Carbon Neutrality Tripartite Talk

# Carbon Neutrality and the Future of the IHI Group

## A Message from Top Management

**Creating a carbon-neutral society is one of the ways to embody IHI Group's goal to "Create a World Where Nature and Technology Work in Unity".
The top three managers gathered to discuss the value to be created by the IHI Group through carbon neutrality and the future of the IHI Group.**

**Tsuyoshi Tsuchida**
Senior Executive Officer

**Hiroshi Ide**
Chief Executive Officer

**Hideo Morita**
Senior Executive Officer

## What type of vision do you have in mind toward carbon neutrality for the IHI Group?

**Ide** The significance of the presence of the IHI Group lies in creating a carbon-neutral society, which is one of the ways to embody the goal of the IHI Group to "Create a world where nature and technology work in unity". Carbon neutrality in the fields of energy, industrial machines, and aviation is also the Company's business field, and we consider it important. We need visions and strategies that combine both speed and scale with a global perspective on each field. In the energy field, we are striving to contribute to decarbonization on an unprecedented scale with clean energy such as fuel ammonia at the core. In the industrial machines field, we intend to work together with our customers to promote carbon neutrality realistically tailored to the customers' on-site needs. In the aviation field, we will further expand the overwhelming technological capabilities we have built up to date and aim to broaden our value chain. The value that the IHI Group offers comes from its technologies. We also have core technologies and research and development capabilities to achieve carbon neutrality. We are tackling our work every day with the enthusiasm and sense of mission that our technological and business developments will determine carbon neutrality worldwide.

## Please tell us your missions as top managers in achieving carbon neutrality.

**Ide** The largest mission as top managers is to forge a path for achieving carbon neutrality. The IHI Group will contribute to the realization of carbon neutrality through its businesses. We have to develop a scenario to clarify which technologies and businesses the IHI Group should engage in to realize a carbon neutral society. The approach of creating a value chain is important in this process. It is difficult to achieve the IHI Group's goal of global carbon neutrality by simply decarbonizing products alone, as has been the case in the past. In the future, we need to look at the entire value chain, from the procurement of raw materials to after-sales service, and increase the scale of decarbonization and our business by recruiting the necessary partners.

To this end, one of my roles as president is to encourage the Japanese government and overseas partners to identify and collaborate with carbon neutrality strategies of the IHI Group and to obtain the necessary support from them. In fact, we are actively communicating the strategies and initiatives of the IHI Group to the world and seeking support from the Japanese government and relevant overseas organizations. My second role is to secure and allocate the necessary resources. The resources required to implement the carbon neutrality strategies include human capital with knowledges and skills that were not available in the IHI Group before. For example, we will acquire resources that we have hardly possessed in the past, such as human capital in the field of chemistry. I believe that the allocation of investment will shift from the traditional focus on tangible assets to an increased allocation to intangible assets, including human capital, intellectual property, IT, and digital transformation, all of which can illustrate the story of realization of innovations and proposals for improvement. I will allocate the acquired resources optimally on the basis of the implementation strategy and will maximize performance.

**Tsuchida** The role of communication that Ide mentioned is shouldered not only by the president, but also by us, the senior executive officers. This is because we believe that when the top management of a company communicates, people will be able to sense the seriousness and effectiveness of our efforts. There are two main initiatives pursued by the IHI Group to realize carbon neutrality. The first is to achieve carbon neutrality in our own business activities, and the second is to contribute to the carbon neutrality of society through products and services. We are communicating our specific implementation strategies for these two initiatives through dialogues with investors and seminars hosted by financial companies.

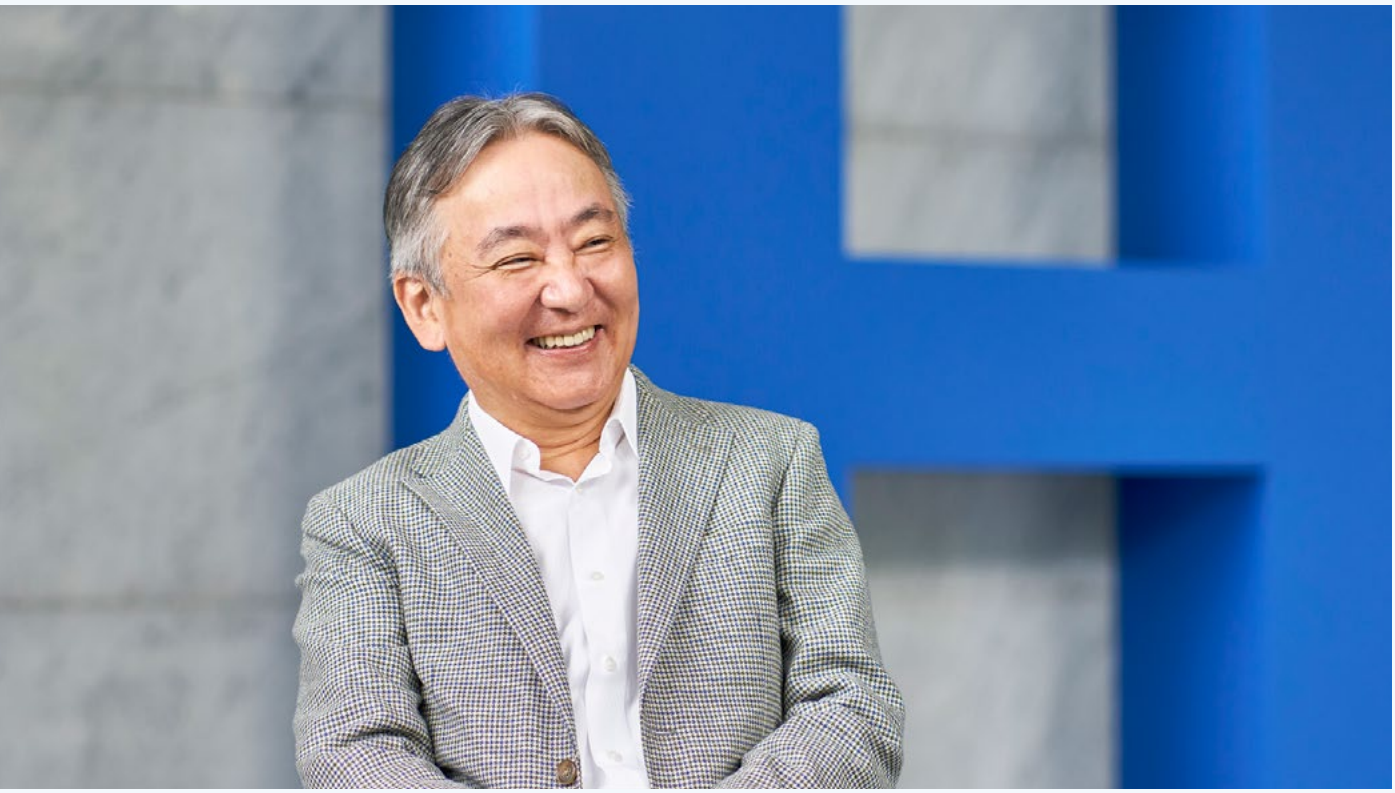
**Morita** In terms of more specific businesses, for example, we are sending out strong messages that the realization of carbon neutrality in the aviation industry depends on our technological and business development. The IHI Group has core technologies that can provide "propulsion", which is closely related to energy efficiency. We will also contribute to carbon neutrality by providing energy-efficient "propulsion". We are communicating specific implementation strategies externally to develop partners with whom we can collaborate.

## What are the implementation strategies unique to the IHI Group to achieve carbon neutrality?

**Ide** As an implementation strategy, we will participate in the building of a value chain and will increase our contribution within the chain. To be highly involved in a value chain, we need strong technologies and experiences that are competitive with other companies. We have these in the fuel ammonia value chain and aero engines businesses; therefore, we have been able to participate in the building of a value chain from an early stage. With strong technologies and experience, we are able to attract partners who empathize with our vision, and we will be able to build a value chain that will be advantageous to our management strategy. Our basic approach in the implementation strategy is to acquire strong technologies and build a value chain based on the vision of the IHI Group. Visualization of the technology, human capital, and other resources held for strategic implementation will help clarify the strategically necessary resources. The aforementioned second role, which is securing and allocating the necessary resources, will play a key role in the success of the implementation strategy.

In terms of our implementation strategy in the energy field, we have based our strategies around the utilization of existing infrastructure. We will convert to fuels that do not produce $CO_2$, such as fuel ammonia, while utilizing existing infrastructure. By doing so, we can promote transitions that achieve both steady reductions in $CO_2$ emissions for our customers and economic rationality. For example, simply converting 50% of the fuel in an existing coal-fired thermal power generation facility to ammonia can reduce $CO_2$ emissions by 50%. Meanwhile, for power generation combusted exclusively with fuel ammonia, we plan to offer the use of (transformation to) large-scale gas turbines. While utilizing existing infrastructure facilities, strategies that follow a roadmap that includes a realistic timeframe based on each country's circumstances are effective.

**Tsuchida** Turning to our business, our Conventional Businesses are served by typical facilities industry with high $CO_2$ emissions, such as steel, paper, and chemical industries. Until now, the IHI Group has provided high-efficiency equipment to meet the issues and needs of our customers, but from now on, we need to provide equipment that can also contribute to carbon neutrality and systems that operate them efficiently and without waste. Our products were based on the use of fossil fuels, so the current trend is a risk. However, we also see it as an extremely huge business opportunity. Without halting the production of our customers, we are aware that the IHI



Group's mission is to make proposals that make efficient, high-quality production with reduced $CO_2$ emissions possible. The key to the implementation strategy of carbon neutrality in the industrial machinery field is to maintain the existing machinery and equipment owned by the customers while changing the contents to be carbon neutral. Instead of replacing equipment with something completely new, as we have performed in the past, we must work together to chart a course toward carbon neutrality from a slightly longer perspective while prioritizing customers' production activities and economic rationality and move forward steadily, one step at a time.

**Morita** Compared with the industrial machinery field, a different style of change is called for in the aero engine field. The development of aircrafts requires a huge amount of capital, and to lower the associated risks, the basic approach is to conduct international joint development in which risks and profits are shared. Joint development was adopted in the recent development of next-generation fighter aircrafts operated by Japan, the UK, and Italy. Thus, joint development with partners from each country will be the basic approach in the development for achieving carbon neutrality in aircrafts. We will need to consider the entire value chain in the future, including the fields that the IHI Group is not involved in. For this, we need to build and strengthen the value chain, which will be beneficial for our strategies. For example, we are considering reinforcing the maintenance business to expand the value chain. We believe that this is a business that will lead to profitability and should be focused on, considering the prolongation of aircraft life and efficiency improvements. To do this, we again need to acquire strong core technologies ourselves.

## How do you see the changes in each market toward the realization of carbon neutrality?

**Ide** In the energy field market, demand for products and services that can realize carbon neutrality will increase. However, I believe that optimal solutions will differ depending on the circumstance of each country. Securing and distributing energy requires large-scale infrastructure facilities that combine safety, economy, and other factors. This means that in the future, changing infrastructure facilities and systems to achieve carbon neutrality will require an enormous amount of financial resource and labor. Therefore, the optional solutions will vary according to various situations in each country, such as economic strength and geopolitical risks. For example, the use of liquified natural gas (LNG) in Japan began 55 years ago, and it has been said that coal will not be consumed any more. However, because of various situations in each country, Germany still relies on coal-fired thermal power generation for approximately 31% of its energy mix, and the same is true in Japan at approximately 30%. In India, plans are underway to add 88 GW of coal-fired power generation capacity by 2032. When we think about realizing carbon neutrality for the entire earth, I believe that we must provide the most appropriate solutions considering the circumstances of each country.

**Tsuchida** We consider that the demand for products and services that have high production capacity and decarbonization volumes will grow in the industrial machines field. In steelmaking, blast furnace to electric furnace conversion is effective, but this consumes enormous amounts of electricity. Steelmakers are working to produce steel using hydrogen instead of coke (coal) and are experimenting with ammonia usage, which is easier to handle. Customers that handle compressors consume electricity in their daily operations. The IHI Group is also considering supplying clean electricity derived from ammonia to these customers. Additionally, by evolving operations that do not consume standby power from individual machines to systems, it is possible to optimize the overall system and minimize electricity consumption. We believe that we are able to make similar proposals in value chains of various fields, and this will further expand opportunities for the IHI Group.

The market for automotive turbochargers will disappear if the electrification of automobiles advances too quickly. However, hybrid vehicles are recently being reevaluated, which shows that transition requires time. For example, vehicles powered by fuel cells will newly require turbochargers for fuel cells that supply air efficiently. It is important to create new added value backed by technology while ensuring sustainability.

**Morita** Taking the movement toward carbon neutrality as one opportunity, there are growing efforts worldwide to take on the challenge of realizing various types of mobility in the aviation field. On the other hand, given the current demand and need for existing aircrafts, it is unlikely that demand will decline solely due to the effects of climate change. Rather, the demand is expected to increase due to the growing world population and globalization of the world economy. For future increases in demand, it is necessary to consider safety, economic rationality, comfort, and other factors, as well as respond to climate change. The IHI Group is strengthening its initiatives toward electrification in the field of "propulsion" of aircrafts, which is a field we excel in. Leveraging the core technologies of the IHI Group, we are developing and proposing an aviation energy management system that replaces conventional electric-powered equipment to operate them efficiently with minimal electricity consumption.

## What are the triggers for market expansion resulting from the realization of carbon neutrality?

**Ide** 2024 will be an extremely important year for the IHI Group, which is a leader in ammonia fuel technology. The world's first demonstration testing of 20% ammonia substitution at JERA's Hekinan Thermal Power Station has attracted much attention worldwide. If safe and stable power generation can be achieved using existing facilities, the adoption of fuel ammonia may increase, expediting the realization of carbon neutrality. Additionally, long-term durability tests for ammonia-fueled gas turbines began in June. In July, a demonstration of a tugboat powered by an ammonia-fueled engine for ships was held in Tokyo Bay.

**Ide** We are aware of JERA's plans to increase the ammonia combustion ratio to more than 50% from 2028 onwards. Furthermore, the IHI Group's project conducted with General Electric Company (U.S.), which is a project that develops heavy-duty gas turbines combusted exclusively with ammonia, is scheduled to be completed in 2030. Therefore, full-scale fuel ammonia utilization will begin around 2030. However, the key to proliferation and market expansion depends on technological innovation and a decrease in fuel ammonia price. We expect green and blue ammonia prices to decline to an economically rational level in approximately 2030. With safety as our top priority, we are also studying the legalization of standards, such as ISO, with governments and various partners. In Japan, there is the impression that hydrogen is leading the way over ammonia. However, ammonia utilization is underway, as you can see in JERA. Ammonia is also increasingly being recommended in Europe. To promote the use of liquefied hydrogen, it is necessary to invest in a huge amount of new infrastructure that can handle liquefied hydrogen at −253° C. In contrast, ammonia is transported by LPG tankers, and existing LPG tanks can be used, so the infrastructure is already in place. Customers in industries are also accustomed to using ammonia with ammonia fertilizers.

**Morita** The aircraft market is expected to grow steadily at 3% to 4% per year and expand to achieve carbon neutrality in approximately 2035. In the aircraft industry, single-aisle aircrafts, aircrafts that have one aisle in the cabin, dominate approximately 80% of the aircrafts operating worldwide. One such aircraft, Airbus A320, began operations in 1988 with the first-generation V2500 engine, and the A320neo, powered by the second-generation PW1100G engine, began service in 2016. The third-generation engine is expected to be in the market in approximately 2035. It is expected that the third-generation engine will significantly reduce fuel consumption through

technological innovations such as electrification. We anticipate the adoption of alternative fuels, such as SAF and e-methane, and beyond that, hydrogen engines that use hydrogen. The business opportunities available to us, including a greater percentage of participation in engine development programs, are extremely large, and we feel that there are growing expectations for the technical capabilities of the IHI Group.

## What should we look out for in the future of the IHI Group?

**Tsuchida** I believe that we will definitely move in the direction of increased profitability in our Conventional Businesses. The approach of updating the content of the customer's equipment without stopping its operation is efficient and can benefit both the IHI Group and the customers. Through the Exploit and Evolution of Lifecycle Business (LCB), we will upgrade only the equipment and functions that are required at the optimal time to achieve decarbonization, energy savings, unmanned operations, and more. Instead of simply taking a price-competitive approach, we will make proposals that maximize customer value from a long-term perspective even in small volumes and on a small scale while ensuring the company's own profitability. The customers also support our approach because the approach realizes not only carbon neutrality, but also a circular economy.

**Morita** The core of the fields of aeroengines and space is "propulsion". Through production innovations that leverage the IHI Group's renowned aero engine technology and digital transformation and business model reforms from the viewpoint of the value chain, the Aero Engine, Space & Defense Business will aim to achieve a revenue of 800.0 billion yen in fiscal 2030 and one trillion yen in fiscal 2040. The target operating profit margin is 15%. The feasibility of the civil aero engine and defense business is now in sight until approximately the first half of 2030, but beyond that, growth could change significantly depending on the development of the space business, and we are very excited about the future.

**Ide** Together with various governments and global partners, we aim to build a value chain for green ammonia in the Development-focus Businesses. Our policy is to develop this business with revenues of 900.0 billion yen, rivaling the Aero Engine, Space & Defense Business by approximately fiscal 2050. To this end, we aim to ensure good profitability through the strengthening of LCB and other means. Additionally, the three organizations, Corporate Strategy Headquarters, Technology & Intelligence Integration, and Business Development Headquarters, will function organically through continuous innovation and exploration of business opportunities from a value chain perspective, with the aim of creating a business that will become the next pillar after ammonia.