 2010 is presented for these policies and their implementation.

The institutional arrangements

The climate architecture in China is well established from the central to local governments (Duan, 2021), where the institutional arrangements relevant to addressing climate issues evolved over time, particularly in the 12th FYP (2011-2015) when the National Committee of Climate Leading Group, initially established in 2007 and focused on energy-saving, was further expanded in 2013. Another leading group was specially established in 2014 solely for statistic works relevant to climate change (China, 2016). In March 2018, the authority for climate issues was transferred from the National Development and Reform Commission (NDRC) to the newly restructured Ministry of Ecology and Environment (MEE) (China, 2018), which is regarded as one of most significant adjustments in that round of bureaucracy reform. General comments highlighted that the reallocation would enhance the synergy mechanism (Zhang, 2018), benefiting the co-control of greenhouse gases (GHGs) and air pollutants. However, concerns were raised that the shift from a macro-economic management agency to one dedicated to environment protection issues, where end-pipe measures are dominant, may result in less effective climate policies (Li, 2018). Three years later, in March 2021, part of the authority moved back to NDRC in the roadmap design, aiming to peak emissions before 2030 (State Council, 2021).

How the climate policies were formulated and implemented

China's environmental policies were once criticized as falling short in interaction between central and local administrations and having less involvement from third parties (Zhu et.al, 2015), such that the effectiveness and legitimacy might not be as good as expected. However, when we look back to the formulation and implementation of climate policies in the 2010s, a different story is observed. The process has progressed significantly to include participatory and interactive mechanisms (Zhao & Liang, 2016; Lo, 2015). In addition to the leading role of central governments, the key players involved in the decision-making process include local governments, industries, think-tanks and non-governmental organisations (NGOs). Therefore, policy learning was undertaken through previous experience, local practices, and expert knowledge, leading to the improvement of climate policies over time to fit more into national/local circumstances. A typical example is given by Zhao & Liang (2016) focusing on the evolution of the energy-saving target allocation system, one of the key polices in China to save energy and reduce emissions. Energy-intensive enterprises

that take large responsibilities to improve energy efficiency also enjoy flexibility to choose their preferred instruments to fulfil the target while also reducing costs (Lo et.al, 2015).

Before 2010, most climate policies were combined with other policies (such as energy policy), without their own clear identity. Since the 12th FYP, more independent and climate-specific policies have been designed and implemented, incubating a "golden climate era" in China. Based on the NAMAs put on the table before the Copenhagen Climate Conference in 2009, a legally binding climate mitigation goal, which requires reducing CO_2 emission intensity by 17% in five years, was set for the first time in 2011, followed by energy-saving targets. The supporting programs, e.g., local demonstration of low-carbon development, pilot emission trading scheme (ETS), were on board and rolling out nationwide soon after the overall goal was announced. In the 13th FYP (2016-2020), the approach was continued with the renewed goal of reducing CO_2 intensity by another 18%, and an additional soft cap on overall energy consumption that should NOT exceed 5000 million ton coal equivalent (Mtce) by 2020.

A noticeable change was witnessed at the end of 2012 when severe air pollution impacted most regions in China mainland. The toughest-ever "Air Pollution Prevention and Control Action Plan" (2013-2017) and "Blue Sky Defense Battle" (2018-2020) were rapidly passed and implemented consecutively, aiming to slash the concentration of fine particle ($PM_{2.5}$) nationwide. The major actions are reducing the consumption of coal in end-use sectors, dashing for gas, controlling pollutant emission from vehicles, improving the oil quality and optimization of industrial structures (Zhang et al, 2019). As a result, synergizing action on the environment and climate are largely highlighted in this period (UNEP, 2019); however, the focus on co-benefits had potential negative implications for greenhouse gas emissions, which are discussed briefly below. Meanwhile, the impact of macro-economic situation on climate governance is significant. Since the middle stage of the 13th FYP, together with an increasing focus on energy security and over-investment in coal-related industries to reboot the slow-down in the economy, the environment/climate and energy policy became less coordinated, as coal consumption rebounded in year 2017 after the historical cut during 2014-2016 when supply-chain reform was being implemented to solve the problem of excessive production capacity. The increased use of coal has fewer negative impacts on air quality generally as the production process could be super-clean regarding traditional pollutants, however, the CO_2 emission increased consequently.

The main features of China climate policies

Climate policies in China have become more and more complete and mature in 2010s, covering almost all categories of instruments/tools summarized in the assessment report produced by the Inter-governmental Panel on Climate Change (Somanathan et al.， 2014), with extensive practices nationwide or in selected regions. In general, except for command and control (C&C) which is the most commonly used measure (e.g., target-responsibility mechanism), other measures – economic or market (pricing, cap-trade scheme, financial incentives, subsidy providing/removing), legislative (e.g., laws, regulation, standards), education and information (e.g., energy and climate labels), research and development (R&D) on emerging technologies – are also being used more widely (Figure 1).

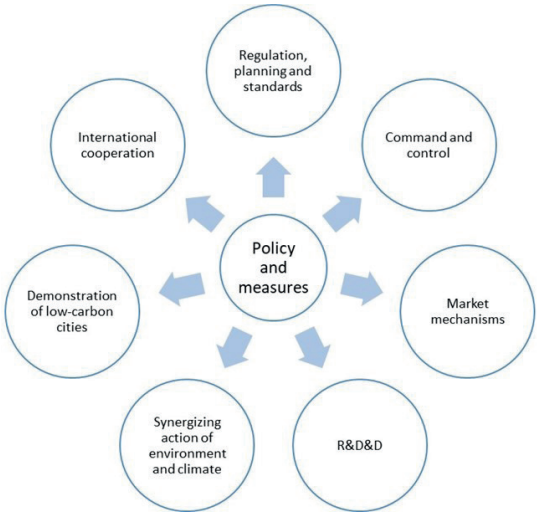

Figure 1. Categories of China's climate policies

Secondly, generally, goal-based climate governance is dominant rather than rule-based governance which is more popular in western countries (Zhao et.al, 2020). Quantitative national goals have played leading roles as reflections of political willingness and other major considerations. Goal setting is then followed by substantial administrative measures that set principles, guidance and actions, with economic instruments joining later. Amid all goal-related instruments, master and specific plans renewed every 5 years and recording all prioritized overall and focused goals/targets have a centralized position. As Young et al (2015) pointed out "state planning plays the dominant role in environmental governance." In the case of climate policies, there were no specific goals set until 2011, after which resources were substantially allocated to climate mitigation and adaptation.

In order to put the goal from paper to practices indeed, the national goal will be disaggregated into provincial targets and/or industrial targets, based on a series of factors. Provincial government and State-own Enterprises (SOEs) are subjected to annual review on their performance on fulfilling respective targets, with the assessment results available to the public. The Target-Responsibility Mechanism (TRM) plays crucial role in ensuring the delivery of national goals, and the promotion of climate awareness from the top to lower-level authorities.

Third, as briefly described before, though economic instruments joined the system later, their use was expanded and accelerated during 2010s. The wide application of the Clean Development Mechanism (CDM) at the project level largely before 2012 already helped China prepare for the utilization of market-based tools. With the pilot demonstration of regional ETS in seven provinces[1]/cities kicking off in 2011, capacities have been significantly built in the fields of carbon measurement, reporting and verification (MRV), allowance allocation and surrender, trade management and supervision, and so on. In 2017, the initiation of the nationwide ETS was announced, starting with the electricity power generation sector. More progress could be expected as the ETS Management Interim Regulation (draft) finally opened for public consultation in March 2021(MEE, 2021).

Finally, the co-control of environment and climate is one of key features in climate governance throughout most of the 2010s, with abatement of air pollutants having urgent priority on the agenda over GHG mitigation (MEE, 2018). While there have been synergies, there are probably also trade-offs. Using clean coal technologies and thereby delivering power generation equipped with advanced pollution abatement technologies benefitted air quality, however, it does not reduce CO_2 emissions (Zhu et al, 2020). Coal-fired plants [without Carbon Capture and Storage (CCS)] can be highly energy efficient, much less polluting and water-saving, but are still carbon-intensive. The strict environmental policies did push the reduction of coal consumption in end-use sectors, such as space heating in rural area, but failed to stop the shift of coal to transformation sectors, e.g., the power sector and coal-related chemical industries. Therefore, when the climate mitigation goal gets more ambitious, independent climate policies are actually needed with, at least, equal priority to environmental policies.

The effectiveness of climate policies

Although there were ups and downs in climate governance, all national climate-related goals were reached in the two FYPs during 2010s. Overall, the energy-related CO_2 intensity in 2020 was reduced by 36.3% compared to 2010, and around 50% compared to the level in 2005, successfully meeting the NAMAs (reducing by 40-45% from the 2005 level) under the Cancun Agreement (Figure 2), whereas economic output grew by 2.3 times during the 2005-2020 period. Other relevant national goals and international pledges, i.e., forest cover, share of non-fossil fuel, and forest stock volume, all rose beyond the committed level. In particular, coal consumption in 2016 declined by 9.4% from the 2013 level, pushed collectively by supply-chain reform, the Target Responsibility Mechanism (TRM), air pollution abatement program, and in general, the new normal of economic development. During the same period, the share of coal in the primary energy mix fell from 67.4% in 2013 to 62.2% in 2016.

1 The China MAP is accessible here: https://map.tianditu.gov.cn/

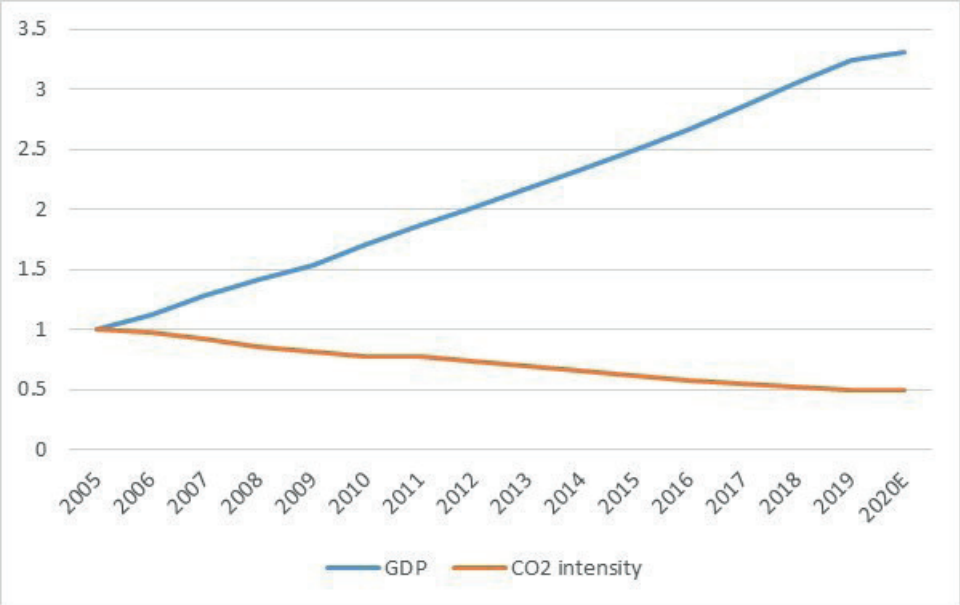

Figure 2. Change of GDP and CO_2 intensity during 2005-2020. Source: GDP data from national statistics; energy-related CO_2 emission estimated by author

Nevertheless, the coal consumption rebounded in 2017 and kept growing in the following years, though it has not changed the fact that the coal peak year was in 2013 (Qi and Lu, 2018). The reasons behind this are complex. From the international perspectives, the globalization after the Paris Agreement was agreed was going-down, tending to have negative impacts on global and national climate governance; from the national perspectives, the fluctuation is relevant to development stage as China is still a developing country, and in practice, relevant to overinvestment in coal-fired plants and coal-chemical industries in reaction to regional economic downturn. Resistance on the part of specific industrial sectors is not easy to suppress (Zhao et al, 2020). By2020, the share of coal in the energy mix had fallen to 56.8%, thanks to the simultaneous rapid growth of non-fossil fuels in the power sector (Figure 3).

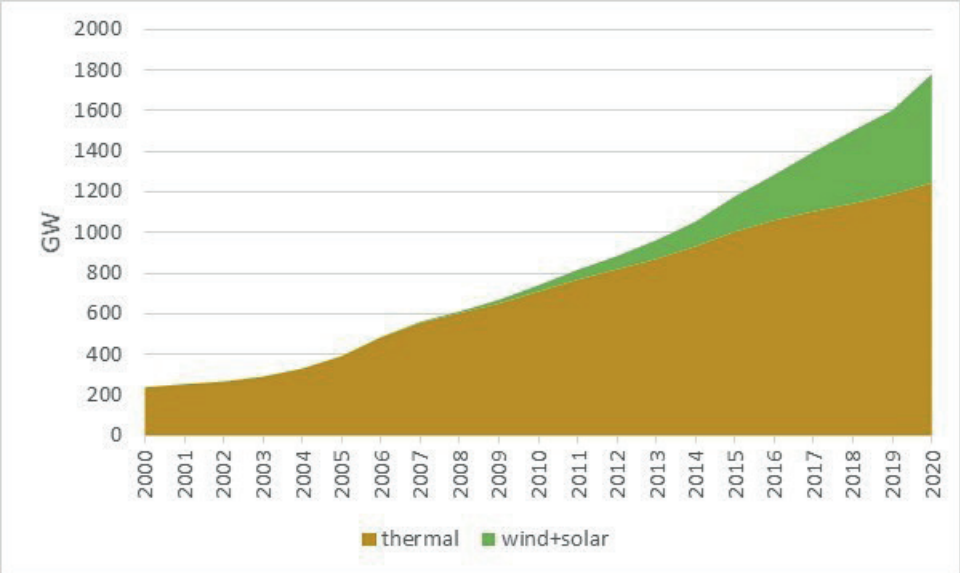

Figure 3. Evolution of thermal and wind/solar power generation installed capacity in China

The cost-effectiveness of climate policies is complicated as well. China provided favorable conditions and intensive subsidies to promote the expansion of wind farms and photovoltaic facilities, as well as massive production of PV solar cells, causing a large burden to the central and local finance. Up to 2018, the subsidy gap between what was already paid and what has promised to the developers was as high as 60 billion RMB, and is estimated to reach 200 billion RMB in 2020 (Tu, et al, 2020).

China is also suffering from job losses during the rapid energy transition. In coal mining industries, as an example, employment shrank by one third during 2015-2019.

Summary

The framework of China's climate policies developed well in 2010s, ranking 11th in 61 countries in the Climate Change Performance Index produced annually by German Watch (2020). The system is tailored to fit into national circumstance, characterized by a goal-based mechanism, many administrative measures (e.g., TRM), and pilot initiatives to accumulate experience before applying nationwide. All national goals and international pledges for climate governance have been met. Nevertheless, lessons have also been learnt, e.g., the instability of climate authority caused by institutional arrangements, less attention to climate issues when co-control was enhanced to combat air pollution, and the dilemma of huge coal-related industries in low-carbon transition, and the associated economic pressure.

A carbon neutral goal has been announced by China's government. Climate policies will need to be further improved and operationalized in the near future to deliver this new goal.

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Chinese Domestic Climate Policy – Looking Ahead – The New Growth Story to Carbon Neutrality in China and Its Implication for Near-term Policy

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The global economy is experiencing a new industrial, energy and technological revolution. A new growth pathway characterized by smart, green, and low-emission development has emerged as the primary direction of global transformation. Peaking carbon emissions before 2030 and achieving carbon neutrality before 2060 are the key strategic decisions made by China's policy process, which is a broad and profound evolution in its socio-economic system. The goals are matters of the sustainable development of China and its efforts to contribute to the global community's shared future for mankind.

The development context of China's climate strategy

Green competition has become more intense, particularly in key areas such as industry, buildings, transportation, and finance. The global markets related to climate change continue to expand. The overall scale of carbon emissions trading, clean energy investment, and green bonds has exceeded trillions of dollars around the world. Since 2015, the annual renewable energy investment of developing countries has exceeded that of developed countries. China is about to enter the ranks of high-income countries as both the proportion of middle-income people and the share of consumption in growth keep rising. At the same time, the country will enter a moderately aging society. The corresponding changes in demand and consumption structures will reshape the original logic and pathway of growth. The traditional economic development model will be faced with the dilemma of demographic dividend loss, diminishing marginal investment benefit, and mounting environmental pressure. The expanding middle-income group will increasingly yearn for a good life featuring safety, health, happiness, and equality. This may lead to simultaneous structural changes in both demand and supply.

In recent years, supply-side structural reform and high-quality development have been continuously strengthened with the new vision of innovative, coordinated, green, open, and shared development. As the first major country to enter the recovery stage and contribute more than 30% to global economic growth, China's economic stimulus plan to combat the Covid-19 pandemic has attracted much attention. There are arguments around those policy options under the stimulus plan, mainly focused on whether China will add new factors and increase institutional inputs to support green and low-carbon manufacturing and a new growth pathway, or still invest, in a simple extensive manner, in high energy-intensive industries such as coal, steel, cement, and chemicals, as well as traditional infrastructure. The choice that China is going to make will undoubtedly exert a profound impact on the effectiveness of China's supply-side structural reform, growth driver shift and global long-term sustainable development. Amid the dual revolution of ICT and energy, China should look into tunneling through the Environmental Kuznets Curve, and explore new growth drivers and paradigms for high quality recovery.

The new journey to China's carbon neutrality

Due to more prominent risks and uncertainties in a more complex domestic and international situation, misjudgment and detour will result in high economic, social, environmental costs and even forfeit the historical opportunity

provided by this round of scientific and technological revolution. China's new growth story denotes: higher-quality, greener, more efficient, and sustainable consumption and production; more open, inclusive and cohesive economy and society; and new civilized development in higher harmony with nature. The connotation and extension of national wealth will change rapidly along with the evolution of public demand. The share of natural capital will rise in the changing structure of physical, human, natural and social capital, making clear waters and lush mountains more valuable assets. There will be a fundamental transformation in the driving force of China's economic growth. Specifically, China's new growth story will present the following characteristics.

Reshape high-quality, low-carbon productivity and competitive advantages.

The achievement of the carbon neutrality requires the efforts of several generations. Green and sustainable growth is the basic premise and important content of promoting ecological civilization and high-quality development. On the one hand, it enhances human capital and development resilience by improving health and well-being. On the other hand, it brings development opportunities for green industries and technologies to leverage low-carbon investment and employment. China has made great progress in the new manufacturing field such as renewable energy and electric vehicles. In terms of market share and investment scale, China has secured the world's first position in recent years. Technological competitiveness also keeps improving. China accounted for more than 57% of the global renewable energy patents, far exceeding the United States (15.6%) and Japan (4.3%) ranking in the second and the third place respectively. IT-based, smart and green growth is at the most critical stage, like a butterfly before getting out of its cocoon.

Pursue cross-border industrial revolution and inclusive development.

In this round of industrial revolution, it is difficult for technological progress in a single field to support the overall development; integration, collaboration and innovation across technical fields are needed. The boundaries between traditional technologies and industries are gradually being broken to adapt to the rapidly changing world. The new generation of IT technologies represented by artificial intelligence (AI), Internet of Things (IoT), and quantum computing blends with low-carbon technologies represented by new-type industries and cities, renewable energy, green buildings and transportation, giving rise to new industries and new formats. Though difficult to define with a single concept, these integrated technologies and development models are interacting to solve increasingly complex non-traditional global challenges such as public health and climate change. Multi-objective balance and systematic solutions are the core part of the new growth story, so more attention should be paid to socioeconomic multi-objective balance and cross-border systematic management, as well as cross-industry/sector solutions. The new growth story should not only fully tap potential opportunities, but also manage risks by reducing inequality in transition and enabling equitable access to share the results of development.

Give play to the spillover effects of new factors such as technology, data and natural capital.

Higher resource productivity is an important driver of the new growth story. Innovation is the main way to increase resource productivity. Human and intellectual capital can grow indefinitely through intellectual development, whereas non-renewable physical wealth will be gradually exhausted when used. Improving human well-being, natural capital protection and investment can also serve as a lever that injects new growth impetus to emerging green industries such as smart grid, renewable energy, electric vehicles, and the digital economy. Many industries stay at the low or medium end of world industrial technology and value chain. Compared with traditional fossil energy and fossil fuel vehicle technologies, new energy vehicles, AI, clean power and energy efficiency technologies have stronger knowledge spillover effects, which improve the innovation capacity of the whole society.

Pay more attention to openness and global consensus.

The Covid-19 outbreak has further proved that the world swims or sinks together and becomes a community of shared future for mankind. No country can alone address this severe challenge. As the largest developing country, China not only acts on, but also inevitably shapes the world arena. Since the global industrial chain, value chain, and supply chain are intertwined, China's future development is crucial to the people of the country and beyond. With the increase of China's overall national strength, the international community has rising expectations of China on global issues such as public health, climate change, and development assistance. However, these issues cannot be solved by one country. Therefore, a global consensus on the new growth story needs to be forged on the basis of openness, mutual trust, and win-win cooperation. In cooperation with other countries, China will be fully able to meet new domestic and global sustainable development needs by investing in natural, human, and intellectual capital. It will boost green technology innovation and green industry development, provide high-quality public products for global ecological security, and share the green benefits from low-carbon development.

The implication for the next five years

The 14th five-year period (2021-2025) presents a critical juncture as well as a window of opportunity for peaking carbon emissions. China is aiming to build a clean, low carbon, safe and efficient energy system by limiting fossil fuel consumption, boosting energy efficiency, implementing renewable-for-traditional fuel initiatives, deepening power market reform, and building a new power system dominantly featuring renewables. Efforts also need to be made to enforce pollution and carbon emission reduction measures in major economic sectors—promoting green manufacturing in the industrial sector, upgrading energy efficiency standards in the construction sector, and accelerating the construction of a green, low carbon transportation system. Such transition is highly dependent on breakthroughs in green technologies. The plan has been made to improve and strengthen green and low carbon regulations and market mechanisms, including the energy "dual control" regulations, the policies that induce green development (such as green fiscal, financial, land policies and so on), the carbon trading scheme and green finance system. As urbanization is ongoing, it is also important to promote green lifestyle. Besides, it is also required to strengthen capacity for carbon sinks, by improving land resource planning institutions, promoting the use of multiple measures of carbon sinks.

In the new growth story, we should focus on the introduction of short-term economic stimulus policies and the deployment of long-term development strategies, and foster the interaction between the two.

New options for the short-term economic stimulus plan.

In the large-scale discussions on post-pandemic economic stimulus plan and 14th FYP, high hopes are placed on new infrastructure such as big data, cloud computing, AI, 5G, IoT, and the Industrial Internet of Things (IIoT). The economic stimulus plan is intended to produce effects in the short term. However, new infrastructure, such as industrial Internet, IoT, and charging piles, highly depends on local economic and social foundations, and its scale and density should match local industrial needs and social governance needs. Without sound overall coordination and management, there will be redundant construction and idle capacity, resulting in large waste of under-utilized investment and higher risk of structural imbalance. In contrast, a reasonable and optimal economic stimulus plan that matches the long-term new growth story will maximize the long-term benefits.

New thinking on the development of metropolitan areas and city clusters.

China's urbanization problems, such as traffic congestion, unequal service, and environmental pollution, reflect the uneven spatial distribution of population and economic activities and the deficiency of corresponding infrastructure and security measures. For new urbanization during the 14th FYP period, China needs to further identify the trends of demographic changes and the associated climate and environmental impacts, and make plans for the sustainable de-

velopment and green development in key areas, while encouraging green urban lifestyle, and innovation-driven development of consumer infrastructure represented by medical care and education. In addition, China should explore the construction of a modern social governance structure, advance the reform of fiscal and tax systems, with a focus on establishing a local self-sufficiency fiscal cycle, so as to fundamentally address local government's dependence on land finance. Effective public fiscal tools will be launched to facilitate the balance between investment and consumption and guide investment flow to sustainable infrastructure.

New perspective from IT-based energy transformation.

The digital revolution with Internet IT innovation as the main direction has expanded from transmission grids to low- and medium-voltage distribution networks, and even affected individual equipment, making it possible to dynamically match supply and demand on the supply and demand sides. Compared with supply-side flexibility solutions, such as coal power electricity and centralized energy storage, the system flexibility solutions that fully harness the grid and demand side have advantages in cost and feasibility. During the 14th FYP period, China will need to formulate a forward-looking target and policy frameworks that meet the needs of future power systems. It should actively promote the application of modern information technologies and advanced communication technologies, such as cloud computing, big data, IoT, mobile internet and AI, in system operation control and end-user integrated energy services. China should facilitate the bidirectional flow and sharing of energy information, and realize point-to-point autonomous transactions between distributed energy resources (DER) and distributed energy storage entities and large industrial users and individuals and household-level micro energy consumers. Besides, the cross-disciplinary integration of renewable energy power supply, electric vehicles, heating and cooling systems should be strengthened.

New reform of economic governance and macro-control modernization.

The definition of property rights of natural capital and pricing mechanism needs to be established. The rights and interests of natural capital owners are protected, and the benefits of natural capital will be shared in a fair manner. A sound trading system is good for environmental rights and interests to facilitate the pricing of natural capital in the factor market, so as to achieve effective market allocation and ensure return on investment. Mechanisms will be created to link the carbon trading scheme with other resource and environmental rights trading systems such as energy use rights and pollutant discharge rights. Taking advantage of the carbon market, we will encourage innovation in carbon financial products, which is in alignment with green finance, to provide financial assistance for the real economy, especially SMEs.

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Evolution of Climate Diplomacy in China

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China's climate governance system has undergone three decades of evolution, and can be divided into four phases as follows: the first phase began with the United Nations Conference on Environment and Development. The main feature of this phase is that environmental diplomacy dominates consideration of climate governance in China. Climate change is more in the service of diplomatic strategy as environmental diplomacy, but not a domestic priority in China. The second phase began with China's establishment of a special interministiral coordinating body, the Leading Group on Climate Change, in 1998, which gradually linked climate change issues to domestic priority issues such as development and environmental issues. In this stage, climate change is considered to be an environmental issue, but first and foremost a development issue. The third phase began in 2007 with China's establishment of a dedicated Climate Change Department (CCD) under the National Development and Reform Commission (NDRC), with climate change policy and decision-making gradually becoming independent of energy and environment policies. The CCD played the dual functions of international negotiations and domestic policy formulation and coordination. The fourth phase began in 2018 with the establishment of the Ministry of Environment and Ecology (MEE) and the transfer to it of the CCD and the functions of combating climate change. The main feature of this phase is the integration of climate change with the ideas and concepts of "community of shared future for mankind" and "ecological civilization" proposed by the Chinese Government.

Phase 1: From IPCC to environmental diplomacy

The Chinese government's formal engagement with climate change began in 1988 at the UN's Intergovernmental Panel on Climate Change (IPCC) inaugural meeting, at which the China Meteorological Administration (CMA) participated as a representative of the Chinese government and was elected as Vice-Chair of IPCC Working Group III. During the discussions in IPCC Working Group III, the representative of China found that the discussion of GHG emissions closely related to national economic development and went beyond the scope of the authority of CMA. After the meeting, CMA tried to convince other ministries to participate in the IPCC, but since China is in the early stage of reform and opening up, and the main focus of all ministries is on domestic economic development, CMA could not convince other ministries to participate. Therefore CMA reported to the State Council, leading to the establishment of a "Climate Change Coordination Leading Group" under the Environmental Protection Commission of the State Council to coordinate China's participation in IPCC activities. It was under the coordination of this group that the various ministries responsible for energy, science and technology, environmental protection, planning and foreign affairs became formally involved in the work of the IPCC. In February 1990 this coordination group was upgraded to include 16 ministries.

The feature of this period was that climate diplomacy became an important part of China's environmental diplomacy and even its overall diplomacy. After the G7 sanctions on China began in 1989, China experienced its most isolated period since the Cold War, but the environmental delegation was the first to engage

with the western countries at a high level, and environmental diplomacy became an important factor in breaking China's diplomatic isolation. In October 1989, the Ministry of Foreign Affairs (MFA) joined the State Council's Environmental Protection Committee, which is responsible for external environment and development affairs. During the negotiations of the United Nation Framework Convention on Climate Change (UNFCCC), the MFA, under the coordination of the State Council, assumed the main task of international negotiations, but the ministries responsible for science and technology, economic planning, energy, agriculture, forestry and oceans also participated in the negotiations. This model of multi-ministerial engagement in international negotiations continues to this day as an important link between international climate governance and domestic climate governance. It was through the climate change negotiations that the Chinese government accumulated the first administrative officials who understood climate change, and this human capital played a vital role in the subsequent development of domestic climate governance.

As the importance of environmental diplomacy increased, China gradually realized the need to establish a clear national position on international environmental issues, particularly climate change. In July 1990, the Environmental Protection Committee of the State Council adopted "China's Principle and Position on Global Environmental Issues", which places climate change at the top of global ecological issues and clearly spells out the position of China on climate change.

Phase 2: Redefine development and climate change

In 1998, as part of the institutional reform of the Chinese Government, the State Council restructured the former National Climate Change Coordination Group and established the National Climate Change Response Coordination Group (NCCRCG), led by the National Development Planning Commission (NDPC) and with the participation of the MFA and other ministries, and headed by the then Director of the NDPC, with the Group's office located at the NDPC. The establishment of the NCCRCG highlights the rise of climate change in the Chinese Government's decision-making priorities. Compared to the CMA, the NDPC, whose main responsibility is to take overall responsibility for economic coordination and planning in China, has higher specifications than other ministries and better policy coordination and implementation capacity.

In 2005, when the Kyoto Protocol came into force, the NDPC promoted the implementation of the Clean Development Mechanism (CDM) in China[1]. The CDM, while criticized by many researchers on its additionality and effectiveness, did contribute to the evolution of China's climate governance. Through the implementation of the CDM, a total of 3807 projects were registered in China by 2015. For the first time, a large number of Chinese companies have learned about climate change through the CDM and have built up their corporate greenhouse gas monitoring and accounting capacity. In addition, a large number of verification needs have contributed to the capacity-building and development of third-party verification in China. Also for the first time, the NDPC also recognized the effectiveness of promoting energy efficiency and emission reduction through market mechanisms. These three factors emerged as the key drivers of the establishment of carbon market in China in 2013.

However, unlike the domestic positive shift on climate change, China did not show a corresponding shift from its original position in the international climate change negotiations during this period, but continued to maintain its original position of not undertaking quantitative emission reduction obligations. On the one hand, this was due to the withdrawal of the United States from the Kyoto Protocol in 2001, which led China to adopt a more conservative attitude towards quantified emission reductions; on the other hand, although the NCCRCG was established and has a support office, its capacity and functions were not enough to support China's

1 The Clean Development Mechanism (CDM) is one of the Flexible Mechanisms defined in the Kyoto Protocol that provided for emissions reduction projects which generate Certified Emission Reduction units (CERs) which could be traded in emissions trading schemes. China was the main generator of such units, and participants in the European Union Emissions Trading Scheme (EU ETS) were amongst the main purchasers.

domestic climate change policy implementation and formulation. As a result, the MFA, which is responsible for international negotiations on climate change, did not have a policy interface with its counterpart in the domestic government and tended to stick to its old negotiating position.

Phase 3: The rise of climate change in the political agenda

At the Conference of the Parties to the Kyoto Protocol (COP11) hosted in Montreal, 2005., developing and developed countries engaged in intense efforts to open negotiations on the second commitment period of the Kyoto Protocol. A consequence was a compromise, whereby developed countries agreed to start negotiations for a second commitment period, while developing countries agreed to launch a two-year dialogue with developed countries on the issue of autonomous emission reductions by developing countries. This dialogue led to the 2007 Bali Road Map, which in turn launched the process of Nationally Appropriate Mitigation Actions (NAMA) for developing countries. While the importance of this dialogue was not realized at the time, China has increasingly felt increasing international pressure. In 2007, a report from the Netherlands Environment Agency stated that China had surpassed the United States as the world's top emitter of greenhouse gases. With this background, on 30 May 2007, Premier Wen Jiabao chaired an executive meeting of the State Council to consider and decide to promulgate China's National Programme to Address Climate Change. The importance of this national programme was severely underestimated at the time, with critics viewing it as a collection of existing energy policies, with no new climate change policies in place. But hindsight suggests that the significance of this programme was to elevate the issue of climate change to the highest level of government - the State Council - which led directly to the creation of the CCD thereafter, opening up institutional space for climate change policy. At the same time, this programme should not be regarded as a simple response to international pressures. Without the redefinition of "development" and the transformation of China's domestic energy resource policy, the domestic underpinnings and landing zone would not exist. Therefore, the National Programme also means that international pressure to deal with climate change began to coincide with China's inherent need for energy conservation and emission reduction. This "two-wheel drive" approach forms the basic logic of China's response to climate change thereafter. Responding to climate change is no longer simply seen as an international pressure, but is beginning to be seen more as a domestic policy need.

In June 2007, China further upgraded the NCCRCG to the National Leading Group on Climate Change Response and Energy Conservation and Emission Reduction, with the Prime Minister as its head and ministers from various ministries as members. This was followed by the establishment of the CCD under the National Development and Reform Commission (NDRC) in the 2008 reform of government institutions, which includes strategic research and planning, domestic policy formulation and implementation, international negotiations and international cooperation on climate change. From the functions of the new team to the main responsibilities of the CCD, the integration of international negotiations on climate change with domestic responses is now a clear feature of the Chinese climate policy process.

CCD also co-led international negotiation on climate change with MFA, and is also responsible for the domestic climate change strategies and policies. Compared to MFA, the NDRC is more aware of the national circumstance in the country and therefore makes more timely and accurate adjustments to its position in the international negotiations. Thereafter, China played a more flexible role in the subsequent negotiations of the Bali, Copenhagen and Paris agreements, which were largely attributed to Mr. Xie Zhenhua, who was then China's Special Representative for Climate Change at the same time. This flexibility enabled a close integration of international negotiations and domestic responses.

Phase 4: From NDRC to MEE

In 2018, the former Ministry of Environmental Protection was transformed into the MEE as a part of new institutional reform that unified the ecological and environmental functions of groundwater, watersheds, agriculture, oceans and climate change, shifting relevant responsibilities from different ministries to the MEE. The purpose of this functional realignment was to manage ecology as a system under one ministry in order to avoid problems of policy overlap and contradiction. For climate change, the environmental inspection system and strong data monitoring capacity of MEE are undoubtedly an advantage, but its relatively weak policy coordination capacity also leads some researchers to worry that climate change may retreat from the epicenter of policy making. At the time of writing, China's 14th Five-Year Plan is in the process of development, and this will be an important test for the changing role of climate change in the overall policy agenda.

In the 2017 Parties' congress, the international cooperation on climate change was closely linked to two core concepts proposed by the new government. Climate change is seen both as a model for building a global "ecological civilization" and as an important element in building a "community for a shared future for mankind". For readers unfamiliar with China, the concept of ecological civilization is somewhat obscure, but since its introduction in 2017, the concept has garnered widespread attention in the country and was written into the constitution in 2018. Although there is still controversy over the meaning of "ecological civilization", it is worth noting that this concept elevates ecology and environmental protection beyond "development" to the level of "civilization". Although some scholars see "ecological civilization" as a moral ideology or political framework, it is undoubtedly an important conceptual framework and guide for future environmental and climate governance in China. Another concept closely related to "ecological civilization" is the "community for a shared future for mankind", which implies that each country should take into account the legitimate concerns of others in pursuing its own interests and promote the common development of all countries while pursuing its own development, a new paradigm for China's handling of international relations. These two concepts seek to take a broader view of human civilizational processes and international relations. Climate change and its international cooperation lie squarely at the intersection of these two concepts. It remains to be seen whether climate change will set an example for a new global vision advocated by China, but it seems to signal the end of the era of "forcing mechanism" in China's climate governance evolution and a future in which China will take a more proactive stance in advancing both domestic and global climate governance processes.

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Section II

Celebrating EAERE Practitioner Achievement Awardee

From Kyoto to Paris: Aligning EU Greenhouse Gas Emissions Reductions Policies

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Turning the page

The Kyoto Protcol's 2nd commitment period recently ended. As illustrated in Figure 1, it obliged the EU to reduce its greenhouse gas (GHG) emissions on average by 20 % in the period 2013-2020 compared to 1990. At the same time, the next phase of international climate action started. It put into effect the GHG emissions reduction pledges or 'nationally determined contributions' that were made in the context of the Paris agreement at the end of 2015. Since the adoption of the Kyoto Protocol in 1997, EU GHG emissions reductions policies evolved in three successive waves employing a growing mix of policy instruments across an increasing number of economic sectors (Delbeke, 2006; Delbeke and Vis, 2015; Delbeke and Vis, 2019).

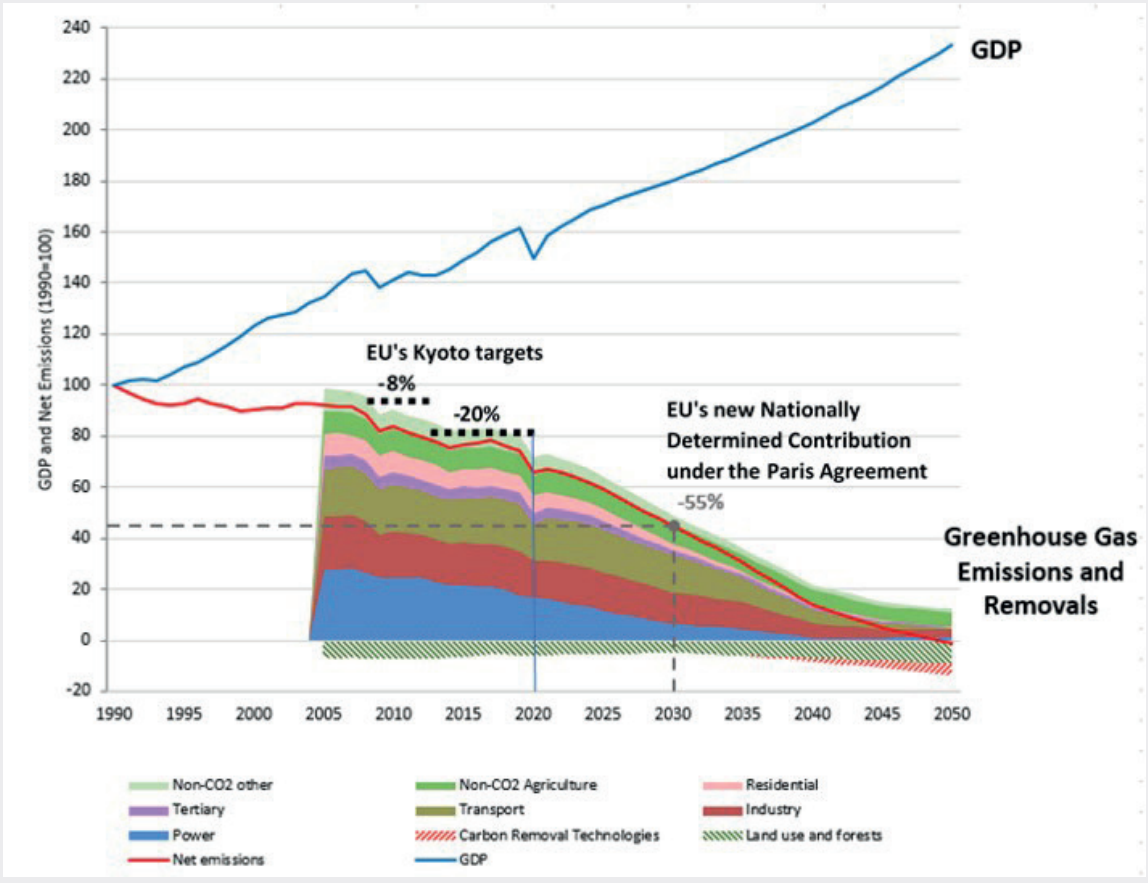

Figure 1: The EU's pathway to sustained economic prosperity and climate neutrality (Source: EC, 2020b, background data)

As a result, the EU as a whole is on track to over-accomplish its Kyoto obligation (EC, 2020f). However, progress in Member States as well as sectors has been uneven. Significant reductions have been observed in the sectors covered by the EU's emissions trading system (ETS), especially the power sector over the past four years. Insufficient progress was made particularly in the road transport, buildings and agricultural sectors. It is also of particular concern that land use sinks have been in decline for six years.

In line with the Paris agreement, the European Green Deal sketches out an action plan for the EU to become the first climate neutral continent, i.e., net zero with respect to all GHG emissions, by 2050 (EC, 2019; EC, 2018b; Stoerk & van Ierland, 2019), and to reduce net GHG emissions by at least -55% by 2030 compared to 1990. The new European Climate Law, as agreed by the European Parliament and the Council in April 2021, will make both targets legally binding. As illustrated in Figure 1, this will require an economic and social transition at an unprecedented scale and pace. While over the past three decades emissions were reduced roughly by 25 %, an additional 30% reduction is now supposed to be achieved within just one decade.

To this end, a new wave of legislation 'Fit for 55' is expected to be tabled before the summer break. This is a good point in time for a personal reflection that identifies key challenges and explores ways forward to reaching the new 2030 target and putting the EU on track towards climate neutrality by 2050.

Towards a robust policy framework

Providing long-term certainty and environmental integrity

The Kyoto Protocol did not fix a quantified long-term objective. Instead, it pursued a static approach whereby 5-yearly national GHG emissions budgets were determined far ahead of time. In order to ensure certainty and environmental integrity, the EU diverted from this static approach to managing its domestic emissions budget dynamically. Under the ETS, long term emissions reduction trajectories were legislated. A market stability reserve was created which annually reduces excess supply. For the non-ETS sectors, carry over of unused allocations from one phase to the other was not permitted, and the starting points of each phase were based on recent historic emissions. The use of offset credits was capped and credits lacking environmental integrity were phased out.

Conversely, the Paris agreement set a concrete long-term global objective "to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of the century". The IPCC translated this into potential pathways delivering global CO_2 emissions to net zero in 2050 (IPCC, 2018); subsequently, the EU decided to revise its long-term strategy and to step up its 2030 ambition as now fixed in the EU's Climate Law.

Creating a transparent and robust governance framework

Transparency is the bedrock of accountability and compliance, and is indispensable both for any effective international treaty and for domestic legislation. Over thirty years, the international set of science-based transparency rules was improved iteratively, and EU transparency rules were updated accordingly. With the Paris Agreement, the EU expanded an already comprehensive governance system (EC, 1993; EC, 1999; EC, 2004, EC, 2013; EC, 2018a; EC, 2020a). This process will be continued ambitiously over the next few years:

- Most urgently, the Kyoto Protocol's counterproductive land accounting rules, e.g., capping of forest removals and its fragmented reporting of land use emissions, will have to be corrected. Instead, every ton of land use emissions and removals must be accurately accounted for, in line with the recently adopted European Climate Law. Real-time sinks monitoring should be introduced with the help of remote sensing.

- Moving towards a circular economy anticipates the use of novel flows of GHG, e.g., the use of captured CO_2 from industrial processes, direct removals of atmospheric CO_2 or trapping CO_2 in new materials. The quantity and quality of these new flows

across different sectors and stocks will have to be monitored.

- National Energy and Climate Plans (EC, 2020d; EC, 2020e) will have to be updated as soon as the -55% legislative package is finalised.

Towards an efficient and fair policy mix

1. Fostering emissions reductions

Accomplishing EU's ambitious new targets will require strengthening the explicit carbon price signal and expanding emissions trading to an increasing number of economic sectors. The 2030 Climate Target Plan presented potential options (EC, 2020b; EC, 2020c). The most promising elements include:

a. Strengthening the ETS (almost 45% of net GHG emissions in 2015). Its linear reduction factor through to 2030 will have to be significantly more stringent. The role of auctioning needs to be expanded. The market stability reserve should be continued with at least the current feed-in rate. In addition, large point sources not yet covered should be added to the downstream system, e.g., shipping, waste incineration. As the number of allowances under the ETS shrinks, the system could be susceptible to increased financial speculation which will have to be monitored and, if necessary, to be regulated.

b. Introducing carbon pricing for key non-trading sectors: In view of the rather poor past performance of sectors not covered by the ETS, an explicit carbon price signal should be introduced covering ideally all fossil fuels outside the ETS. These amount to roughly 40% of 2015 net GHG emissions. An absolute and declining emissions cap would be set for the lagging sectors, in particular road transport and buildings. It should be started as a separate upstream emissions trading system allowing for a learning phase. The subsequent increase in fossil fuel prices might raise a number of social questions for low and lower-middle income households, small transport operators and commuters. These will have to be tackled head on.

c. Establishing direct incentives for climate friendly land use: In view of the need to reverse the declining sink, specific national removal targets should be set, ideally well beyond 2030 as investments into forests require long lead times and certainty for foresters. Member States should develop innovative carbon farming approaches rewarding performance, e.g., restoring peatlands or afforesting/reforesting. Over time, land use and non-CO_2 emissions from agriculture could be integrated into a single land use pillar. Within this pillar emissions (equivalent to around 13% of 2015 net GHG emissions) are larger than removals (equivalent to roughly 8% of 2015 net GHG emissions), i.e., currently this pillar is a net emitter. This land use pillar would need to be climate neutral between 2030 and 2035, and net negative afterwards. National targets should take into account current land use, cost-efficient mitigation/removal potential and the financial capability of farmers/foresters.

d. Strengthening policies for the remaining sectors: Remaining emissions including, e.g., methane losses from waste and gas network and fluorinated gases would represent around 13% of 2015 net GHG emissions. A smart mix of EU and national policies should deliver cost-effective emissions reductions.

e. Enhancing flexibility: While, in the long-term, there should be full flexibility between all sectors to maximise cost-efficiency, the current system of limited flexibilities will need to be expanded.

f. Reviewing the safeguards against carbon leakage: If carbon prices were to increase beyond €60 per ton of CO_2 by 2030 only in the EU, the risk of carbon leakage would significantly rise. Preferably, major global competitors should collaborate to minimise future carbon leakage. However, the EU continuing unilaterally with free allocation or introducing a WTO-compliant carbon

border adjustment mechanism for sectors most at risk might be inevitable.

g. Ensuring fairness: An efficient policy outcome will not automatically lead to a fair outcome. Already in the past, a significant part of the cost-efficient mitigation potential in the EU was found in less wealthy Member States, particularly in central and eastern Europe. The significant step up in ambition will amplify the need to address arising social issues. Distributional elements of EU climate policy will require strengthening, e.g., by allocating

   i. a higher proportion of ETS revenues in favour of less wealthy Member States or regions or households facing specific social challenges, e.g., distribution of auctioning allowances, increasing the size of the Modernisation Fund and the Innovation Fund.

   ii. additional budgetary sources, e.g., to a newly set up Just Transition Mechanism.

   iii. targets and obligations on the basis of financial capability, e.g., differentiated national targets on the basis of financial capability or de minimis provisions.

h. Developing a robust legal framework for CO_2 removals: In 2050, all residual emissions in the EU will have to be balanced with CO_2 removals from the atmosphere. As nature-based solutions require a long lead time to establish themselves, within the next five years a robust new regulation certifying removals of atmospheric CO_2 should be developed. Difficult questions like permanence, liability, and the timing of allowing removals to balance the residual emissions of other sectors will need to be addressed.

2. Accelerating innovation

The development and demonstration of innovative zero and low emission technologies will have to be accelerated in the coming years, e.g., large scale industrial processes, advanced low and zero carbon fuels, carbon capture, use and storage, material substitution, low emissions livestock husbandry. Deploying most of these novel technologies would require carbon prices well above €60 per ton of CO_2. Therefore, the European Green Deal foresees a raft of targeted incentives on top of a gradually rising carbon price, e.g., targets/quotas, mandatory standards, subsidies and revised State aid rules. The Innovation Fund alone, given current allowance prices and its current size of 450 million allowances, could provide more than €20 billion public support in the coming decade. If smartly spent, it could mobilise a significant amount of private finance. In all cases, preference should be given to performance-based instruments rewarding economic actors for actual GHG emissions reductions, e.g., carbon contracts for difference. Many innovative technologies will require predictable support well beyond 2030 in order to attract private investment.

3. Financing the deep modernisation

The transition towards a climate neutral Europe in 2050 will require massive investments in modernising the entire economy. In the coming decade, an estimated additional €350 billion will have to be invested annually compared to the last decade with particular focus on buildings and transport (Figure 2).

The Green Deal Investment Plan foresees mobilising €1,000 billion in sustainable investments over this decade. In addition, the Covid recovery programme could add €750 billion in the coming years. This public support will have to lever as much sustainable finance from private sources as possible. Support will often have to be sustained beyond 2030, e.g., long-term infrastructure investments.

Concurrently, the revenue basis for support will have to be broadened. In 2019, Member States received €14 billion in revenues from ETS auctioning, of which 77% was recycled towards low emission investments (EC, 2020f). A more stringent ETS cap will lead to increases in carbon prices. Together with the expansion of emissions trading, annual auctioning revenues could rise up to €55 billion in 2030 (EC, 2020c). Part of this revenue could be frontloaded to kickstart investments.

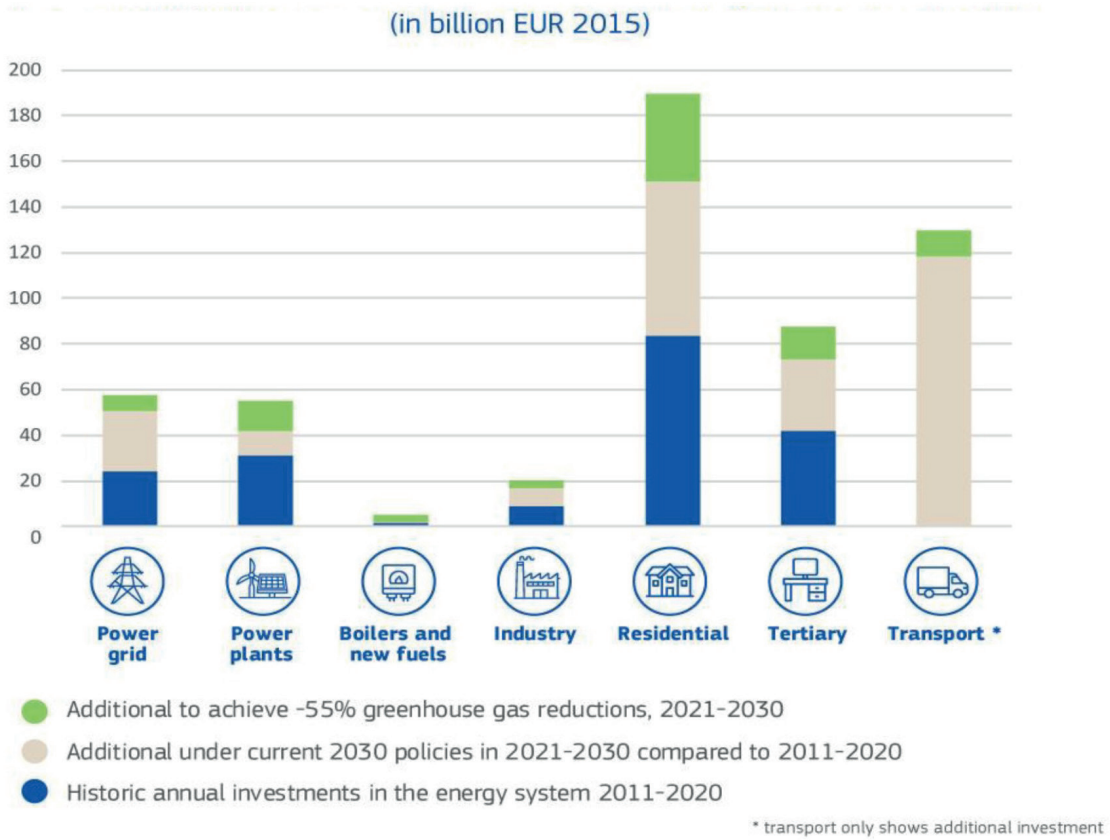

Figure 2: Average annual investments 2011-2020 and additional annual investments 2021-2030 under existing policies and to achieve -55% GHG emission reductions by 2030 (Source: EC, 2020c)

All major investment projects in the EU should be in line with the EU becoming climate neutral by 2050. The European Investment Bank, for instance, will follow the new sustainable finance taxonomy and stop funding fossil fuel energy projects from the end of 2021 (EIB, 2019). Moreover, when assessing bankability, it is proposed to use a shadow cost of carbon that will rise from €80 in 2020 to €800 per ton of CO_2 in 2050 (EIB, 2020).

Looking ahead

The 'Fit for 55' legislative package that will be tabled before the summer break will be negotiated over the subsequent 18-24 months, and will enter into force not much before 2025. Thus, this legislative cycle will *de facto* start shaping the EU's overall climate policy framework beyond 2030. In fact, as foreseen in the EU's governance regulation, post-2030 policy proposals should be tabled in early 2024 for the EU to be ready in time for the next pledging round under the Paris Agreement in 2025. Work, in other words, has only just begun. Solid foundations exist for the EU to build upon, but bold new initiatives and strengthening of existing measures are needed. In climate policy terms, this is no time for the faint-hearted.

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Note

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