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Contribution by China

to the CSTD 2022-2023 priority themes on “Technology and innovation for cleaner and more productive and competitive production” and “Ensuring safe water and sanitation for all: a solution by science, technology and innovation”

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PRIORITY THEME 1: Technology and innovation for cleaner and more productive and competitive production

1. What are some specific examples (from the public and private sectors) of green technology and innovation for cleaner and more productive and competitive production in your country? Please include contact, website, link to reports and any other relevant information concerning these projects and initiatives.

1. The innovation and application of clean and efficient vanadium extraction technology by the sub-molten salt method. To solve the problems existing in the traditional process of "vanadium extraction from vanadium-containing steel slag by sodium roasting", including the low vanadium extraction rate, chromium being unable to be extracted, the high treatment cost of wastewater with high salt, ammonia and nitrogen, HBIS Chengsteel and the Institute of Process Engineering, Chinese Academy of Sciences jointly developed a next-generation vanadium extraction technology in a fluidization manner with independent intellectual property rights. The technology is clean and environmentally friendly. It addresses the discharge of harmful kiln gas and wastewater with high salt, ammonia and nitrogen from the source, realizes the efficient extraction and

high value utilization of the associated chromium resources in vanadium-containing steel slag, and creates a new development model of chromium salt based on the steel, vanadium and titanium industry, which can effectively support the efficient and clean utilization of China's bulk vanadium titanomagnetite resources, and is a disruptive technology in the green manufacturing of vanadium. (Contact: Zhang Yiying; Tel: 0086-15354046256)

2. Key technological innovation and application of thermal-electric decoupling for coal-fired (gas-fired) generating units in Taiyuan City. Taiyuan City is in the north of China, and the coal-fired pollution caused by winter heating of the city has a serious impact on its air environment. The financial department of the city arranged a special technology fund to transform the 860MW gas-steam combined cycle heating unit of Jiajie Gas-fired Thermal Power Plant and the two 300MW sub-critical air-cooled thermal-electric cogeneration units of Guojin Coal-fired Thermal Power Plant to develop the key technologies of thermal-electric decoupling for coal-fired and gas-fired generating units, which has improved heating

capacity, enhanced peak load regulation capacity and reduced environmental pollution. While ensuring the heating supply of 14 million square meters in the city, Jiajie Gas-fired Thermal Power Plant has reduced natural gas consumption by 50%, increased its peak heating supply capacity by 40% and its peak load regulation capacity by 210MW. Meanwhile, Guojin Coal-fired Thermal Power Plant has increased its heating supply capacity by 38%, the heating supply area by 5 million square meters with the same coal consumption, and its peak load regulation capacity by 160MW. The two power plants can reduce emissions of sulfur dioxide by over 6,000 tons, carbon dioxide by 166,000 tons, nitrogen oxide by over 3,500 tons, soot by over 3,000 tons and ash and slag by 25,000 tons per year, which ensures the heating supply, improves the quality of urban air environment and promotes the consumption of new energy. (Contact: Ma Honghe; Tel: 0086-13620619641)

2. What are the national strategies, policies, and laws concerning green technology and innovation for cleaner and more productive and competitive production in your country?

China's National Development and Reform Commission,

together with China's Ministry of Science and Technology (MOST), issued the "Guidance on Building a Market-oriented Green Technology Innovation System", which put forward policy initiatives for fostering the innovation players, improving incentive mechanisms, promoting technology demonstration and adoption, improving innovation environment, and enhancing openness and international cooperation for green technologies. These initiatives leverage the decisive role of the market in the allocation of resources, better play the role of government, and promote the optimal allocation of innovation resources, so as to provide strong scientific and technological support for green production.

The Ministry of Ecology and Environment (MEE) of China is committed to green development, aiming to cut pollution and carbon emissions. MEE compiles a Catalogue for National Advanced Pollution Control Technologies on a regular basis. Together with the National Development and Reform Commission and the Ministry of Industry and Information Technology, MEE promotes the "Catalogue for National Advanced Cleaner Production Technologies", the innovative piloting of cleaner production audit, and the shift to cleaner production in traditional industries, so as to facilitate green production and the overall green transformation of the economy and society. In June 2022, MEE and seven other ministries and

agencies jointly issued the "Implementation Plan for Coordinated Pollution and Carbon Reduction", regarding the pollution and carbon reduction as a core focus in promoting the overall green transformation for China's economic and social development. Also, MEE, the National Development and Reform Commission and the Ministry of Industry and Information Technology jointly issued the "Several Opinions on Strict Energy Efficiency Constraints to Promote Energy Conservation and Carbon Reduction in Key Fields", and the "Guidelines for the Implementation of Energy Conservation and Carbon Reduction Transformation and Upgrading in Key Fields of High Energy-consuming Industries (2022 Edition)", which identifies the benchmark level of energy efficiency in steel and other industries.

3. What are the key industries that are pioneering green innovation in the country? List the key actors in the national ecosystem of innovation related to green innovation in your country (firms, universities, financial institutions, regulators)? What are the key networks of the ecosystem in your country (including online networks, innovation hubs, forums, etc.)?

China's National Development and Reform Commission, with relevant departments, issued the "2019 Green Industry Guiding Catalogue" to actively promote the rapid development of green

industries such as energy conservation and environmental protection, clean production, clean energy, ecological environment, green infrastructure upgrading, and green services, and to channel private capital and advanced technologies toward green industries and spur on various favourable national and provincial policies in this regard. At present, the production scale of China's wind power, photovoltaic power, and other clean energy equipment ranks first in the world, and its production of polysilicon, silicon wafers, cells and modules account for more than 70% of global production. In 2021, the output value of China's energy conservation and environmental protection industry was more than 8 trillion yuan, with an average annual growth of over 10% in recent years.

After China announced it will achieve the peak of carbon dioxide emissions and carbon neutrality, carbon capture, utilization and storage (CCUS) has become an inevitable technology for China to achieve the goal. CCUS is the only technical means to achieve large-scale low-carbon utilization of fossil energy, and an important way for the green transformation of the industries where emissions are difficult to abate, as well as a fundamental technology to promote deep emission reduction in the future. China Technology Strategic Alliance for CO₂ Capture, Utilization and Storage Technology Innovation, founded by a group of China's top enterprises, universities and

research institutes in the field of CCUS, is to promote China's technological innovation and project demonstration in the field of CCUS based on the guidance of national policies and the needs of China's climate change and industrial development. The Alliance has been working for many years to coordinate the research and development efforts of various stakeholders. It has organized many seminars and scholar salons, vigorously promoted the information sharing and communication between the domestic CCUS industry and academia, and established a CCUS industrial technology innovation system with enterprises as the mainstay and the integration of the industry, academia, research and application.

4. What are the challenges that your government have faced or may face in promoting green technology and innovation in your country to contribute to national development priorities and accelerate the progress towards the SDGs?

N/A

5. What should governments, the private sector, organized civil society, and other stakeholders do so that developing countries can benefit from these technologies?

To meet the sustainable development needs of developing countries, achieve the UN 2030 Agenda for Sustainable Development, implement the Belt and Road Science,

Technology and Innovation Co-operation Action Plan, and promote the transfer and application of sustainable development technologies to the Belt and Road countries, China launched the "Selection of Sustainable Technologies Suitable for the Belt and Road countries" to select China's green technologies applicable to Belt and Road countries, including resource and energy utilization technologies, ecological environmental protection technologies, and pollution control technologies.

Through the evaluation on the sophistication, feasibility, applicability, reliability and safety of the selected technologies and several rounds of expert review, the "List of Advanced and Applicable Technologies for the Belt and Road Countries" containing 1,000 technologies was formed. The Chinese Ministry of Science and Technology will release and share the list with other countries in due course to facilitate the transfer of green advanced and applicable technologies, facilitate the role of the technologies as a driver for promoting green transformation and upgrading in key areas of relevant countries, and benefit the majority of developing countries.

China, relevant UN agencies, the World Bank, the Global Environment Facility, the International Energy Agency and other international organizations are carrying out green technical assistance, capacity building and pilot projects in key areas such

as industry, energy, transportation, urban and rural development. Based on Tsinghua University, Inner Mongolia Agricultural University and Nanjing Agricultural University, the projects of China-Indonesia Joint Lab on High Temperature Gas-Cooled Reactor, China-Mongolia Joint Lab on Biopolymer Application and China-Kenya Joint Lab for Crop Molecular Biology have been built. China has also increased technical assistance to other countries by launching "Luban Workshops" in Pakistan, Cambodia and Mongolia.

6. What are some examples of international cooperation mechanisms, projects, programmes or strategies, including triangular and South-South cooperation, in green technology and innovation that your country is part of?

At the "Green Belt and Road" sub-forum of the second Belt and Road Forum for International Cooperation, China, together with UNIDO, UNESCAP and the Energy Foundation, launched the Belt and Road Green and Efficient Refrigeration Initiative. Also, with UNDP, UNIDO and UNESCAP, China launched the Belt and Road Green Lighting Initiative. Through the China International Fair for Trade in Services, the China (Shanghai) International Technology Import and Export Fair, the China International Import Expo and other domestic and international exhibition platforms, China has been promoting cooperation

with Finland, South Korea, Japan and other countries in the field of green technology. Meanwhile, China advocates the establishment of the Belt and Road Initiative International Green Development Coalition and the Belt and Road Ecological Big Data Service Platform, carries out South-South cooperation, and helps developing countries improve their environmental governance capacity.

Through the “Memorandum of Understanding between the Ministry of Science and Technology of the People's Republic of China and the United Nations on Technological Innovation for Sustainable Development Goals” (hereinafter referred to as "MOU"), the Ministry of Science and Technology of China has been deepening international cooperation in green technology innovation and promoting international dissemination of green technologies.

Since the signing of the MOU with the United Nations in 2017, cooperation has been carried out in the key areas listed in the 2030 Agenda for Sustainable Development, with both sides jointly promoting the cooperation and development of the Online Platform for the Technology Facilitation Mechanism as mandated by the Agenda and the Green Technology Development Bank, and collaborating on research in green technology transfer, commercialization, assessment and certification.

In 2022, the Chinese Ministry of Science and Technology and the United Nations renewed the MOU to increase the breadth and depth of cooperation on science, technology and innovation for sustainable development.

The Administrative Centre for China's Agenda 21 and the United Nations Development Programme (UNDP) have jointly established the Technology Transfer South-South Cooperation Center (TTSSCC). By building a technology transfer platform and database, the center has been precisely matching technology demand and supply, and providing South-South partners with appropriate technology solutions for sustainable development.

7. What actions can the international community, including the CSTD, take to help your country take advantage of green technology and innovation for cleaner and more productive and competitive production?

N/A

8. Could you suggest some contact persons of the nodal agency responsible for projects/policies and international collaboration in this context as well as any experts (from academia, private sector, civil society or government) dealing with projects in this area? We might contact them directly for further input or invite some of them as speakers for the CSTD inter-sessional panel

and annual session.

Mao Xin, Deputy Dean, the Research Institute for Environmental Innovation (Suzhou), Tsinghua, 0086-13911918217.

Zhang Xian, Director-General, the Administrative Centre for China' s Agenda 21, 0086-13911577798.

9. Do you have any documentation, references, technological assessments, future studies or reports on the priority theme in your country or region?

N/A

PRIORITY THEME 2: Ensuring safe water and sanitation for all: a solution by science, technology and innovation

1. What are the concrete challenges that your country has encountered in managing water and sanitation and providing access for all to these services?

N/A

2. What projects/policies has your country implemented to use the above-mentioned range of technologies and innovations or other STI, including frontier technologies (e.g., AI and drones) to address these challenges? What are the main outcomes? What

are the main difficulties confronted while trying to implement these projects/policies? Pls. include the gender dimension.

MEE has actively explored the refined management mode of drinking water source protection, built a technical system of water source protection zone delineation, established the delineation technical methods and regulations, "environmental survey--pollution source analysis--risk analysis--delineation methods and plans--site delineation", developed the technical methods for delineation based on pollution risk control, and improved the water source protection zone delineation system. It also carried out the research and development of water source "satellite remote sensing + APP" technology, mastered the key technology of high-resolution detection and precise prevention and control of environmental risk sources, developed the "meter-level" information products regarding the spatial distribution of risk sources in water source regions, developed the technology for accurate detection of the risk sources in water source regions, which provide scientific and technological support for efficient protection of water sources. Through the automatic water quality monitoring system of water sources, real-time online water quality early warning and monitoring have been carried out for the particular pollutants of risk sources, including heavy metals, VOC and other particular parameters, besides the conventional water quality parameters such as pH

and dissolved oxygen.

The “Water Cellar for Mothers” Project of China:

In 2000, the China Women's Development Foundation (CWDF) conducted a deep study on women's living conditions in western provinces, and the results showed that the difficult access to drinking water is one of the constraining factors for rural development, especially women's development. Thus, CWDF, the All-China Women's Federation, People's Government of Beijing Municipality and China Central Television (CCTV) jointly initiated the "Water Cellar for Mothers" project. Implemented by CWDF, the project aims to address water shortage in poor and arid areas in western China by building family-based rainwater collecting cellars, improve the living and working conditions of women and their families, thus helping them achieve sustainable development. By the end of 2021, the project had built 139,900 rainwater collecting cellars, 1,941 centralized water supply facilities, and 1,045 safe drinking water projects on campus in 30 provinces, autonomous regions and municipalities nationwide, helping 3.3 million people obtain safe drinking water.

The project has enabled women to have more time and energy to improve themselves and their financial conditions. Due to the cellars, many of them have been able to grow vegetables and

raise poultry and livestock, which has improved their family income.

In 2005, given the serious challenge in rural drinking water safety, China put forward the policy of "shifting the focus from addressing difficult access to drinking-water to ensuring drinking water safety". The "Water Cellar for Mothers", based on the experience of recent years from the centralized water supply facilities in some pilot villages, built safe drinking water projects across rural areas to provide the villagers with easy access to healthy drinking water.

In 2018, with the construction of new or renovated centralized water supply facilities, sanitary household toilets and sewage treatment facilities, the project was further upgraded

In 2021, CWDF officially released a new five-year plan for the project. The project not only provides clean drinking water, but takes seriously "clean water" for agriculture and "clean" water ecological environment. In terms of agricultural water, the project focuses on building agricultural water supply projects in areas with less developed agricultural infrastructure, equipping them with water-saving facilities, promoting water-saving agricultural techniques, and calling on women to participate in water-saving agriculture to increase agricultural production and

thus income. In terms of water ecology, the project focuses on offering a beautiful rural living environment by building sanitary toilets and sewage treatment projects, and providing garbage sorting facilities, and environment protection education, etc. In the construction and operation process, water-saving appliances have been used, and sewage treatment has been controlled and monitored with the help of digital solutions, so as to improve nutrient removal rates, save energy and cut costs.

The project provided a convenient and safe way to collect and drink water in the pilot villages. The average water collection time for villagers of the pilot villages was reduced from 30.6 minutes to 6.2 minutes, and the average water collection time for villagers in the pilot villages with centralized water supply facilities in southwest China was reduced from 13 minutes to 0.27 minutes. In this way, the project provided sufficient water, and increased the villagers' income.

It also has increased the women's understanding of health care, effectively controlled infections due to drinking water, and reduced medical expenses; through hygiene behavior interventions (building sanitary toilets) as well as public hygiene training and health education, it has effectively changed their poor hygiene habits that they had developed due to the long-term lack of water.

Women have been guided to protect the water sources, so as to achieve sustainable development of water resources and environment.

From the design to the implementation of the "Water Cellar for Mothers" project, the main role of women in the project has been emphasized, so that they can learn agricultural techniques through project training, and participate in decision-making on water use and project management.

3. Can your country provide examples of policies/projects/initiatives aimed at strengthening national STI capabilities in managing water and sanitation for ensuring their access by all population in your country? One example is what institutional and regulatory arrangements are in place to stimulate R & D and innovation in managing water and sanitation for access by all.

MEE attaches great importance to water source protection, regarding it as an important element in the fight against pollution. *The Law of the People's Republic of China on the Prevention and Control of Water Pollution* has a special chapter on the "Protection of Drinking Water Sources and Other Special Water Bodies". It specifies that the state establishes a system of

protected areas for drinking water sources, and sets out the requirements for the supervision and management of pollution, risk prevention, and water quality testing for the protected areas at all levels, which provides legal protection for the safety of drinking water. MEE also established the annual assessment mechanism of water sources, and informs all provincial governments (autonomous regions and municipalities) of the assessment results. MEE will urge prefectural and municipal governments that have failed to protect water sources properly to effectively address existing problems. It has continuously strengthened supervision over law enforcement, such as organizing special inspections over the environmental protection of national lake and reservoir water sources and centralized drinking water sources, and random inspections over standardized construction of water sources. MEE has investigated and dealt with violations of environmental protection laws in the protected areas, and urged local governments to rectify the problem, which has obtained good results.

4. Could you share case studies of regional and international cooperation that have helped your country in strengthening STI capacities? Can you provide success stories in this regard?

The Chinese Research Academy of Environmental Sciences (CRAES) of MEE is leading a Sino-German project on

monitoring and risk assessment of toxic and hazardous pollutants in Taihu Lake. The project takes the Taihu Lake Basin as the main research area, and by adopting German equipment and technology for online water monitoring and collection, the project studies the distribution of toxic and hazardous pollutants in different environmental media such as water, sediment, organisms, and the migration and transformation patterns of typical pollutants in water-sediment-organisms, providing scientific and technological support for the water environment management of the lake. CRAES carried out a comparison of the performance of online monitoring instruments and equipment for water quality between China and Germany, absorbed three advanced monitoring technologies from Germany, improved the level of online monitoring technology for water quality in China, and applied the technology in the Wuxi environmental protection Internet of Things (IOT) project.