

A Conversation with the Senior Executive Vice President: Toward Broad Application of Carbon Neutrality Technologies



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■ The Significance of MHI Group's Carbon Neutrality Initiatives to Society at Large

Mitsui I've been researching mainly corporate disclosure at a think tank for many years, and I'm also involved in the advocacy activities of several investor and analyst organizations. Recently, I've been focusing on the disclosure of ESG data and actual corporate responses to ESG issues, especially as regards initiatives addressing climate change. MHI is known for having many technologies that will be key to achieving global decarbonization, so I have been looking forward to this conversation. It's a great pleasure to be here today.

Kaguchi It's my pleasure to have you with us today.

Mitsui Since around 2018, I have been closely following the efforts of EU regulators working within the EU Sustainable Finance framework. At that time, I worried that if things continued as they were, investments would only be made in companies that can take steps toward decarbonization according to the EU's definition of "green

finance". I also wanted Japanese companies to be cautious of those developments. When the Japanese government issued its Carbon Neutrality declaration in October 2020, there was still a feeling inside Japan that there was no way to achieve Carbon Neutrality by 2050. However, just a month later, I was astonished when MHI held a briefing on the Energy Transition, outlining how you aim to decarbonize power generation infrastructure with hydrogen. This gave the world the impression that Japanese companies are also making full-fledged moves toward decarbonization. What was behind your strong push for the Energy Transition at that particular point in time?

Kaguchi Honestly speaking, it had nothing to do with the timing of the government's declaration on Carbon Neutrality. During internal discussions concerning the environment in 2018 – which was around the time I was placed in charge of MHI Group corporate strategy – we spoke of both decarbonization, i.e. the elimination of carbon, and carbon

reduction. The prevailing view in Japan at the time was that decarbonization faced rather high hurdles and would be difficult to achieve, leaving carbon reduction as a more viable choice. But then, as we saw how discussions at international forums on the environment and other places were unfolding, and also from our conversations with stakeholders outside Japan, we became certain that in formulating our next Medium-Term Business Plan – the 2021 MTBP – targeting carbon reduction alone would be insufficient: we had to devise strong measures for achieving full decarbonization. Normally, we would have announced our new business plan in May 2021, timed to coincide with our FY2020 Financial Results Briefing. But we decided to move the announcement up by half a year, to October 2020, in order to respond quickly to the dramatic changes taking place in our operating environment amid the global COVID-19 pandemic. Then one month later, at our briefing in November 2020, we focused on the Energy Transition, describing how we had decided to position the Energy Transition as a growth engine in our 2021 MTBP, a development that met with your approval.

A year later, in October 2021, we issued our Carbon Neutrality declaration, with the slogan “MISSION NET ZERO.” As a

company grounded in technology, we knew that setting vague targets without a clear factual basis was out of the question. So in formulating MISSION NET ZERO, we made our projections as precise as possible, and based on them we concluded that, technologically speaking, it would be possible to achieve Carbon Neutrality by 2040. We set our goal for 2040, a full 10 years earlier than Japan’s target, convinced that, if Japan was to achieve the government’s Carbon Neutrality target in 2050, we had to act first, taking into account the lead time required for our customers to implement our products and technologies. We felt that announcing an earlier target would constitute an extremely significant message to the world.

Mitsui It was remarkable that you aimed for full decarbonization when many Japanese companies said it would be a challenge to reduce their carbon footprints. In MISSION NET ZERO, you announced a target to reduce Scope 3 emissions to zero across your value chain by 2040, which translates to cutting the equivalent of 1.5 times Japan’s total carbon emissions. This gave strong support to the government’s Carbon Neutrality declaration.

■ Contributing to Global Decarbonization through Scope 3 Emissions Reductions

Mitsui The initiatives being taken by MHI Group, in your position as a provider of power plant infrastructure, will surely have a big impact on the world. While it’s important for all companies to strive to reduce their Scopes 1 and 2 emissions, Carbon Neutrality can’t be achieved by any single country or by the whole world without successful emissions cuts from power plants – the largest source of CO₂ emissions. Since MHI Group supplies the equipment used in power plants, the emissions from those plants are directly linked to your Scope 3 figures.

Kaguchi As of 2022, we estimate our Scope 3 emissions – the volume of CO₂ emissions resulting from the use of MHI Group products by our customers – at around 1.2 billion tons. This corresponds to approximately 3% of all CO₂ emissions worldwide. This extremely high fig-

ure is due to the fact that the total volume of emissions anticipated throughout the lifecycle of a power generation system, one of our main products, is recorded at the time of delivery. Our ultimate aim is to bring the volume of CO₂ emitted during power generation down to zero: by replacing coal-fired power generation systems with high-efficiency gas turbines, by cutting CO₂ emissions by half in the future through use of ammonia-mixed fuels, and by converting existing gas turbines to hydrogen fuels with combustor replacements. Obviously, it isn’t possible to abruptly shut down power plants as a way to achieve zero emissions; electricity supplies have to be maintained. We believe achieving Net Zero emissions is possible, however, by gradually reducing the CO₂ emissions of power plants at a sustainable pace, and by cutting CO₂ emissions through installation of our CO₂ capture systems.

A Conversation with the Senior Executive Vice President:

Another factor that needs to be considered is that our products are, in many cases, used over long periods of time, and it isn't realistic to expect that existing coal-fired power plants can be replaced all at once. Even today, a

fair amount of the power being used is generated from coal, so the Energy Transition has to be approached in a realistic fashion – one that is feasible not just on a technological basis, but on an economic one as well.

■ High Hopes for Achieving Hydrogen and CO₂ Solutions Ecosystems

Mitsui MHI is going to decarbonize power plants by switching fuels to hydrogen or ammonia. Recently I visited Takasago Hydrogen Park at MHI's Takasago Machinery Works. There I was given a progress update on hydrogen gas turbine development, and I also heard your plans for a hydrogen solutions ecosystem, including hydrogen production systems. What was particularly impressive was that if all the hydrogen stored in the many tanks found around the extensive premises were used to generate power, it would be consumed in roughly one hour. This means that your customers will have difficulty achieving zero emissions unless a complete supply chain

– including hydrogen production and supply systems – is implemented. CO₂ capture faces the same difficulties: although the technology may already be available, the question remains as to where to store the captured CO₂. What strategies does MHI have for creating hydrogen and CO₂ solutions ecosystems going forward?

Kaguchi To begin with, I would like to stress that power generation using hydrogen and ammonia is already technologically possible, as is CO₂ capture. These achievements are the end result of years of R&D and validation testing. But as you just pointed out, technological capability doesn't translate to immediate practical implementation. Carbon neutral power generation will be achieved only after the necessary infrastructure is fully in place – from facilities to make the hydrogen and ammonia to be used as fuels, to their distribution systems. That said, these ecosystems won't be achieved unless we can demonstrate economic viability to all potential participants in the target ecosystems. And achieving economic viability will require collaboration with partners with relevant expertise. If we are to aim for broad implementation of hydrogen and CO₂ solutions ecosystems, we will have to work long and hard, hand in hand with our partners. We will also need to work hard to gain the understanding of both society at large and financial backers.



Chie Mitsui

Ms. Mitsui is a Senior Researcher at Nomura Research Institute, where she specializes in corporate disclosures, corporate governance, and sustainable finance. She has also been involved in the advocacy activities of several investor organizations. From 2014 to 2020, she was a member of the IFRS Taxonomy Consultative Group of the International Financial Reporting Standards Foundation. Since 2021, she has been a member of the Corporate Disclosure Policy Council of the CFA Institute, a global association of investment professionals. Ms. Mitsui is also a member of the Study Group on Disclosure Policies for Non-financial Information under the Ministry of Economy, Trade and Industry.

Mitsui So there are a number of difficulties to overcome: producing and transporting the vast amounts of hydrogen needed, and demonstrating economic viability. How, specifically, does MHI intend to solve these challenges?

Kaguchi First of all, producing green hydrogen – hydrogen created by using renewable energy to electrolyze

water – in Japan in large enough volumes to meet the demands of industry as a whole isn't very realistic given the state of Japan's renewable energy resources. So Japan will inevitably have to rely on imports. Another problem is that hydrogen has an extremely low boiling point at -253°C . As a result, transporting hydrogen in liquid form presents both technological and economic challenges. To overcome these difficulties, we at MHI Group are considering a solution where hydrogen would first be converted to ammonia or other gases that are more easily transported, and we are currently working to commercialize this. Going forward, we will contribute to improving the economic viability of a hydrogen solutions ecosystem as a whole by developing technologies to be applied at various stages in the supply chain, including hydrogen production systems and pumps to be used in hydrogen fueling stations.

Mitsui I understood that the hydrogen ecosystem is well on its way to becoming a reality. Japan imports natural gas by tanker, so if green hydrogen is produced elsewhere in a form that can be easily transported, importing it into Japan would by no means be impossible. What do you think about carbon capture and storage (CCS)? It's been suggested that even if CCS were introduced in Japan, the country has no suitable storage locations.

Kaguchi Personally, I'm not so pessimistic regarding the storage portion of CCS. I think the reason people say Japan has no suitable locations for CO_2 storage is related to the fact that the country has only a limited number of oil or gas fields similar to those found in North America or the Middle East. But the feasibility of storing CO_2 in aquifers and volcanic rock strata is currently being considered, so the potential for storage in Japan is by no means lacking. In fact, good progress is being made toward establishing CCS in Japan, as illustrated by the Ministry of Economy, Trade and Industry's (METI) selection of seven "Advanced CCS Projects" in June 2023. At one of the selected project sites, Tomakomai in Hokkaido, validation testing of aquifer storage has already been completed by the New Energy and Industrial Technology Development Organization (NEDO). In my view, as such validation continues, the possibilities for CCS in Japan will increase.

Mitsui Based on what you just said, it seems some places can expect CCS in Japan. Even so, wouldn't storage in Japan alone be inadequate to meet actual needs?

Kaguchi Yes, that's true. However, any CO_2 that can't be stored domestically – due to the timing of the start of commercial operations for instance – could be transported outside of Japan and stored there, if agreements are reached with countries willing to do so. But here again, the issue of economic viability comes up. Currently, we're studying potential solutions to this problem. Earlier I spoke briefly about green hydrogen. If, for example, Japan's CO_2 were transported by carrier ship for storage abroad, the same vessel could then return to Japan carrying blue hydrogen made from CO_2 captured from natural gas. In June 2023, we acquired Approval in Principle from ClassNK for a carrier concept designed to simultaneously transport ammonia and liquefied CO_2 . Ammonia and CO_2 liquify at similar temperatures and pressures. In this way, considering the economic viability of the ecosystem as a whole can be an effective approach to the issue.



■ Striving Simultaneously for Carbon Neutrality and Economic Viability

Mitsui You have given me a clear picture of why, even if the technological challenges are overcome, implementation of hydrogen and CO₂ solutions ecosystems won't proceed unless economic viability is also achieved. You've also given me a good understanding of the various initiatives MHI Group is undertaking to realize that. Still, to achieve zero Scope 3 emissions as a business, sometimes governmental policies are important. In the U.S., for example, the government helped improve the economic viability of entire ecosystems through enactment of the Inflation Reduction Act (IRA) in 2022. Don't you think similar initiatives need to be taken in Japan? Some investors highly evaluate the future value of companies proactively engaging with the government on policy and regulation matters to ensure the sustained growth of both their organizations and the entire ecosystem including their suppliers and customers.

Kaguchi In terms of engagement with the Japanese government, MHI Group provides relevant ministries and agencies with input on technologies and the latest trends, and we also participate as members of a variety of councils and investigative bodies. Additionally, we offer policy proposals on green transformation through the Japan Business Federation. Going forward, perhaps we need to be even more proactive, because there are things MHI

Group can do precisely because we are a company grounded in technology. Going forward, first we will build up our track record in the U.S., Europe, and other markets that are leading the way in sustainability initiatives such as renewable energy and CCUS. This, together with further enhancements to our technological and product capabilities as well as the achievement of real results in cutting CO₂ emissions, will enable us to show the world that decarbonization technologies are ready for use. In this way, we will contribute to Carbon Neutrality throughout industry.

Today, as initiatives to achieve Carbon Neutrality in the power generation industry move forward worldwide, there is a risk that products manufactured using carbon-intensive electricity will become subject to carbon tariffs, gradually eroding their competitiveness. From the perspective of Japan as a whole, I believe we need to maintain the competitiveness of Japanese products. One way to do this would be to introduce subsidies in the power generation industry to curb electricity price increases arising from advances in Carbon Neutrality. But this method would require large subsidies to offset price differentials between fossil fuels and imported Carbon Neutral fuels, and for that reason economic benefits within Japan or impact as a growth driver would be limited. Rather than this approach, I would prefer to see funds directed into technological development.

Mitsui I understand your stance prioritizing technology, and I agree that MHI Group is uniquely positioned to be proactive in this way. As concerns Carbon Neutrality, every country has its own targets. And as countries compete against each other, clearly the U.S. and Europe are in the lead in terms of public policy. As you just indicated, indeed there is a great risk that Japanese products may lose their competitiveness through carbon tariffs and similar mechanisms. I sincerely hope that MHI Group will engage with the government on policy and with society at large. Of course, since MHI Group has customers across the globe, you may not be solely concerned with Japanese policies.



Kaguchi I hope we can gain understanding for MHI Group's decarbonization technologies in all countries – not only the U.S., Europe, and Japan. We also plan to show the world a path to applying these various technologies to contribute to Carbon Neutrality. Even outside the U.S. and Europe, we have already concluded multiple memoranda

of understanding for the installation of decarbonization technologies at some existing customers in the power generation sector, including public and private entities. We aim to cooperate proactively with these partners while making full use of MHI Group technologies.

■ Increasing Corporate Value through Achievement of Global Carbon Neutrality

Mitsui I've come away from our conversation today with an understanding of how advanced MHI Group is in designing paths to Carbon Neutrality with your cutting-edge technologies. At the same time, I've also come to understand the difficulties involved in achieving broad adoption of technologies that contribute to Carbon Neutrality, and essential issues of the challenges needing solutions. I've also gotten a sense of the Company's strong determination to play a leadership role in helping your customers achieve decarbonization as well.

The energy sector is significantly impacted by public policy and regional considerations. Regarding the evaluation of economic viability in the leadup to practical implementation of these technologies, I believe it would be useful to engage in dialogue with relevant governmental bodies around the world, as well as with financial institutions and institutional investors. I hope that going forward

MHI Group will actively engage in discussions with a wide range of investors to help achieve global Carbon Neutrality and, by so doing, increase your corporate value.

Kaguchi Through our conversation today, I've become all the more aware of how indispensable constructive dialogue with financial backers – including financial institutions and investors – will be in realizing a smooth Energy Transition and in implementing economically viable Carbon Neutrality initiatives worldwide. Going forward, we will continue to dedicate our resources to technological development and, through engagement with society at large and innovative collaboration with our partners, we will contribute to realizing global Carbon Neutrality as soon as possible. We sincerely look forward to everyone's support as we proceed toward achieving these goals.

