(UNOFFICIAL TRANSLATION)

Progress on the Implementation of China's Nationally Determined Contributions (2022) [1]

[1] This is an unofficial translation. In case of any divergence, the official text in the Chinese language shall prevail.

Contents

China updated its Nationally Determined Contributions (NDC) targets in 2020 as per the requirement to "reflect its highest possible ambition" under the terms of the *Paris Agreement*; subsequently submitted its updated NDC targets to the *United Nations Framework Convention on Climate Change* (UNFCCC) in October 2021. To achieve related terms of the *Paris Agreement*, commitments should be honored and concrete actions should be implemented. China's progress toward its NDC targets is presented below.[2]

1. China's New Arrangements and Measures to Achieve NDC targets

China implements a national strategy to deal with climate change actively. The NDC targets present not only China's current and future efforts to address climate change, but also as part of its responsibility to build a global community with a shared future; it is an important way of promoting ecological civilization and realizing high-quality development. In 2015, China set its nationally determined action objectives by 2030. By the end of 2019, it had delivered on its 2020 climate action targets ahead of schedule. In 2020, China announced the updated NDC, namely strive to carbon dioxide peaking before 2030 and achieve carbon neutrality before 2060, lower its carbon dioxide emissions per unit of GDP by over 65 percent from the 2005 level, increase the share of non-fossil fuels in primary energy consumption to around 25 percent by 2030, increase the forest stock by 6 billion m^3 from the 2005 level and its total installed capacity of wind and solar power to over 1.2 billion kW by 2030. As a developing country, China has made its utmost effort in response to climate change based on its development stage and national conditions. China has always placed a high priority on implementing the NDC targets as a crucial step to promote the comprehensive green and low-carbon transformation in economic and social development.

1.1 Leading a Comprehensive Green Transformation of Economy and Society with Carbon Dioxide Peaking and Carbon Neutrality

Responding to climate change is something we must do, not something imposed upon us because it is the inherent requirement for achieving China's sustainable development. Upholding the concept that "clear waters and green mountains are invaluable assets", China has adopted a coordinated approach to the protection and governance of mountains, rivers, forests, farmland, lakes, grasslands, and deserts. China has spared no effort in promoting ecological development, strengthening pollution control, and improving the production and living environment for the people. In the backdrop of tackling climate change and boosting the post-pandemic economic recovery, China has incorporated the goals of peaking carbon dioxide emissions and achieving carbon

[2] This report is compiled upon the notice from the UNFCCC secretariat dated April 22 to report China's progress on meeting its NDC targets.

neutrality in its overall plan for ecological, economic and social development. And pushed for the all-round green transformation of the economy and society through coordinated efforts of reducing pollution and carbon emissions and increasing green growth.

Making coordinated efforts to reduce pollution and carbon emissions. Synergizing the efforts to reduce pollution and carbon emissions is the inevitable choice to accomplish the all-round green transformation of economic and social development in the new development stage. In June 2022, seven authorities, including the Ministry of Ecology and Environment, jointly issued the *Implementation Plan for Synergizing Reduction of Pollution and Carbon Emission*, which was an important component of the "1+N" policy framework for peaking carbon dioxide emissions and achieving carbon neutrality. Taking this plan as a key approach, China has coordinated the work on carbon dioxide peaking, carbon neutrality, and eco-environmental protection and better aligned the policies on eco-environment governance and the energy industry. Keeping a close eye on the main sources of environmental pollution and carbon emission, China has focused on areas such as industries, urban-rural construction, traffic and transportation, agriculture, and ecological work and refined the technical paths for the governance of air, water, oceans, soil, and solid wastes. Through promoting innovation mechanisms, introducing pilot initiatives, and intensifying safeguards, China has made many practical efforts to achieve two strategic tasks – the fundamental improvement of the eco-environment and carbon dioxide peaking and carbon neutrality.

Accelerating the formation of a spatial layout for green development. China respects nature, leaves the time and space for natural ecology to rest and recover, and aims to build a community of life for man and nature. It implements the most rigorous eco-environmental protection system, emphasizes the underpinning effect of territorial spatial planning, firmly defends the boundary for natural and ecological security, and enhances the ecosystem's carbon fixation capability. The zoned eco-environmental management and control have been tightened, the requirement for zoning and purpose regulation in territorial spatial plans have been applied, and the "Three Lines One Permit" policy (red line of ecological conservation, bottom line of environmental quality, upper line of resource utilization, and the access list of projects with eco-environmental impacts) has been explored and integrated to embed carbon dioxide peaking and carbon neutrality. The Chinese Government has initiated to build a number of national parks, with the Three-River-Source National Park, Hainan Tropical Rainforest National Park, and Wuyishan National Park already established in the first batch, etc., in the effort to build the world's largest national park system with a view to keeping the natural ecosystem in its integrity and entirety with better carbon fixation capacity.

Strengthening eco-environmental access regulation. Regulating and controlling the discharge from point sources is a vital approach to achieving green transformation at a low cost. China has consistently and strictly controlled the expansion of high-energy-consumption, high-emission projects with low–technology and subjected them to list-

based management, classified handling, and dynamic monitoring. These projects are required to go through stringent environmental impact assessment before approval, and environmental impact assessment on GHG emission is carried out on a trial basis for projects in key industries such as electric power, iron and steel, building materials, non-ferrous metals, petrochemical and chemical industry, and coal chemistry. Efforts like these are aimed at adjusting the industrial mix and promoting green, low-carbon and high-quality development at the source.

Fostering green growth and sustainable ways of life. Establishing and improving the green, low-carbon and circular economic system and advancing the green transformation of economic and social development is the fundamental policy for addressing the resource, environmental and ecological issues. To foster green growth and sustainable lifestyle, China has boosted green production, delivered plans for green industrial and agricultural development, and pushed the construction of an industrial system featuring high efficiency, energy conservation, advanced environmental protection, and circular use of resources. Initiatives such as green design, clean industrial production, circular economy, clean and low-carbon energy, and green agricultural development have been promoted, and the lists of green plants, green products, green industrial parks, and green supply chain management enterprises to promote green manufacturing have been delivered. Green plans have been pushed ahead in the direction of sustainable development and green consumption across the whole product cycle, logistics chain, and the entire system of consumption, covering clothing, food, housing, travel, etc. Several provinces and cities have been designated to pilot low-carbon development, which has shown a significant reduction of their carbon intensity faster than the national average. The idea of green and low-carbon development is incorporated into the national education system, and demonstrative projects are launched for building a green and low-carbon society, so as to forge consensus across the society and bring everyone on board as soon as possible.

1.2 Improving the Policy System

China adheres to the principle of overall planning, giving priority to saving, “two-wheel-drive” strategy, seeking for coordinated efforts at home and abroad, and risk prevention. It also strengthens the top-level design and strategic layout for carbon dioxide peaking and carbon neutrality, for which a “1+N” policy framework has been put in place.

Having put in place a “1+N” policy framework for carbon dioxide peaking and carbon neutrality. The “1” means the guidance and the top-level design for carbon dioxide peaking and carbon neutrality. It consists of the two documents issued in 2021: *Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy* and *The Action Plan for Carbon Dioxide Peaking by 2030*, which clearly articulate the schedules, road maps and working procedures for carbon dioxide peaking and carbon neutrality. Whereas the “N” is the implementation schemes in key areas and sectors, such as energy, industry, urban and rural development, transport, agriculture and rural areas, reduction in

pollution and carbon emissions, coal, oil and natural gas, steel, non-ferrous metals, petrochemicals and building materials, and the supporting plans, such as technology support, financial support and statistical and accounting work. Meanwhile, all provinces have also had their implementation schemes for carbon dioxide peaking within their respective jurisdictions. As a result, these serial documents have on the whole formed a full-fledged policy system for carbon dioxide peaking and carbon neutrality with definite objectives, reasonable division of functions, effective measures and efficient collaboration, lay out a sound and coordinated arrangement, and give a steady boost to the momentum for reaching the "dual-carbon" goal.

Refining green and low-carbon policies. China has ramped up efforts to control energy intensity and consumption, although the incremental renewable energies and energy use as raw materials are not counted. Carbon dioxide peaking and carbon neutrality standards have been refined and a unified and standard carbon emission statistics and accounting system has been created to gradually replace the dual control of energy intensity and consumption with that of carbon emission and intensity. Policies in support of climate change response, covering the fiscal and tax system, price, investment, and finance, are being improved, and climate investment and financing have been launched for a trial run. A standard system for carbon dioxide peaking and carbon neutrality featuring multiple dimensions, areas and levels has been primarily established, with a special emphasis on the consistency and effectiveness of the standards.

1.3 Strengthening Strategic Planning and Institutional Development

The journey toward carbon dioxide peaking and carbon neutrality is challenging and involves an extensive and profound reform. It requires strategic thinking and planning, systemic efforts, and institutional reform.

Strengthening overall planning and coordination. In 2021, China set up a national steering group to guide and coordinate the work of carbon dioxide peaking and carbon neutrality. The leading groups at the provincial level (autonomous regions and municipalities directly under the central government (PARMs) were all set up for planning and coordinating carbon dioxide peaking and carbon neutrality. An orderly working mechanism featuring unified planning and coordination across different levels has been established.

Incorporating green and low-carbon development into the overall plans of national economic and social development. 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 of the People's Republic of China* set an obligatory indicator: the carbon dioxide emission per unit of GDP in 2025 will be 18 percent lower than in 2020, and all provinces have also incorporated green and low-carbon development into their 14th Five-Year Plans, outlining their specific targets and tasks. Dealing with climate change, promoting green and low-carbon development, and

achieving carbon dioxide peaking and carbon neutrality form important contents of major national and regional strategies. Related promotion and project deployment were carried out accordingly.

Formulating Medium and Long-term Strategies for Addressing Greenhouse Gas Emissions. In October 2021, China officially unveiled *China's Achievements, New Goals and New Measures for Nationally Determined Contributions* and *China's Mid-Century Long-term Low Greenhouse Gas Emission Development Strategy*, respectively specifying the new targets and new measures for implementing its NDC and the fundamental policy and strategic vision of its GHG emission development in the long run. The two documents represent China's specific moves to fulfill the *Paris Agreement* and embody its commitments and efforts to promote green and low carbon development and actively respond to global climate change.

Formulating and implementing the national strategy for climate change adaptation. China has issued the *National Strategy for Climate Change Adaptation 2035*, which puts forward the main targets of its climate change adaptation work in the new era. Based on the level of exposure and vulnerability of different sectors and regions to the adverse effects and risks of climate change, the plan specifies the key sectors and regions of the adaptation work with corresponding preventative measures, providing important guidance to reduce the harmful effects of climate changes and striving for climate resilient.

2. New Achievements of Controlling GHG Emissions in Key Areas

Based on preliminary calculations, in 2021, China's carbon intensity dropped by 3.8 percent and 50.8 percent from the level respectively in 2020 and 2005.

2.1 Gradual Improvement of the Low-carbon Industry System

Green, low-carbon and circular development is the inherent requirement for developing a high-quality modern economic system. China has actively improved the low-carbon industry system through aligning efforts to adjust the structure of the industry and boost the development of low-carbon industries.

Strongly developing green and low-carbon industries. China has steadily developed emerging industrial clusters in new energy, new-energy vehicles and green, eco-friendly sectors, supported the green, low-carbon and high-quality development of industries and built up a pro-environmental manufacturing system. In 2021, the high-tech manufacturing sector saw its added value rise 18.2 percent year on year, accounting for 15.1 percent of the total for industries above the designated size, its output of new-energy vehicles come in at 3.677 million units, up 152.5 percent from the previous year, its output of photovoltaic modules stand at about 182GW, leading the world for 15 consecutive years; generated the pro-environmental output value of more than CNY 8.0

trillion, and saw an annual growth rate of over 10 percent. China saw the operating revenue of its strategic emerging service enterprises rise by 16.0 percent and the investment of its high-tech industries rise by 17.1 percent from the previous year.

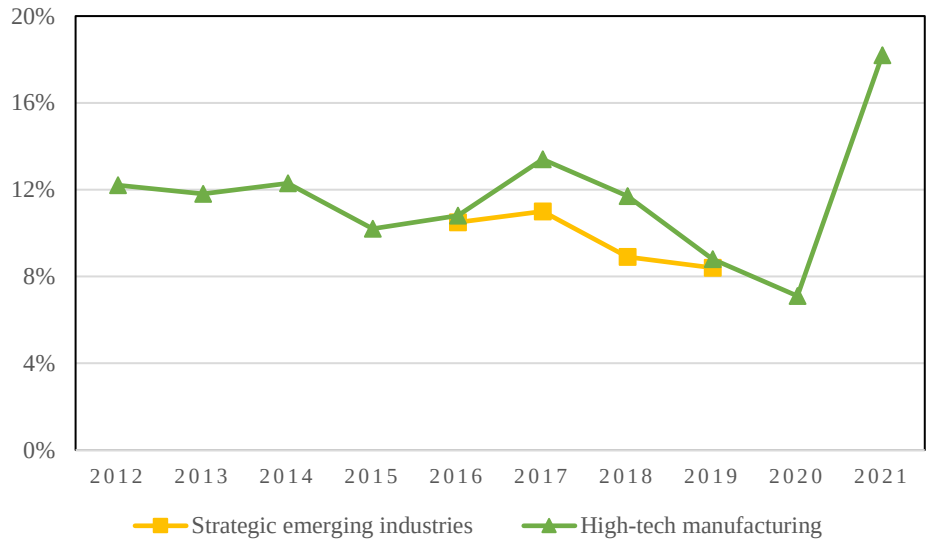

Figure 1. Annual growth of added-value of strategic emerging industries and high-tech manufacturing, 2012-2021

Optimizing industrial structure. As a 'stabilizer', service sectors' value added accounted for CNY 60.968 trillion annually, an increase of 8.2 percent, accounted for 53.3 percent of GDP, contributed to 54.9 percent of economic growth, and boosted GDP growth by 4.5 percentage points. The economic structure continued to be optimized from primary, secondary and tertiary industries, with the ratio of the value added in GDP accounting for 7.3 percent, 39.4 percent and 53.3 percent of GDP, respectively.

2.2 Sustained Improvement of Quality and Efficiency in Industrial Sector

Continuous improvement of energy efficiency in the industrial sector. Energy consumption per unit of value added of industrial enterprises above the designated level was significantly reduced a decade ago, with the overall energy consumption per unit product of crude steel, aluminum, and ethylene reduction by 9.0 percent, 4.7 percent and 4.9 percent, respectively. Guidelines have been developed to upgrade iron and steel, coking, and ferroalloy industries to lower energy and carbon intensity, and to foster benchmarks to drive up the industry's energy efficiency in general. Thanks to the combined approach of energy efficiency inspection and diagnosis, the overall energy consumption per unit product of cement clinker, plate glass, and aluminum is in a leading position in the world. In 2021, the energy consumption per unit of value added of industrial enterprises above the designated level was reduced by 5.6 percent.

Clear improvement in clean production. The iron and steel industry has undergone the retrofit of high-quality ultra-low emission. In 2021, a total of 23 iron and steel companies completed the renovation for about 145 million tons of crude steel

production capacity, and the work is in progress for another 540 million tons of capacity. The emission intensity of main pollutants in key industries was reduced by more than 20 percent during the 13th Five-year Plan period.

Initial establishment of a green manufacturing system. China has established 468 sectoral standards for energy-saving and green development and fostered 662 green plants, 989 green-design products, 52 green industrial parks, and 107 green supply chain enterprises. It has also cultivated 117 demonstrative companies for green design of industrial products, covering sectors such as the light industry, textile, building materials, chemical industry, and electrics and electronics. By 2021, there were 430 “little giant” enterprises specializing in energy conservation and environmental protection, which have effectively motivated small and medium-sized enterprises (SMEs) to become more capable of green and low-carbon innovations.

Continuous optimization of industrial structure. China has made consistent efforts to eliminate excess production capacity. In 2021, about 300 million tons of iron and steel capacity, nearly 400 million tons of cement capacity and 150 million weight cases of plate glass capacity had been eliminated. The obsolete technology for aluminum and cement production has been phased out. China would resolutely curb the irrational expansion of high-energy-consumption, high-emission projects with low–technology. So far, the country has canceled more than 350 such projects prior to launching and reduced the demand for energy consumption by 270 million tons of standard coal. Working guideline for the high-quality development of petrochemical, chemical, and iron and steel industries has been compiled and issued accommodating for the 14th Five-year Plan period, and the catalog has been released to encourage technologies and products in the petrochemical and chemical industry in a bid to promote the use of cutting-edge technologies and processes.

2.3 Continuous Improvement for Green and Low-carbon Performance in Urban and Rural Construction

Promoting the low-carbon transformation in urban and rural construction and management. China has launched a city renewal campaign at a steady and consistent pace. It organized comprehensive “health checks” for 59 pilot cities nationwide and developed a criteria system comprising a wide range of indicators such as “percentage of days with fine air quality”, “percentage of surface water reaching or exceeding Type-III standard", and "intensity of water logging points”, under eight categories such as ecological hospitality and security resilience. It helped identify any potential issues and shortcomings of the cities in dealing with climate change.

Vigorously developing energy-saving and low-carbon buildings. Policies and plans issued by the Chinese government have been given to develop energy-saving and green buildings, and the targets, overall requirements, key tasks and safeguards have been set for the 14th Five-year Plan period. It has promoted the implementation of national standards for better energy conservation performance in the construction sector. By the end of 2021, China had increased the usable floor area of solar and shallow geothermal

energy-powered heating in urban buildings to 5.07 billion m^2 and 470 million m^2 respectively, the usable installed capacity of photovoltaic power generation in urban buildings to 18.16 million kW, the replacement rate of renewable energy in urban buildings to 6.0 percent, the share of energy-saving civil buildings in the total to over 63.7 percent, and the cumulative floor area of ultra-low and near-zero energy consumption buildings to over 13.9 million m^2. China has steadily pushed ahead with the energy-saving reconstruction of residential buildings in northern heating areas and other areas where it is hot in summer and cold in winter, completing the energy-saving renovation of 1.6 billion m^2 of residential buildings and the green construction of 8.5 billion square meters of new buildings.

Accelerating clean winter heating in Northern China. Since 2017, several key regions for air pollution prevention and control, such as Beijing, Tianjin, Hebei with their surrounding districts, and the Fen-wei Plain, have been given guidance to shift to collective heating and other clean heating approaches. By replacing bulk coal with clean energies like electricity, natural gas, geothermal energy and nuclear energy or cogeneration, a warm and clean winter supply has been secured for the people. By the end of 2021, about 27 million households in those regions stopped using coal heating and shifted to clean heating in winter, reducing more than 60 million tons of bulk coal consumption.

Expediting energy conservation and the use of renewable energies in rural areas. When the seismic performance and reinforcement for dilapidated rural housing in northern China were conducted, energy conservation measures were adopted simultaneously to ensure reduced energy consumption and residents' heating expenses. China has vigorously promoted renewables like biomass and solar and accelerated the use of renewable energies in heating, cooking and farming in the countryside as the alternatives of fossil fuels in agricultural production and rural life. In 2020, there were about 7,395 large-scale biogas and bio-natural gas projects across the country, which produced 1.41 billion m^3 of gas annually and supplied more than 394,500 households. There were also more than 2,664 straw fuel plants and processing outlets with an annual output of nearly 12.7965 million tons. A total of 27.4273 million energy-saving stoves had been used cumulatively, and 238 collective heating stations burning straw bundles had been built, heating 106,200 households.

2.4 Steeping Up in Developing a Green, Low-carbon Transport System

Continuing to optimize and adjust the transport structure. China promotes multi-modal transport. At the end of 2020, coal concentration in main ports around the Bohai Sea, in Shandong Province, and in the Yangtze River Delta has shifted to rail or water transport and achieved 61.3 percent of mineral ores being shipped to the ports by rail, water or conveyer belt. The promotion of "road-to-rail" and "road-to-water" in cargo transportation has been advancing, and rail-water inter-modal transport of containers has developed swiftly, reaching 7.54 million TEUs in 2021.

Accelerating energy-saving and low-carbon vehicles. China has promoted new-energy vehicles vigorously, including mandating electric buses and taxies in cities, with over 71 percent of new-energy buses operating nationwide. Green delivery demonstration projects have been launched in various cities. By the end of 2021, the 16 demonstrative cities and the 30 cities conducting demonstrative projects have cumulatively put into use 120,000 new-energy delivery vehicles, driving the total number to over 270,000. Furthermore, the use of shore power for berthing ships has been actively promoted, and 75 percent of the berths have been equipped with five types of specialized shore power facilities. Liquid natural gas (LNG) as an alternative to fuel oil has been introduced and promoted, and the related policy issued by the government gives priority to LNG-powered ships to use when passing the ship locks at the Three Gorges. An LNG fueling system has been primarily established along trunk lines of the Yangtze River, and over 310 LNG-powered ships are navigating on inland rivers. Intensive efforts have been made to electrify existing railways to lower energy consumption. In 2021, 73.3 percent of the railways were operated with electricity, and the overall energy consumption per unit of transport by national railways as decreased by 3.9 percent from the previous year. The level of electric operation at airports has been continuously raised. By the end of 2021, electric power accounted for nearly 60 percent of the energy consumption of Chinese airports, with PV projects generating more than 20 GWh of electricity per year, and over 21 percent of the vehicles running within airports were electric-powered. Electric vehicles accounted for nearly 80 percent at Beijing Daxing International Airport (BDIA), and more than 95 percent of all airports with an annual 5 million passengers throughput or over have installed and used Auxiliary Power Unit (APU) alternative equipment, saving about 640,000 tons of jet fuel and reducing around 2.016 million tons of CO_2 emissions since 2018.

Further promoting the elimination of diesel trucks. China has stepped up to eliminate diesel trucks of national emission standards of III or below in Beijing, Tianjin, Hebei, and the Fen-wei plain and actively promoted the same exercise in other key regions to meet all the targets on schedule.

Advocating low-carbon travel. Priority is given to comprehensively implementing the strategic development of public transport in cities, building national cities known for advanced public transit, and accelerating the construction of green traffic infrastructure. China has urged local authorities to invest more in public transit development, provide stronger supportive policies, and lead urban development with public transit. At present, 46 cities have been designated as “national demonstrative cities for public transit”, and 51 cities are operating 8735.6 km of urban rail transit in total. By the end of 2021, China had installed 2.617 million charging stations of various kinds and launched green travel campaigns in over 100 cities. The Green Travel Month/Week publicity event was organized in September 2021, which called on the public to give precedence to public transit, bike, walking, and other green travel modes.

2.5 Actively Improving Efficiency and Reducing Emissions in Agriculture

Promoting energy conservation and emission reduction in crop farming. Demonstrative projects have been launched to promote rice production technologies to produce a high yield and low emission to lower methane emissions in rice paddles. China has developed a new rice production mode featuring high yield and low methane emission by means of straw mulching (SM) with some encouraging results: rice yield increased by 4.1 percent-8.8 percent and efficiency of nitrogen fertilizer by 30.2 percent-36.0 percent, cost reduced by 8.3 percent-9.7 percent and methane emission decreased by 31.5 percent-71.7 percent. It has also cultivated and promoted water-saving and drought-resistant rice, which reduces methane emission by 90 percent-95 percent per *mu* (one *mu* is around 666.67m^2), and has been planted in Anhui, Hubei, Zhejiang and Hainan provinces for more than 200,000 *ha* every year. Efforts have been made to reduce the use of fertilizers with higher efficiency in order to cut the mission of nitric oxide in farmlands. In 2020, the national use of fertilizers shrank by 12.8 percent compared with 2015; the fertilizer utilization rate of the three major grain crops was 40.2 percent, five percentage points higher than in 2015; formula fertilization based on soil testing was applied to 128.67 million *ha*, an increase of 17.7 percent over 2015.

Reducing carbon emissions in husbandry. Eco-friendly and modern methods of livestock waste recycling have steadily increased. In 2021, 96 counties received support in recycling livestock manure production, building infrastructure for airtight processing and manuring, and developing demonstration bases for animal manure management. As a result, the emission of non-CO_2 GHG related to manure management has also been reduced.

Reducing emissions and increasing carbon sink in the fishery. China has built 136 national demonstration aquafarms, released 20.93 million m^3 of artificial reefs, and used over 2,336 km^2 of sea areas to help to contribute to marine carbon sequestration.

Promoting energy-saving and emission-cutting agricultural machinery. In 2021, the government provided a support package of CNY 266 million to scrap more than 30,000 agricultural machines, which significantly speeded up the process of phasing out old and adding new equipment to transform modern agriculture with high-yield farming, optimized energy conservation, and emission reduction.

2.6 Action for Low-carbon Scoiety

The government provided active guidance. China has launched various mass campaigns, events and initiatives, such as the National Energy Conservation Week, the National Low-carbon Day and the World Environment Day; popularized the knowledge of climate change to the public through the World Meteorological Day, the Meteorological Science and Technology Activity Week and the National Science Popularization Day; released reports on scientific facts and impacts of climate change through the China Weather Network; strengthened the interpretations of IPCC report; and actively enhanced the green travel awareness through the Green Travel Month and the Public Transportation-based Travel Week. China has explored and implemented the innovative mechanism of voluntary emission reduction - Carbon Inclusion - to

encourage the whole society to participate in carbon emission reduction.

Enterprises took active actions. Central government-administered enterprises have all made their action plans for carbon dioxide peaking and carbon neutrality, and many have also set up research institutes to conduct basic research on carbon dioxide peaking and carbon neutrality. Particularly, China Three Gorges Corporation successfully issued the first-ever carbon-neutral bond, and many others launched special funds for green and low-carbon development. Central government-administered enterprises in various sectors, including petroleum, power, transportation, construction and telecommunication, have declared their green and low-carbon statements, calling the whole society to participate in the carbon emission reduction drive for a cleaner and better homestead.

The general public plays an active role. China has launched a campaign themed "Being a Contributor to a Beautiful China" to encourage the whole society to participate in developing ecological civilization to foster a positive atmosphere of everyone having a stake in, supporting and participating in eco-environmental conservation and protection. Incorporated developing ecological civilization into the national education system to strengthen education in ecological civilization at primary and secondary schools. Launched a green life campaign to promote energy-efficient fittings to build conservation-oriented public institutions, green families, green schools, green communities, green travel cities, green buildings and shopping malls. A series of forums and science population events on carbon dioxide peaking and carbon neutrality were held to raise social awareness on green development and guide the public to practice green and low-carbon lifestyles. The 6th China (Shenzhen) International Climate Film and Television Conference was held in October 2021, calling on the public to actively respond to climate change through films and videos.

3. Accelerated Shift Toward Green and Low-carbon Energies

In 2021, non-fossil energies accounted for 16.6 percent of energy consumption, total installed capacity of wind power and solar power reached 635 GW, and coal consumption per unit of GDP was notably lowered.

3.1 Rapid Development of Non-Fossil Energies

Installed capacity of non-fossil energies increased rapidly. In 2021, China installed 134 GW of renewable power generation capacity, which accounted for 76.1 percent of the national increase in installed capacity. Non-fossil energy power generation capacity reached 1,120 GW and exceeded coal power capacity for the first time, and renewable power capacity reached 1,063 GW, accounting for 44.8 percent of the installed power capacity. The capacity of hydropower, wind power and solar power all surpassed 300 GW, with offshore wind power capacity jumping to the first position in the world. In

June 2021, the No.1 and No.14 units of the Baihetan Hydropower Station, which boasted the largest single-unit capacity and the greatest technical difficulty worldwide, were officially put into operation. From 2021 to the first half of 2022, five nuclear power units were put into service with an additional installed capacity of 5,618 MW.

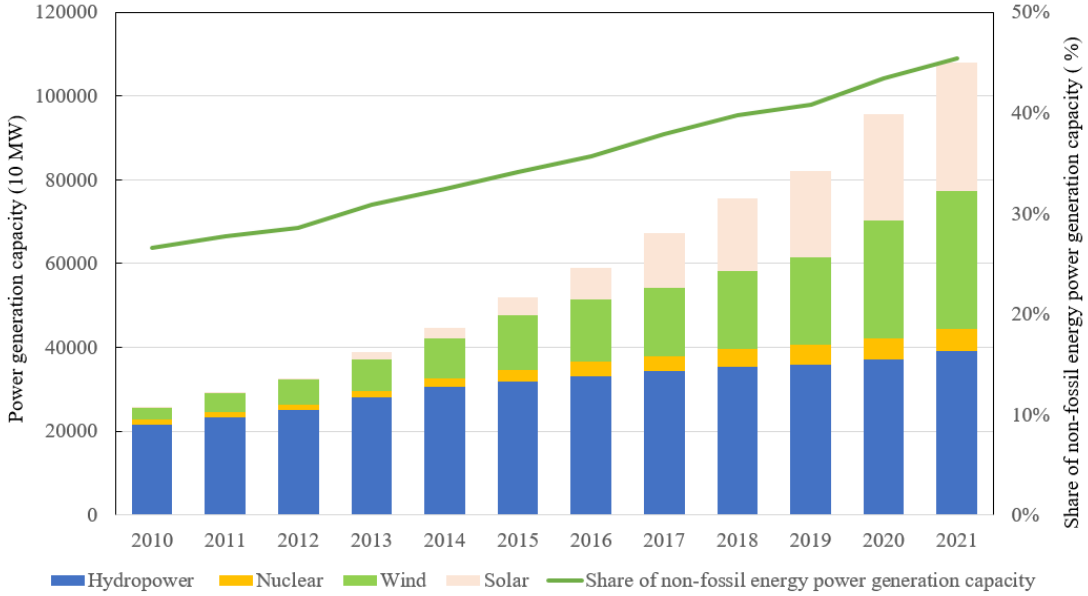

Figure 2. Non-fossil energy power generation capacity, 2010-2021

Utilization of renewable energies improved significantly. In 2021, 2,480 TWh of renewable electricity was generated, making up 29.8 percent of total electricity consumption. Of this total, wind supplied 655.6 TWh of electricity, 325.9 TWh of electricity from PV, and 163.7 TWh of electricity from biomass, a year-on-year increase of 40.5 percent, 24.8 percent and 23.5 percent, respectively. Compared with the same period of the previous year, the hydropower utilization rate in main river basins nationwide stood at around 97.9 percent, up 1.5 percentage; the average utilization rate of wind electricity was 96.9 percent, increased by 0.4 percentage; average utilization rate of PV electricity was on a par of 98 percent; loss of electricity due to abandoned water resources was reduced by 14.9 TWh. To give further impetus to the large-scale development of renewable energies, China has planned large wind power and PV bases and pushed the planning and construction of power transmission lines to transmit renewable electricity across provinces and regions. All twelve cross-provincial power transmission lines (three AC and nine DC lines), including the Longdong-Shandong line and Jinshang-Hubei line, have been incorporated in the power development plan of the 14th Five-year Plan period and carried out in a well-planned manner.

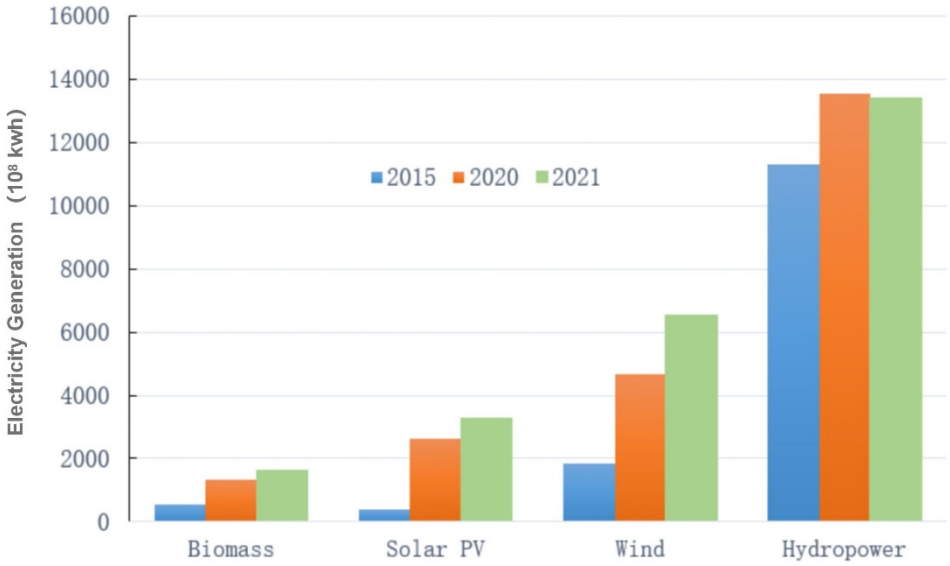

Figure 3. Renewable electricity generation in China, 2015, 2020 & 2021

3.2 Effective Management of Total Fossil Energy Consumption

Reasonable control of coal consumption. In 2021, clean energy consumption in China was raised to 25.5 percent of total energy consumption, while the portion of coal consumption was dropped to 56.0 percent with surging electricity demand among end users. Coal-burning projects of newly built, modified, or expanded in key regions of effective air pollution prevention and control such as Beijing, Tianjin, Hebei and surrounding areas, the Yangtze River Delta, and the Fen-wei plains, etc., were traded off for equal or reduced coal consumption.

3.3 Intensified Clean Use of Coal

Advancing the transformation and upgrading of coal consumption. China actively promotes clean coal centralized utilization. About 1.03 billion kW of coal-fired power units achieved ultra-low emissions retrofits, accounting for 93 percent of the country's total installed coal power capacity, and became the world's largest clean coal power system. China has made constant efforts to promote the campaign of carbon reduction retrofits, flexibility retrofits and heating transformations in a well-ordered way, and stops building any coal power plants overseas. In 2021, 110 GW of coal power units were retrofitted to save energy and reduce carbon emissions, 63.8 GW for greater flexibility transformation and 68.3 GW for heating transformation. The average net coal consumption of thermal power was reduced to 302.5 g standard coal/kWh, down 6.9 percent from 2012. The quality of commodity coal has improved steadily amid the drastic increase in output, while the modern coal chemical industry is moving towards high-end, diversified, and low-carbon development.

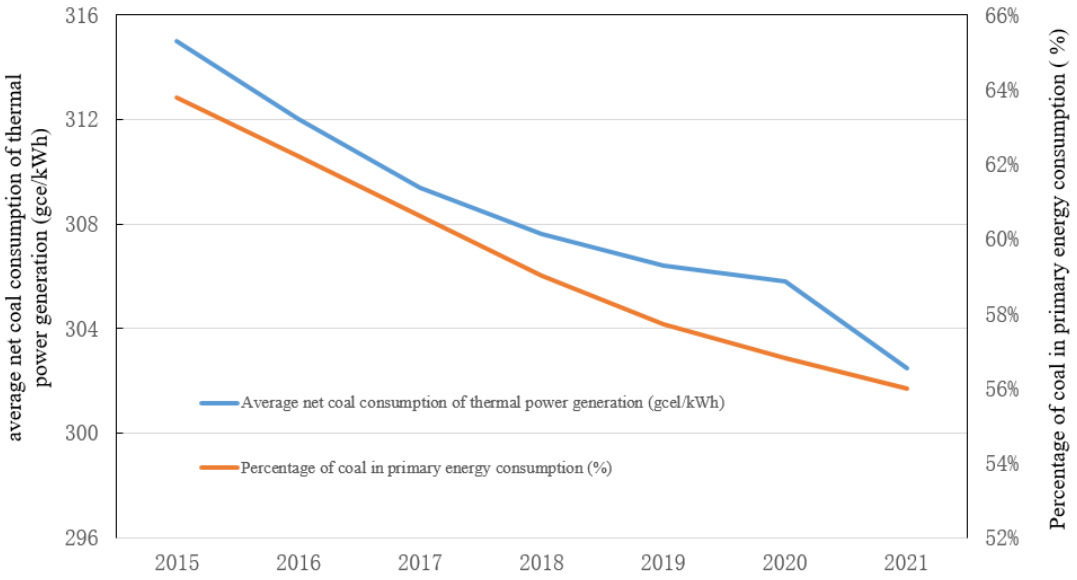

Figure 4. Average net coal consumption of thermal power generation, 2010-2021

4. Consolidated and Enhanced Ecosystem Carbon Sink

By the end of 2021, the national forest coverage rate in China reached 24.02 percent with a forest stock of 19.493 billion m^3. In 2022, China announced its action objective of “striving to plant, conserve and restore 70 billion trees within 10 years”.

4.1 Consolidating the Ecosystem’s Carbon Sequestration Effect

Intensifying resource protection comprehensively. In 2021, China carried out ten projects for the coordinated protection and restoration of mountains, rivers, forests, farmland, lakes, grasslands, and deserts; afforestation tasks were assigned directly to counties and put them on maps for the first time; the natural reserve system centered on national parks has been developed smoothly. The redline of ecological conservation has been drawn out that covers most natural forests, grasslands, wetlands, and other typical land ecosystems, along with marine ecosystems such as mangroves, coral reefs, and seagrass beds. Ecological security has therefore been further cemented nationwide and the ecosystems’ carbon sequestration guaranteed. The number of forest fires and areas of affected forests and grasslands have been reduced by 47 percent, 50 percent and 62 percent year-on-year, respectively. A five-year campaign for preventing and controlling pine wilt disease has been initiated that involves 10 million *ha* of forests and 13.73 million *ha* of grasslands.

4.2 Enhancing Biological Carbon Sink Capacity

Increasing carbon sink in forests, grasslands and farmlands. In 2021, China planted 3.6 million *ha* of forests, improved 3.07 million *ha* of grasslands, and treated 1.44

million *ha* of sandy and rocky desertification land. It also built nine national reserves of sandy land, tended 2.31 million *ha* of forests, restored 0.93 million *ha* of degraded forests, and added and restored 72,667 *ha* of wetlands. A total of 7.03 million *ha* of high-standard farmlands were planted across the country, and more than 6.67 million *ha* of black-earth arable land typical in the northeast was protected, of which 4.8 million *ha* was subject to conservation tillage. A straw utilization campaign was carried out in 401 counties, from which more than 400 million tons of straws were reused as manure across nearly 73.33 million *ha* of farmlands. The central finance earmarked CNY 2 billion for the subsoiling of 8.07 million *ha* of farmlands.

4.3 Strengthening Groundwork for Ecosystem's Carbon Sink Performance

Taking stock of forest, grassland, and wetland resources and their ecological status. In 2021, the forestry and grassland authorities of various levels nationwide dispatched 17,000 surveyors and monitors to monitor 457,000 sample plots and 470 million soil delineations in 31 provinces. This was the first full-coverage monitoring of forest, grassland, and wetland resources based on the third national land survey. The third national survey of carbon sinks in forests and grasslands was also carried out.

Strengthening technical support for increasing carbon sink in wetlands, oceans, and karst areas. China has issued the technical specifications for surveying and assessing the carbon sink capacities of mangroves, coastal salt marshes and seagrass beds, and conducted carbon storage surveys in 16 pilot areas. Special actions have been taken in key sea areas to bring back blue bays and preserve and restore coastal zones and mangroves. China has regularly monitored marine dysoxia and acidification and air-sea CO_2 flux, as well as the dysoxic areas at the Yangtze River and Pearl River estuaries. Work has been done to explore the marine carbon sink trade. The country has also issued industrial standards for surveying the carbon cycle and evaluating the carbon sink effects of karst areas; the construction of relevant test fields has been started, and typical river basins have been selected for survey and evaluation.

5. Launched National Carbon Trading Market

The carbon trading market is an important policy tool for achieving carbon dioxide peaking and carbon neutrality goals. A unified national carbon trading market officially started online trading on July 16, 2021.

5.1 Market Operating in an Orderly and Stable Way

Making positive progress on carbon market development. Since it officially came online, the national carbon trading market has operated steadily with growing activity and pricing. December 31 of 2021 the first compliance cycle of the national carbon trading market came to end successfully. This cycle involved 2,162 key emitters in the

power generation industry and about 4.5 billion tons of CO_2 emissions annually, making China the largest carbon trading market in the world in terms of emission volume. During the first performance cycle, the market had 114 trading days, on which 179 million tons of carbon emission quota was traded for a cumulative turnover of CNY 7.661 billion.

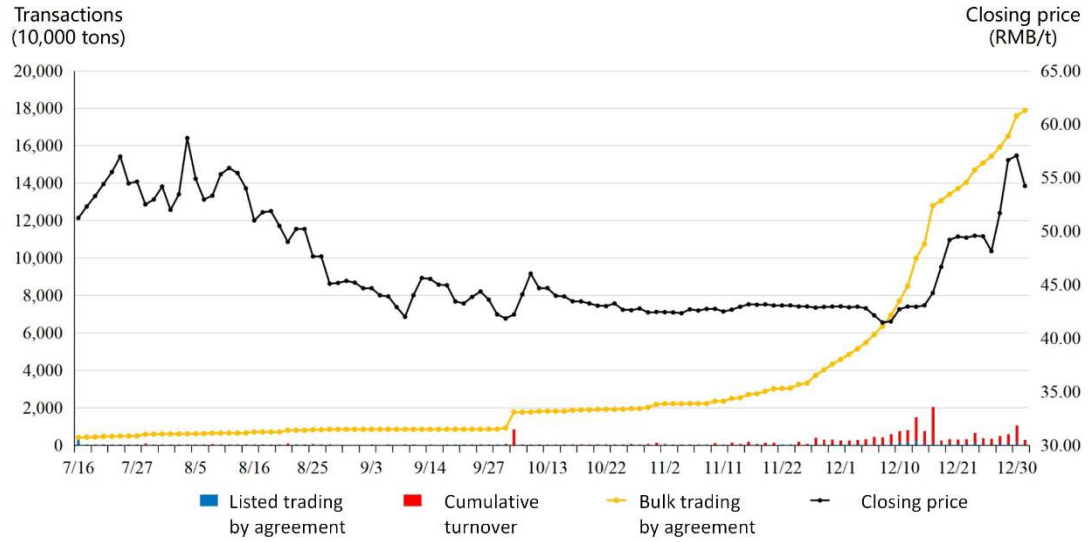

Figure 5. Transactions and prices during the first performance cycle in the national carbon market

5.2 Sustained Progress on Institutional Construction

Establishing a system of policies and regulations to support the national carbon trading market. China has pushed the legislative process to provide a high-level legal guarantee for the national carbon market. The *Measures for the Administration of Carbon Emissions Trading (for Trial Implementation)* taking effect on February 1, 2021 stipulates a sound system covering the registration, trading and settlement of carbon emission rights, and the verification of enterprises' report on GHG emissions. It provides for the various links regarding the carbon market operation and the rights and responsibilities of concerned parties and intensifies the quality management of emission data, providing the basis for the construction, operation and supervision of the national carbon trading market. China has sped up the revision of the *Interim Measures for the Administration of Voluntary Greenhouse Gas Emission Reduction and Transactions* and related technical specifications.

5.3 Initial Effects of Carbon Incentives and Restraints

Carbon trading market starts to bear fruit. The carbon market is an important policy tool that uses market mechanisms to control and reduce GHG emissions. It has played an effective role in driving the adjustment of the energy mix, saving energy, raising energy efficiency, and helping with ecological conservation and compensation. Aimed to encourage advanced production capacity and eliminate obsolete capacity, the national carbon trading market supports local authorities and enterprises in fully guaranteeing livelihood in order to strike a balance between development and emission

reduction. Upholding the policy that “emissions come at a cost and reductions yield benefits”, it has distributed emission quota to the power generating industry in a science-based and rational manner, motivating power generators to renovate their units for heating supply, energy conservation and emission reduction, and better flexibility. With the right incentives and restraints, the national carbon market has taken the initial effect in raising enterprises’ awareness and enhancing their capability of emission reduction.

6. Continuously Enhanced Ability to Adapt to Climate Change

China takes proactive adaptation as a key part of implementing the national strategy in response to climate change. It has formulated the National Strategy for Climate Change Adaptation, constantly improved climate monitoring and early warning, and intensified the capability of climate change adaptation in key sectors and regions. It has also carried out pilot programs and deepened international cooperation to raise awareness and enhance the capability of climate change adaptation.

6.1 Formulating and Implementing the New Strategy of Climate Change Adaptation

In June 2022, China formulated and implemented the *National Strategy for Climate Change Adaptation 2035* (hereinafter referred to as *Adaptation Strategy 2035*), which planned and deployed the climate change adaptation work through 2035 in a holistic way. The *Adaptation Strategy 2035* lays down the following basic principle: active adaptation and prevention first, science-based, systematic and coordinated adaptation featuring priorities to prevention, focus on key areas, joint efforts, and following the law of nature. It also sets the following goals: By 2035, China’s capability of climate monitoring and early warning reach world-leading level in the same period, a climate risk management and prevention system is well developed, risks of serious climate disasters are effectively prevented and controlled, the technical systems and standards for climate change adaptation have been perfected, and a climate-resilient society is basically in place that’s obviously more capable of adapting to climate change.

The *Adaptation Strategy 2035* highlights the monitoring, early warning, and risk management of climate change. On the two dimensions of the natural ecosystem and economic-social system, it specifies the adaptation tasks in a wide range of key sectors: Water resources, land ecosystem, ocean and coastal zones, agriculture and food security, health and public sanitation, infrastructure and major projects, cities and living environment, and sensitive secondary and tertiary industries. Underlining the importance of fostering a climate-resilient regional layout on multiple levels, the document combines climate change adaptation with territorial spatial planning while considering the regional differences in climate change and its impacts and risks. Under

this guiding thought, it sets out the adaptation tasks in eight major regions nationwide and a number of strategic regions, including the Beijing-Tianjin-Hebei region, Yangtze River Economic Belt, Guangdong-Hong Kong-Macao Greater Bay Area, Yangtze River Delta, and Yellow River Basin. The safeguards and measures for implementing the adaptation strategy have also been detailed.

6.2 Continuously Improving Climate Change Monitoring and Early Warning System

In order to manage climate risks effectively, China has set strategic targets, including the ability to monitor, forecast, warn of climate change, and impact risk assessment. It has built a comprehensive meteorological observation system comprising automatic surface weather stations, radars, and weather satellites. It has also developed a database of regional meteorological disasters over long sequence time series, accelerated the construction of a risk survey database, and conducted meteorological disaster zoning and risk classification. Strengthening multi-factor monitoring and risk assessment in areas vulnerable or sensitive to climate change, constantly improved the layout of monitoring networks in forest, hydrology, ocean, ecological environment, health and other fields, completing offshore and South China Sea observation networks, island and offshore hydrometeorological monitoring networks, and Yellow Sea and Bohai Sea observation networks.

Efforts have been made to accelerate the informatization of natural disaster monitoring and early warning, speed up the development of business applications for that purpose, and to further improve relevant platforms for online monitoring and early warning, the informatization level of consultation, research, emergency commanding and dispatching for disaster monitoring and early warning have been constantly improved. China has carried out the first national comprehensive risk census of natural disasters in an orderly manner, identifying the tasks of national census and survey, zoning pilot evaluation areas and establishing and improving the operation and technology systems, technical specification system and institutional system.

China has developed a country-province-city-county disaster information dispatching system covering the whole country and improved the agricultural meteorological consultation mechanism so as to enhance its capability in agricultural disaster risk prevention and early warning. China has instituted a long-term mechanism for emergency broadcasting and initially laid out a nationwide emergency broadcasting system framework throughout all levels from the state, provinces, cities, counties and townships to villages for increasing its capability to release and receive early warning information of extreme meteorological disasters and secondary and derivative disasters. Likewise, China has also set up a geological disaster monitoring, early warning and forecasting system, improved its nationwide monitoring and prevention system throughout four levels from counties, townships and villages to teams and institutionalized meteorological early warnings on geological disasters, largely covering all mid/high risk-prone areas.

6.3 Improved Climate Change Adaptation Capability in Key Sectors

China has improved the allocation of water resources and enhanced its ability to water harnessing by conducting water projects across river basins and regions, represented by the south-to-north water diversion project. It also has advanced key projects for the harnessing of rivers and lakes and kept reinforcing the flood control and disaster mitigation system. China has also implemented many national key water and soil conservation projects, including integrated control and management of small watersheds, sloping farmlands, vulnerable dams, check dams and silt arresters, expanded the acreage of controlled soil erosion lands to 63,600 km^2.

Basically accomplished the target of building an ecology-friendly small watershed beautiful countryside in the first 55 pilot counties, significantly improving the ecological environment of rural rivers and lakes. Efforts have been made to promote green and climate-smart agriculture, refine farmland infrastructure, and guide ecologically fragile, disaster-prone areas to proactively adjust their planting structure and choose adversity-resilient crops. As a result, agriculture has become much more resilient to climate change. China has conducted major ecosystem conservation and recovery projects, which have basically curbed the trend of ecological deterioration and kept the natural ecosystem generally stable with a favorable tendency. The backbone of a national eco-security framework is primarily in place.

Relevant parties are organized to evaluate the risk of rising sea levels, develop a series of technical standards for that, and reinforce climate change response at corroded coastal areas. The *Special Action Plan for Mangroves Protection and Restoration (2020-2025)* has been put into practice, new reclamation of the sea has been strictly controlled, and a campaign has been launched to build demonstrative "beautiful islands" with the aim of better protecting the coastlines. China issues the sea level bulletin and marine disaster bulletin annually. By the end of 2021, it has improved 3.07 million *ha* of grasslands, cultivated 60 million *ha* of high-standard farmlands, and registered the 0.568 productivity coefficient of farmland irrigation water, 24.02 percent forest coverage rate, 56.1 percent vegetation coverage of grassland, and 52.65 percent wetland conservation rate.

6.4 Making Solid Progress of Cities to Adapt to Climate Change

China has promoted the construction of 28 pilot climate-resilient cities and explored a corresponding construction and management model suitable for local conditions. Building on the experience of the 30 pilot "sponge cities", 45 demonstrative "sponge cities" have been built since 2021. It issued the *Opinions on Strengthening Waterlogging Control in Cities* and the *Action Plan for Building Urban Drainage and Waterlogging System in the 14th Five-year Plan Period* to equip the cities with better flood control and drainage systems. A city health check and evaluation system has been established, which incorporates a city's security resilience as an indicator to facilitate the construction of low-carbon and resilient cities. Robust steps have been taken to push

city greening and landscaping. More than 80,000 km of greenways and 220,000 urban parks have been built across the country, which has largely heightened the cities' ecological carrying capacity and hospitability and created a better ecology and living environment in urban and rural areas alike. Several national actions have been taken to build demonstrative water-saving cities, ecological garden cities, and zones for ecological progress, in a bid to coordinate with the climate change adaptation work for higher efficiency and better results.

6.5 Increasing the Awareness of Climate Change Adaptation

Major cities have been encouraged to carry out climate change impact analysis and assess the risks caused by climate change in order to raise awareness and be more adaptable to deal with climate hazards and reduce the risk for people and ecosystems. Public events such as World Meteorological Day, International Day for Disaster Risk Reduction, National Disaster Prevention and Mitigation Day, World Water Day, China Water Week, Tree Planting Day, World Day to Combat Desertification and Drought, International Day for Biological Diversity, and World Environment Day, have been used as strategic approaches to public interest communications to boost both climate change awareness and climate change adaptation training. The program "United Nations Decade on Biodiversity, China in Action" has been launched to promote biodiversity protection and climate change adaptation based on natural reserves, zoos, botanical gardens, and forest parks. The country also successfully held the first segment of the 15th meeting of the Conference of the Parties to the *Convention on Biological Diversity* (CBD COP15) in Kunming, Yunnan Province in October 2021. The conference resulted in some important outcomes and commitments to harness ecosystem-based adaptation: The *Kunming Declaration* was adopted, the Ecological Civilization Forum was held, and the initiative of "protecting biodiversity and building a global ecological civilization" was announced. Publicity and educational events were also conducted at schools and communities on disaster prevention and mitigation, trying to engage the whole society in the work.

6.6 Enhanced International Cooperation on Climate Change Adaptation

China actively participates in international negotiations under *United Nations Framework Convention on Climate Change* (UNFCCC) and other channels and in the formulation of the Intergovernmental Panel on Climate Change (IPCC) assessment reports. It has played a constructive role in urging the international community to place equal emphasis on mitigation and adaptation and reinforce global climate change adaptation actions. China jointly launched the Global Commission on Adaptation with other relevant countries to accelerate action and support for climate change adaptation solutions, and has taken an active part in the council meeting, high-level dialogue, and other activities of the Global Center on Adaptation, knowledge sharing and idea exchanging from the international to the local and in partnership with the public and private sectors to learn from each other and work together for a climate-resilient future.

China has also worked with the International Union for Conservation of Nature (IUCN) to jointly release the Global Standard for Nature-based Solutions (Chinese version) and typical cases of China's practices, disseminating China's experience in and telling the China story of climate change adaptation. Efforts are also made to advance the co-development of the Nature-based Solutions (NbS) Asian Center to strengthen pragmatic cooperation in climate change response. China has provided equipment, including microsatellites and mobile meteorological stations to other developing countries to help them better adapt to climate change.

7. Conclusion

In 2021, China made new arrangements to meet the new NDC targets, and its strong and solid measures yielded considerable progress and results. China's new NDC targets and its efforts to meet those targets are substantial contributions to global climate governance, demonstrating the country's commitment to its responsibility.

As a strong supporter of multilateralism, China will continue working closely with all parties to observe the targets, principles and rules set in the *United Nations Framework Convention on Climate Change* and its *Paris Agreement*, especially the principles of common but differentiated responsibilities, equity, and respective capabilities, while making practical efforts to realize its own NDC targets and advancing green, low-carbon, and circular development. China has emphasized its objection to unilateralism, protectionism and hegemonism of any form. It urges developed countries to fulfill their obligations under the *Paris Agreement*, live up to their historical responsibilities, show greater ambitions and take more actions, take the lead in reducing their own emissions, honor their own commitment to providing sufficient financial and technical support for developing countries, and carry out practical technological cooperation. These efforts will preserve mutual trust and confidence among countries in order to lay the foundation for implementing the *Paris Agreement* effectively.

China will work with the international community to accomplish the commitments, strengthen practical actions, and promote balanced progress in mitigation, adaptation, and support, with a view to achieving comprehensive, balanced and effective implementation of the *Paris Agreement*. China will advance South-South cooperation in climate change, and will make efforts for an equitable global climate governance system aimed at win-win cooperation. Through these efforts, China is committed to making greater contributions to building a community with a shared future for mankind and a better planet for humankind.

Appendix 1

Targets and progress of Hong Kong Special Administrative Region in Response to Climate Change

1. Targets and progress

To align with China's commitment to carbon neutrality, in 2022, the Hong Kong Special Administrative Region (HKSAR) Government announced its plan to realize carbon neutrality by 2050. To meet the target, it made another announcement in 2021 to halve its total carbon emissions from the 2005 level by 2035, and released the *Hong Kong's Climate Action Plan 2050* (hereinafter referred to as *Plan 2050*). The *Plan 2050* put forth four decarbonization strategies – net-zero power generation, energy saving and green construction, green transportation, and waste reduction – targeting the three main emission sources of electricity generation, transportation, and waste. The HKSAR is moving steadily toward its decarbonization targets. Thanks to the adoption of various mitigation measures, the total emissions have peaked in 2014 and the per capita emission has fallen from 6.2 tons of CO_2e in 2014 to 4.5 tons of CO_2e in 2020.

2. Policies, Actions and Targets

2.1. Institutional Arrangements

The HKSAR Government upgraded the Steering Committee on Climate Change to the Steering Committee on Climate Change and Carbon Neutrality in 2021. The Chief Executive chairs the new committee, formulates the overall strategy and oversees the coordination of various actions. The Environment and Ecology Bureau will form a new Climate Change and Carbon Neutrality Office to step up overall planning and coordination of deep decarbonization, and will initiate a consulting committee to encourage the whole society, including young people, to actively participate in climate actions.

2.2. Actions to Cut GHG emissions

To achieve carbon neutrality, the HKSAR Government has implemented the four major strategies and measures set in *Plan 2050*.

First, net-zero power generation. HKSAR has pledged to cease using coal for daily power generation by 2035 or earlier and increase the share of renewable electricity generation to 7.5 percent to 10 percent and then to 15 percent. It will conduct new energy utilization and strengthen the cooperation with neighboring regions to increase the share of zero-carbon power generation to 60 percent or 70 percent by 2035 and realizing net-zero power generation by 2050.

Second, energy saving and green construction. HKSAR has pledged to comply with the energy efficiency standards and requirements specified in the Building Energy Code and undergo major retrofitting for the existing buildings, and advocate a low-carbon lifestyle. It aims to reduce electricity consumption by 30 percent-40 percent in commercial buildings and by 20 percent-30 percent in residential buildings from the 2015 level by 2050 or earlier and achieve half of this target by 2035.

Third, green transportation. HKSAR has been focused on promoting electrically powered vehicles and ferries, developing new energy vehicles, and improving traffic management measures in order to attain zero-emission both in vehicles and in the whole transport sector by 2050. It will cease the new registration of fossil fuel-propelled and hybrid private cars in 2035 or earlier and work with bus companies and other stakeholders to test out hydrogen fuel cell electric buses and heavy vehicles by 2024 or earlier while promoting electric buses and commercial vehicles.

Fourth, waste reduction. To realize carbon neutrality in waste disposal by 2050, HKSAR will develop more advanced waste-to-energy facilities in 2035 or earlier and move away from reliance on landfills for municipal waste disposal to avoid methane generation. The government will encourage waste reduction and recycling, and expects to implement solid waste charging in the second half of 2023 and the first-phase regulation of disposable plastic cutlery earlier than the previously suggested 2025.

2.3. Improved Capability of Climate Change Adaptation and Response

The main measures in this regard include:

First, fortifying infrastructure. The Climate Change Working Group on Infrastructure under the Steering Committee on Climate Change and Carbon Neutrality would update the design standards for various infrastructure facilities according to climate change parameters, coordinate the studies of potential impacts of climate change on infrastructure, and work out measures and execution plans for making infrastructure more adversity-resilient.

Second, responding to rising sea levels and protecting the coast. Reinforcement projects have been conducted and management measures formulated for some low-lying or windward locations along the coast in the order of priority. Studies have also been done on coast management in order to work out long-term and rational policies and preventive measures.

Third, coping with extreme rainstorms and tropical cyclones. HKSAR has made appropriate flood control and drainage management measures on three principles: Closure in the upstream, flood storage in the midstream, and dredging in the downstream, and removed spots prone to waterlogging. To cope with landslip risks, it continues to implement the *Extended Landslip Prevention and Mitigation Programme* (LPMitP), reinforces artificial slopes and mitigates the risks on natural ones, and fortifies them against extreme rainstorms.

Fourth, coping with extreme drought and ensuring water supply. HKSAR practices

"comprehensive water resource management". It controls the increase in drinking water demand, applies intelligent technologies to tighten water management, and uses substandard water for non-drinking purposes on a larger scale. It also builds seawater desalination plants to be more resilient and flexible in the supply of drinking water.

Fifth, coping with sweltering weather. HKSAR promotes green architectural design, sustainable building environment, and urban greening to mitigate and cope with the rising temperature.

Sixth, strengthening response to natural disasters. According to the *Contingency Plan for Natural Disasters*, HKSAR evaluates the situation in the preparatory stage, makes contingency measures and plans, and timely dispatches resources and manpower to cope with natural disasters and their consequences. The "Emergency Monitoring and Support Centre" would be actuated immediately when it is necessary for the government to launch a comprehensive emergency action. In extreme weather or other emergencies, the emergency warning system is used to issue notices to the public through the mobile network.

2.4. Relevant Research and Support Measures

The HKSAR Government set up a Green Tech Fund (GTF) in 2020 to provide adequate and targeted funding for HK's decarbonization efforts and scientific research projects for environmental protection. As of 2022, the government has injected HKD 400 million into the fund. By the end of 2021, more than ten projects by universities and private firms have received support, amounting to almost HKD 70 million. Moreover, from 2014 to 2021, the Hong Kong Innovation and Technology Fund granted more than HKD 200 million to fund about 80 environmental protection projects, some involving energy conservation and new energies development.

To fund its green projects, the HKSAR Government issued the first batch of green bonds in 2019. By the end of May 2022, it had issued green bonds worth equivalent to USD 10 billion. To expedite green and sustainable financial development, the Hong Kong Monetary Authority and the Securities and Futures Commission initiated the establishment of the Green and Sustainable Finance Cross-Agency Steering Groupin May 2020. The Steering Group aims to help the financial sector manage climate and environmental risks and move toward carbon neutrality and facilitates climate-related disclosures and carbon market development.

2.5. International and Regional Cooperation

Attaching great importance to international and regional cooperation, the HKSAR Government will continue to participate in several climate change-related organizations, including C40 Cities Climate Leadership Group, the Global Covenant of Mayors for Climate & Energy, and the World Meteorological Organization (WMO). It participates in WMO's Global Climate Observing System (GCOS) Reference Upper-Air Network and has been designated as the Regional Specialized Meteorological Centre (RSMC) for nowcasting. On the regional level, HKSAR maintains communication and cooperation with Guangdong Province and Macao Special Administrative Region on

climate change response. Guided by the *Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area*, it has also worked with other cities in the Greater Bay Area to promote ecological progress.

3. Enhancing Policies and Actions

In the past decade, the HKSAR Government has spent HKD 47 billion on promoting various energy-saving measures, renewable energy projects, and electric vehicles and ships and introducing innovative waste-to-energy and waste-to-material facilities. In the next 15 to 25 years, it will continue to invest about HKD 240 billion to implement measures for climate change mitigation and adaptation. This includes implementing the four decarbonation measures proposed in *Plan 2050*, as well as other measures such as intensifying coastal defense, consolidating slopes, and improving the drainage system to better adapt to climate change. It will also continue to carry out climate change studies and motivate society to engage in climate action actively.

As a special administrative region of China, HKSAR will keep playing an active part in the global efforts to tackle climate change, promote effective implementation of the *Paris Agreement*. It will further push international and regional cooperation by leveraging platforms such as C40 Cities Climate Leadership Group and Hong Kong-Guangdong Joint Working Group on Environmental Protection and Combating Climate Change.

Appendix 2

Targets and progress of Macao Special Administrative Region in Response to Climate Change

1. Targets and progress

The Macao Special Administrative Region (Macao SAR) has been actively promoting climate change mitigation and adaptation. To align with the targets of China's climate change actions, the Macao SAR Government has set forth the intensified targets of response to climate change by 2030, that is, reducing carbon intensity by 60 percent-65 percent from the 2005 level. Macao's carbon intensity in 2021 was 8.3t CO_2e/million MOP, down by 56.1 percent from 18.9t CO_2e/million MOP in 2005.

2. Policies, Actions, and Achievements

2.1. Institutional and Policy Innovation

The Macao SAR Government published the city's *Second Five-year Plan for Economic and Social Development (2021-2025)* in 2021. The Plan focuses on proactively complying with the country's overall strategy on environmental protection; facilitating energy saving, emissions reduction, and waste reduction from its source; strengthening pollution control and prevention and optimizing environmental protection infrastructure; striking a balance between urban development and environmental protection, to build a green, low carbon and livable Macao. In 2022, the city released the *Macao Environmental Protection Plan (2021-2025),* which laid down a slew of measures and action plans to respond to climate change and promote low-carbon development, ranging from the application of electric vehicles, energy conservation and emission reduction, and green city construction to green life and consumption, and environmental protection efforts by enterprises, among others.

2.2. Controlling GHG emissions

To achieve the intensified emission reduction targets, the Macao SAR Government has consistently promoted policies and actions in recent years to create a low-carbon economy and society and mitigate climate change.

First, optimizing the energy supply structure. At present, most of Macao's power demand is met by electricity transmitted via the Southern Grid from the mainland, which clean electricity accounts for more than 40 percent, and this proportion will be gradually increased with the future improvement of the power supply structure in southern China. Meanwhile, power generation in Macao is mostly from natural gas, and the percentage has risen from 30.9 percent in 2008 to 86.4 percent in 2021.

Second, expanding the application of renewable energy. The Macao SAR has continuously boosted solar PV power generation and encouraged the use of green energies by means of the preferential feed-in tariff and PV power purchase contract. By the end of 2021, five departments or organizations have installed solar PV systems and sold their electricity to the grid. The Macao SAR will double its efforts to expand the use of solar PV electricity, encourage private entities to install the systems and give priority to them on the rooftops of newly built, eligible public projects.

Third, controlling emissions in the transportation sector. The city will continue to implement the policy of prioritizing public transit and promote environment-friendly vehicles and electric vehicles. Charging infrastructure will be added to existing public car parks, as well as in new public car parks and in public buildings. In 2022, the *Subsidy Scheme for Replacing Old Motorcycles with New Electric Ones* was launched and aimed to phase out old motorcycles with high pollution and popularize electric ones.

Fourth, saving energy and improving energy efficiency. About 54 percent of road lamps in Macao were LED as of 2021. The city will continue to replace its high-pressure sodium lamps with LED.

Fifth, motivating emission reduction in hotels and advocating a low-carbon life. By granting the Macao Green Hotel Award and organizing events such as World Earth Day, World Car Free Day, and Lights Off for Earth Hour, Macao has been advocating emission reduction and a low-carbon life across society.

3. Improving the Capability of Climate Change Adaptation

In the context of global climate change and sea level rise, Macao is exposed to greater risks of extremely disaster weather and serious storm tides. The Macao SAR Government issued the *Disaster Prevention and Reduction Plan (2019-2028)* in 2019, which listed the priority areas for strengthening Macao's emergency response capability. The Plan includes reinforcing infrastructure for disaster prevention and mitigation, improving the emergency management system, and strengthening risk management and monitoring and early warning capability. The purpose of the Plan is to cope with extreme weather events, water shortages, and other challenges affected by climate change, making the city more resilient, sustainable and adaptable to climate change.

First, strengthening the capability of fending off extreme weather. In 2021, Macao completed the new rainwater pumping station in the northern area of the Inner Harbor to mitigate severe flooding caused by the storm surge and astronomical tide. In 2021, it completed the flood control project from Fai Chi Kei to Ilha Verde coast, heightening the embankment to protect the people from a storm tide.

Second, stabilizing water resources. In recent years, the Macao SAR Government has adopted a series of policies to stabilize the water supply by making the supply system more efficient and ensuring emergency water use. The total effective capacity of Macao's water storage facilities stands at 1.9 million cubic meters at present, enough to support the city for seven days. To increase the reservoir capacity, the government is

expanding the Seac Pai Van reservoir and the Ká Hó reservoir in order to improve the water supply and increase the storage capacity of the freshwater resources, raising the total storage capacity to about 3.12 million m^3, enough to supply the city's water demand for 12 days.