MINUTES of
The 9th Tripartite Roundtable on
Environmental Business

Dates: September 27th, 2024

Location: Lotte Hotel (Emerald Hall), Jeju, Korea

Theme: Efforts among the three countries' governments and industries for carbon neutrality

Participants: Korean, Chinese and Japanese delegates

[SESSION 1: Opening]

Mr. Min Jaehong, Vice President, Korea Environmental Industry Association, the Chair of Session1 started the 9th TREB.

Mr. Choung Hwanchin, Director, Global Green Project Team, Ministry of the Environment (Korea) made an opening remark welcoming all delegations from Korea, China and Japan. He emphasized that international cooperation is essential to overcome climate change and environmental crisis and highlighted that Korea has set a goal of carbon neutrality by 2050 and is making national efforts. Korea looks forward to sharing technologies and policies, also learning from each other's experiences.

Mr. Miyahara Kaoru, Assistant Director, Minister's Secretariat Environment and Economy Division, Ministry of the Environment (Japan), gave a brief summary of the 8th TREB meeting. Since 2015, the three countries have held a roundtable in which representatives of government and private sector gather to share their experiences and discuss cooperation plans. The 8th TREB was held online on March 7, 2024, under the theme of "Addressing environmental issues and information disclosure in the value

chain". In the first topic of "Government strategy on addressing environmental issues throughout the value chain and environmental information disclosure", the Government of Japan presented on the "Global and Domestic Trends in Environmental Due Diligence and Environmental Information Disclosure". The Chinese government presented the "Reform of China's Environmental Information Disclosure System according to Law and Progress with ESG". The Korean government gave a presentation on "Environmental Labeling and the Government's Environmental Information Disclosure System under the title of "Life Cycle Assessment (LCA) and Environmental Product Declaration". The second topic was "Various actions of enterprises corresponding to the environmental issues throughout the value chain and the requirement of environmental information disclosure". Japan presented on "Environmental Due Diligence and Environmental Information Disclosure of Ajinomoto Group", and China presented on "Building Product Carbon Footprint Management System in China", and finally, Korea presented on "Utilizing and Expanding Life Cycle Assessment (LCA) of SK Innovation Energy and Chemical Products".

At the end of session 1, TREB9 commemorative photographs were taken during the photo session.

[SESSION 2: Policies and Technologies for Green Hydrogen]

Mr. Wang Zuguang, Deputy Chief, Technology Cooperation Division, Foreign Environmental Cooperation Center (China), the Chair of Session 2, started the session with an introduction of the topic and presenters for the session.

Mr. An Kwangmin, the Head of Center, Hydrogen Distribution Center, Korea Gas Cooperation (Korea), delivered a presentation on "Government Policy and Industry Status of Hydrogen Distribution in Korea". Korea Gas Corporation (KOGAS) is committed to enhancing public convenience by ensuring the stable supply of hydrogen and natural gas. It ranks as the second-largest energy company in South Korea by

revenue, following Korea Electric Power Corporation (KEPCO), with annual sales of KRW 44.5 trillion. Many countries have established Nationally Determined Contributions (NDCs), with South Korea setting multiple targets under its 2050 NDC, including the enactment of the Hydrogen Act, the world's first legislation dedicated to hydrogen. This law outlines a comprehensive roadmap for hydrogen production, transportation, and utilization. Clean hydrogen, including blue and green hydrogen, is defined by South Korea, like the United States, as hydrogen whose production emits 4kg or less of CO_2 per kilogram of hydrogen. KOGAS is currently reviewing the feasibility of blending hydrogen into its natural gas pipeline network, with plans to proceed after assessing pipeline stability and potential hydrogen leakage. Blending of 20% hydrogen could help Korea achieve 2.8% of its carbon dioxide reduction target. Also, KOGAS, in collaboration with the government, compiles annual statistics on hydrogen in South Korea to forecast its supply and demand.

Mr. Ren Feng, Chairman of the Board, Mixwell Technology (China) delivered a presentation on "Exploring a Practice of Hydrogen Energy Development and Technology Innovation". Chinese government announced a medium- to long-term development plan for the hydrogen industry up to 2035 through the National Energy Development Committee. At least 29 provincial-level administrative regions have also unveiled hydrogen energy development plans. Specifically, China plans to build at least 700 hydrogen refueling stations and supply 50,000 hydrogen vehicles by 2025. The demand for hydrogen-related applications in China is surging explosively, with various hydrogen production methods including offshore and onshore wind power, blue hydrogen, and by-product hydrogen. Mixwell Technology is exploring methods for hydrogen energy transition and is committed to promoting energy sustainability through fuel cell technology. It is recognized as a national-level high-tech enterprise and holds over 80 intellectual property rights. The company focuses on research and development as well as production.

Mr. Shima Kiyoshi, General Manager, Obayashi Corporation, Japan, delivered a presentation on “Introduction of Initiatives to Create a Green Hydrogen Supply Chain”. In order to achieve Japan's decarbonization goals, the use of CO2-free hydrogen is essential, and the Ministry of the Environment, Japan is strongly promoting businesses for hydrogen supply chains and value chains. In Japan, various demonstration projects are being carried out to create hydrogen supply chains, but there are relatively few projects to create hydrogen supply networks for the last mile of supplying hydrogen as an urban energy source. Therefore, in the demonstration project we are working on with the support of the Ministry of the Environment, Japan, we decided to conduct a demonstration that would contribute to the creation of a hydrogen supply network for the last mile. In the demonstration, we first developed a hydrogen delivery management system to optimize the hydrogen supply network, and then conducted a demonstration in a town. In Namie Town, Fukushima Prefecture, where the demonstration is being carried out, a hydrogen production demonstration plant is in operation as part of a project by the Ministry of Economy, Trade and Industry, Japan which uses 10 MW of the 20 MW of PV power generated to produce hydrogen. In this demonstration, hydrogen is supplied from the hydrogen production demonstration plant, and the hydrogen supply network is optimized by transporting the hydrogen to a new hydrogen demand center established in the town. The management system remotely monitors and controls the status of hydrogen production, demand for hydrogen, and transportation of hydrogen, and uses AI to formulate optimal hydrogen delivery plans, which are then sent to drivers via tablet devices to instruct them on the delivery routes and timing. Furthermore, the management system is also able to predict future demand for hydrogen and electricity and can therefore make plans for future transportation in advance and place orders for contributions of hydrogen. The hydrogen supply network envisioned in this demonstration project is one in which, when there is an energy supply base in the town that produces hydrogen using solar power, the solar power is first supplied to each building in the local microgrid, while at the same time, hydrogen is produced in advance using excess power or demand response, and while the town is sunny, instructions are given to the fuel cells in each building to avoid generating power as much as possible, and to give priority to using solar power. When it rains or at night, the system will

instruct the fuel cells to operate at 100%. This will start the use of hydrogen in each building, and the transportation management system will optimize the transportation of hydrogen accordingly. Furthermore, by positioning the town's hydrogen stations not only as refueling stations for vehicles, but also as intermediate supply bases for hydrogen supply, by filling 70 MPa hydrogen containers and supplying hydrogen via hydrogen pipelines, the aim is to make the last one-mile hydrogen supply more robust. Furthermore, in this demonstration, a system that can manage the safety of the hydrogen supply network is also being developed. This system acquires all kinds of data, including hydrogen pressure and temperature data obtained from the transportation management system, hydrogen leak sensor data, and data from web cameras, and it is possible to manage the safety of the hydrogen supply network from an overview of this data. The project will continue to be developed in collaboration with the Ministry of the Environment, Japan with the objective of contributing to the construction of an urban infrastructure based on hydrogen.

During the discussion session, active Q&As were made.

1) Question from Korea to China and Japan: There is high demand for green hydrogen production in China, and as more applications emerge, production is expected to increase. China mentioned that hydrogen is being utilized in the transportation sector. Mr. Choung would like to inquire if there are any policies or technical challenges for the large-scale use of green hydrogen in China in the future.
For Japan, given the frequency of earthquakes, He is curious whether facilities for storing hydrogen in buildings can remain safe if equipped with earthquake-resistant systems, and if Japan is preparing technical countermeasures. This question arises due to the known fact that earthquakes produce both P-waves and S-waves, and despite proper preparations for S-waves, P-waves can also cause significant damage.

> **Answer from China to Korea**: China is at a mature stage in terms of hydrogen pr oduction, transportation, storage, refueling, and product applications. In view of th e future possibilities for hydrogen energy application, the demand is expected to b e immense. With abundant wind, solar, and nuclear resources, China is well positi

oned to produce ample green hydrogen.

Answer from Japan to Korea: There is a time gap between the arrival of P-waves and S-waves, and Japan has measures in place to address this. However, the standard for large S-wave events has not been updated. Since hydrogen is stored at higher pressures compared to city gas, Japan is carefully considering whether seismic standards should be increased by 1.5 times. Under Japan's high-pressure gas regulations, seismic technologies are strictly regulated, and Japan believes legal amendments are necessary.

Additional question from Korea to Japan: While P-waves may rarely cause significant damage, during the Kobe earthquake, the middle sections of buildings were destroyed. Since hydrogen storage tanks are round at the ends and cylindrical in the middle, while they may withstand S-waves, P-waves could cause crumpling and breakage in the middle section. Mr. Choung would like to know if there are any specific regulations or research on this matter.

Answer from Japan to Korea: There is no national report on this issue. While there have been cases of storage tanks toppling, there has been no destruction of tanks during an earthquake. At present, Japan has safety measures in place, such as emergency shut-off systems that can automatically close valves.

2) Question from Korea to China and Japan: Hydrogen faces cost challenges, and Europe is working on developing technologies to reduce the production cost to $2 per kilogram by 2040. Mr. An is curious whether China and Japan have such cost roadmaps, and whether there are regulations or roadmaps on the percentage of hydrogen blending.

Answer from China to Korea: The production cost of green hydrogen ranges from 20 to 35 yuan per kg, and hydrogen is currently being used primarily for vehicles. households can also use hydrogen, and the blending ratio is 10 to 25%. It can also be utilized for transportation, shipping, manufacturing, and power generation. China has the National Development and Reform Commission and a roadmap which contains detailed information.

Answer from Japan to Korea: The standard for city gas only regulates combustion

speed in Japan. Under this standard, it is possible to blend up to 25% hydrogen with city gas, but it causes energy efficiency issues and there are no specific plans yet. Japan aims to lower the cost to 30 yen per Nm3 by 2030, and there is a movement to blend 1% methane into the gas supply. However, this will result in longer lead time.

3) **Question from Japan to Korea**: The cost of natural gas gradually went down due to the economies of scales after oil crisis. Mr. Shima is curious about whether hydrogen could follow the similar path as natural gas and the demand outlook of hydrogen.

Answer from Korea to Japan: It is anticipated that demand for hydrogen will be identified, and hydrogen will be commercialized, and there are methods for blending hydrogen and ammonia. The blended ammonia can be used as a refrigerant or fertilizer. Water electrolysis equipment is essential for this, and efficiency is the key. With the expansion of diverse applications, there may be a rapid increase in global demand.

[SESSION 3: Circular Economy Practice Cases for Carbon Neutrality]

Mr. Miyahara Kaoru, Assistant Director, Minister's Secretariat Environment and Economy Division, Ministry of the Environment (Japan) started the session with an introduction of the topics and presenters for the session.

Mr. Chen Dengke, Eco-Environmental Technologist, China National Chemical Southwest Engineering Technology (China) made a presentation on "95+ Heat Recovery Industrial Energy Saving and Emission Reduction Technology Applications ". It was stressed that achieving the Double Carbon target requires multi-faceted cooperation across energy, industry, economy, and society. In relation to carbon capture and utilization by large chemical companies, the principles of the technology where

green hydrogen react with carbon dioxide to generate methane, along with the effects of reducing carbon dioxide emissions and its economic value, were explained in comparison with production with fossil fuels. The energy-saving principle of permanent magnet drive technology, which increases energy efficiency up to 95% by utilizing permanent magnets was explained with the mention that this technology allows for physical disconnection and connection, low-cost maintenance, and significant energy savings. In addition, the value and significance of low-temperature heat recovery technology in the petrochemical sector were explained. The technical principles of the high-efficiency rotating heat exchanger, which can achieve energy efficiency of over 95%, reduce electricity consumption and costs, along with examples of return on investment analysis, were also presented.

Mr. Hirao Yoshihide, Director, Minister's Secretariat, Environment and Economy Division, Ministry of the Environment (Japan) made a presentation on "The fifth Fundamental Plan for Establishing a sound Material-Cycle Society and Practical Case Studies in Japan". The Fundamental Plan for Circulation is a significant document revised every five years and the 5th plan was proposed and approved at the Ministerial Conference on Circular Economy on July 30th, attended by Prime Minister Kishida. This plan has been established as a national strategy, expanding beyond the environmental framework to include policy and regional benefits, and the key is consideration of potential for stimulating economic growth. The Fifth Fundamental Plan for Circulation contains measures for reusing recycled materials. The product life cycle encompasses stages of resource input, production, manufacturing, distribution, and use, eventually leading to disposal. Previously, there were no indicators for footprint, but indicators for reducing input quantities and material and ecological footprints have been introduced. The goal is to decrease the input of natural resources by inputting recycled and circular resources, as well as biomass, while also reducing the final disposal amount. The waste management industry is often associated with the Not In My Backyard (NIMBY) concept, but Japan has cooperated with local communities to create value in the region. Japan plans to promote these efforts on a national level.

Mr. Byong-Oh Chong, Pro (Ph.D), WAYBLE Circular Team, SK Ecoplant (Korea) delivered a presentation on "Circular Economy Achieved by Digital Technology and AI". SK Ecoplant, an EPC construction company, operates 10 incineration plants and owns landfills. WAYBLE is a term coined by SK Ecoplant, as one of its environmental industry brands. It is designed to digitally manage greenhouse gas emissions from companies and optimize sustainability by applying AI to incineration plants. SK has declared a net-zero goal by 2040. To achieve this, it is essential to accurately identify where and how emissions can be reduced, and WAYBLE DECARBON is the system designed for it. From a value chain perspective, the waste-related value chain had not been managed in an integrated manner. As a result, they developed and launched WAYBLE LOOP, a system that tracks and records the process of waste generation, transportation, and treatment, like an open market platform that facilitates intermediary matching. For WABLE REENERGY, AI assesses conditions such as temperature and pressure in incinerators and helps determine the timing of waste input, stoker speed, and blower speed for efficient operations. This system is currently applied to approximately 10 incinerators in South Korea. Through these solutions, SK Ecoplant will contribute to realizing a sustainable society.

During the discussion session, active Q&As were made.

1) Question from China to Japan and Korea:

It was mentioned that the government provides subsidies in certain sectors, but this becomes a burden on the government budget. For Japan, Mr. Wang was curious if there are special treatment with persistent organic pollutants (POPs) related to waste.
For Korea, he was curious if Korea is collaborating with China for this matter, and whether the purchaser of the WAYBLE system is the government or private companies. In China, there are waste-related service providers, and he would like to know about the efficiency and cost saving effect of the system.

Answer from Japan to China

Subsidies are provided where the highest investment is required in the initial stage. Regarding pollution, Japan ensures thorough management as nearby residents do not tolerate contamination. Strict regulations are enforced, and operations are prohibited in cases of odor or other violations of waste treatment standards.

Answer from Korea to China

While there is no collaboration with China yet, SK Ecoplant is open to the possibility. *WAYBLE CIRCULAR* may not be immediately applicable, but it is linked to the *Allbaro* service provided by the Ministry of Environment. If there is a service for industrial waste in China, it could be linked and developed accordingly. SK Ecoplant focuses on industrial waste and has not yet expanded to household waste. Lastly, cost savings vary case by case, but cost reduction can be as high as 15%.

2) Question from Japan to China and Korea:

The discussions on thermal energy utilization sounded interesting. It was mentioned that low-temperature heat is around 200°C. Japan also faces difficulties in operating at such low temperatures. He would like to know if China believes it is possible to operate at low temperatures.

Korea mentioned that it is difficult for companies to implement a circular economy on their own and that collaboration is necessary. He wanted to know how SK plans to generate profits, and how it will incentivize consumers to spend.

Answer from China to Japan: In temperatures below 100°C, chemical organizations are using the heat and at 69°C and 80°C, two companies are using it. They have shown an energy efficiency of 95% and it is deemed that they have achieved their energy goals with their achievements over the past two years.

Answer from Korea to Japan: SK Ecoplant views the end-users in the value chain such as brand owners like cosmetic brands, refineries, and automakers as our

customers. While this technology was introduced earlier this year and has not yet generated profits, SK Ecopalnt is managing a significant number of business sites.

[SESSION 4: Policies and Practice Cases for Digital Transformation in the green Industry]

Mr. Inagaki Koichi, Manager, NEC, Japan, who is a lead of "Visualization WG" of the Green x Digital Consortium, which is run by the Japan Electronics and Information Technology Industries Association (JEITA), gave a presentation on "Initiatives and PoC for "Visualization" of Supply Chain CO2 Emissions through Inter-Company Data Linkage Using Digital Technology". As the number of companies certified under the SBT scheme increases worldwide, and companies continue to make progress towards carbon neutrality, it is becoming essential to visualize CO2 emissions across the entire supply chain. In order to accurately grasp supply chain CO2 emissions, data collaboration between companies is essential, but there are also issues to be overcome. In order to solve these issues, this consortium has developed CO2 calculation rules and data collaboration specifications using digital technology, with the participation of 129 companies from a variety of industries and has successfully conducted a demonstration experiment with 32 companies. Furthermore, in order to enable data collaboration in the supply chain, which is expanding globally, this consortium is also collaborating with the PACT of the WBCSD. It is anticipated that this initiative will be expanded in the future to include data collaboration with South Korea and China.

Mr. Hyun Donghoon, Professor, Tech University of Korea (Korea) delivered a presentation on "DX Based Net-Zero Solutions for industry". In response to the trend of stricter carbon reduction regulations overseas, domestic export compan ies must take appropriate actions. Companies in industrial complexes lack the c apacity to address the various disclosure demands required by their supply chai n customers, rather than direct exports. In addition, there is insufficient awaren ess of Net-Zero and capabilities to effectively address it are inadequate. To ena

ble AI-integrated calculation, reporting, and third-party verification of greenhous e gas emissions in line with international initiative evaluation methods, in relati on to Net-Zero, it is essential to innovate the processes of data collection, proc essing, transmission, and utilization. Developing and sharing a Net-Zero self-ass essment tool tailored to industrial complexes through a collaboration of large a nd small enterprises and a carbon supply chain alliance in each industry type i s crucial.

Mr. Shao Kunkun, General Manager, IEM Holding (China) delivered a presentation on "Digital Transformation Practices of Major Science and Innovation Carriers in Green Industry". IEM is a platform that helps start-ups through digital transformation, and many small and medium-sized businesses can use the platform without cost. IEM is also collaborating on intellectual property rights, with the goal of eventually creating a value chain. IEM also supports start-ups through scientific research, and there are cases of research and development of turbines and energy storage systems. In addition, the China-Japan joint venture introduced a water quality improvement system, which developed a water quality improvement system suitable for China and entered the Chinese market.

During the discussion session, active Q&As were made.

Question from Japan to Korea and China: Three countries are using the power of digital, and there is a lot of discussion about small and medium-sized enterprises today. Mr. Hirao sympathizes with the need to cooperate with SMEs on the business side, so he would like to ask to share an example of how you have solved it.

> **Answer from China to Japan:** In the past, cooperation between China, Japan, and South Korea was organized by the government. Therefore, it is necessary to have a platform that can be supported in the long term, and it is necessary to think about how to support the digital environment/finance.

Answer from China to Japan: Hydrogen energy is the most meaningful market for carbon reduction goals and it is believed that it is better to create a trading platform. Since Korea, China, and Japan are geographically close to each other, it may be possible to develop the industry by cooperating on carbon trading, etc.

Answer from Korea to Japan: The Korean Ministry of Environment is conducting exchanges between the three countries in each sector. Mr. Choung found that Chinese and Japanese companies were already engaged in many activities in abroad. He believes that the three countries will be able to provide better opportunities through cooperation overseas.

[Session 5, CLOSING SESSION]

The closing session was made by the chair of the closing session, **Ms. Choi Jina, Secretary General, Korea Environmental Industry Association (Korea).**

Mr. Wang Zuguang, Deputy Chief, Technology Cooperation Division, Foreign Environmental Cooperation Center (China), introduced the 10th TREB that would be hosted by China in 2025. Regarding the theme of the TREB10, it will be proposed by China, and they will share the suggestion by email to Japan and Korea.

Mr. Choung Hwanchin, Director, Global Green Project Team, Ministry of the Environment (Korea) made a closing address. He highlighted that the TREB9 was the place to reaffirm the importance of international collaboration in the environmental industry. He expressed the desire to continue the discussions to practical cooperation and results. Also, he promised the Korean Ministry of Environment to actively address global environmental challenges and extended his appreciation to all those involved in organizing the event.

Mr. Zhou Jun, Division Chief, Ministry of Ecology and Environment (China) made

a closing address. He emphasized that the 'dual carbon' goal is a major task for the international community, and China is willing to cooperate with Korea and Japan to expand low-carbon policies. He hoped to make a positive contribution to sustainable development through sharing successful cases in environmental cooperation, ecological civilization construction, and green development concepts among the three countries.

Mr. Hirao Yoshihide, Director, Minister's Secretariat, Environment and Economy Division, Ministry of the Environment (Japan) made a closing address. He extended his congratulations to each country on the productive discussions that had taken place at TREB9 and expressed his gratitude for the opportunity to hold TREB9 in person. He observed that the three countries were facing to the challenges of carbon neutrality, biodiversity, and the circular economy, and that TREB9 had addressed shared concerns. He also shared his expectations for TREB10. Finally, he expressed his gratitude to the Korean delegation and all the interpreters who had worked diligently to prepare for TREB9.