

**PROJECT**

# **MEET NEWS**

Mitsubishi Marine Energy & Environment Technical Solution-System

**23**

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## **Special Feature**

**Decarbonization Activities for the Maritime Industry**

**Success Achieved in Next Generation Oilless Cryogenic ORC Turbine Generator**

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# Special Edition: Decarbonization Activities for the Maritime Industry - Season 5 -

## Technical Seminar Held in Greece

MHI-MME held a Mitsubishi Heavy Industries Group Technical Seminar in Athens Greece in November 2022. To coincide with the MARTECMA (Marine Technical Managers Association) conference, we introduced MHI group-wide activities and initiatives across the value chain to decarbonize the maritime industry to more than 50 participants of Greek shipping companies. The seminar's agenda is as follows:

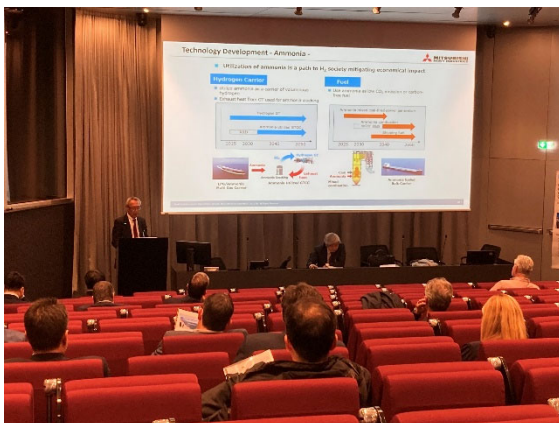
(Greece seminar agenda)

- Overview of the Mitsubishi Heavy Industry Group
- Energy transition
- Project between MSB & MME "Project MaTis"
- Shipping, Marine Solutions (MSB)
- Marine Machinery, Onboard Energy & Environmental (MHI-MME)
- Technical Update of MET turbochargers

Although we have been conducting these seminar once every two years, this was the first seminar in three years due to COVID-19. Compared to the previous seminar, it was remarkable that all the companies showed a very high level of interest in decarbonization.



Opening of seminar in Greece



Seminar

At the reception following the seminar, participants discussed technical challenges of decarbonization of the maritime industry from their own perspectives, which proved to be a very useful opportunity. We will try to propose future decarbonization solution responding to customer needs.

Since its founding in 1884, as a global leader in engineering and manufacturing, the MHI Group has been committed to addressing social issues and supporting people's daily lives. By incorporating cutting-edge knowledge into advanced technological capabilities accumulated over its long history, we are working to enrich people's lives through energy transition toward a carbon-neutral society, making social infrastructure smarter, and developing cyber-security fields.

## MMMCZCS CEO Visits Carbon Neutral Park

In October 2022, Mr. Bo Cerup-Simonsen, CEO of MMCZCS(\*1) and Mr. Claus Winter Graugaard, Head of Onboard Vessel Solution, visited the MHI Head Office and the Carbon Neutral Park located at the Research & Innovation Center of MHI Nagasaki.

We introduced MHI's zero emission initiatives, including an ammonia combustion facility, a CO<sub>2</sub> capture facility, and a biomass gasification facility. We received enthusiastic questions from the viewpoint of marine applications, and the tour was attended with great interest.

\*1 Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping. A Denmark-based survey and research organization that promotes the decarbonization of the global maritime industry.

The MHI Group is also involved as a founding partner.



Commemorative photo in the Carbon Neutral Park

## Success Achieved in Next Generation Oilless Cryogenic ORC Turbine Generator

MHI-MME has conducted a demonstration test using low-boiling point refrigerant to generate electricity by utilizing the cold energy generated when the cryogenic medium vaporizes. The test has shown the stability of the refrigerant cycle, and that the specified regenerative output can be achieved.

The demonstration test facility consists mainly of a Cryogenic Organic Rankine Cycle (ORC) turbine generator, refrigerant condenser (cryogenic medium vaporizer), refrigerant tank, refrigerant pump, and refrigerant evaporator, and was designed to simulate actual gas vaporization facilities (e.g., marine FGSS(\*1) and land-based gasification facilities).

This demonstration test has yielded useful results that will lead to future product commercialization, such as understanding the phase change(\*2) of cryogenic medium and refrigerant cycle characteristics, as well as confirming controllability.

The next-generation cryogenic ORC turbine generator developed solely by our utilizes MHI's proprietary turbine and cryogenic technologies. In addition to compactness and high performance, the fully-sealed hermetic casing does not leak refrigerant outside the system, and maintenance-free operation has been achieved through the use of oilless magnetic bearings.

We will continue to contribute to the low carbon and decarbonization of the maritime industry by developing various new technologies and further expanding its offerings, including products that contribute to improved engine efficiency, such as cold heat recovery systems for gas vaporization and engine exhaust heat recovery systems.

\*1 FGSS: Fuel Gas Supply System.

\*2 Phase changes are changes in the three states (phases) of material substances: for example, from liquid to vapor.



100kW class cryogenic ORC power generation demonstration testing equipment



Next-generation oilless cryogenic ORC turbine generator



## 20th Anniversary of MET Turbocharger License with Hyundai Heavy Industries

In commemoration of the 20th anniversary of the MET turbocharger license agreement with Hyundai Heavy Industries Co., Ltd (HHI) of South Korea, MHI-MME presented the company with a model of an MET turbocharger rotor in February 2023.

HHI has been the world's largest manufacturer of marine engines since it produced its first 2-stroke diesel marine engine in 1979. Today, its engine division is based in Ulsan, manufacturing a large number of diesel engines for major ship builders in South Korea and China.

Many of those diesel engines are equipped with MET turbochargers, and over 2,000 MET turbochargers have been manufactured by HHI.

We will continue to maintain and develop a good relationship with HHI and contribute to further efficiency improvement and IMO environmental regulation measures, through the manufacturing of engines and turbochargers that employ new technologies and are compatible with new fuels.



Commemorative gift ceremony  
Mr. J.S. Han, CEO of HHI and Mr. Kuzu,  
Senior Executive Vice President of MHI

# TURBOCHARGER ORDER

## Strong Demand for MET Turbochargers for J-ENG Engines with Low Pressure EGR Systems

MHI-MME has received its order for a MET53MB turbocharger for Japan Engine Corporation's (J-ENG) 6UEC50LSH-ECO-C3-EGR type engine equipped with a low pressure EGR system (\*1). The order is scheduled for delivery in early 2023.

We have been developing turbochargers for engines equipped with low pressure EGR systems in close conjunction with J-ENG to meet the specifications required by main engine.

The cumulative number of turbochargers we have delivered for engines with low pressure EGR now exceeds 30 units since the first shipment in 2018, which has now expanded to 5 types: 37MB, 42MB, 48MB, 53MB, and 60MB.

We have also already received indications for over 30 additional orders and expect the business volume to further increase going forward.

As a manufacturer of turbochargers that focuses on the needs of customers, we will continue to provide the best products that meet various engine specifications and are compatible with new fuels

\*1: Low pressure Exhaust Gas Recirculation (EGR) system

A system that recirculates low pressure exhaust gas at the outlet of a turbocharger. Name for a new technology developed by J-ENG for UEC engines to comply with Tier III NOx (nitrogen oxides) regulations, which is one of the IMO environmental regulations.

The technology enables the use of low-pressure exhaust gas from the turbocharger outlet to reduce NOx emissions while minimizing the impact on fuel economy.

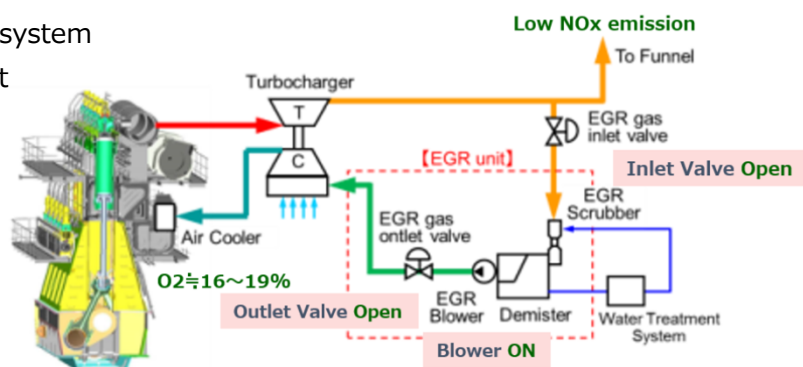


Diagram of EGR in operation

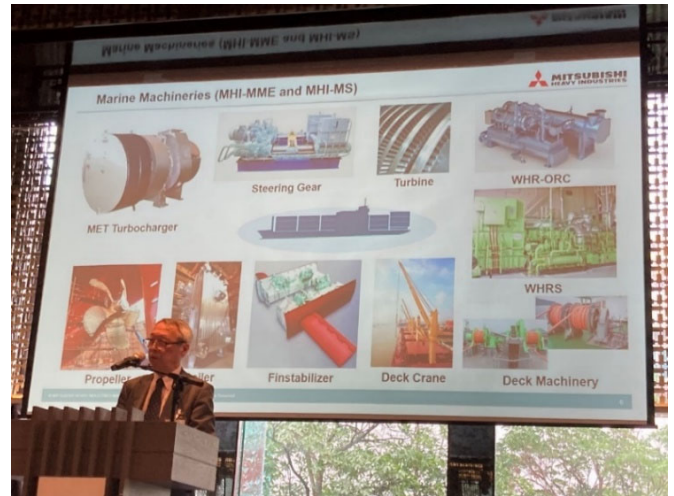
## Participates in the Taiwan Japan Business Matching Forum 2023

On February 20, 2023, MHI-MME participated in the Taiwan Japan Business Matching Forum 2023 sponsored by the Japan Ship Machinery & Equipment Association held in Taipei, Taiwan.

As this was the first marine machinery related event in Taiwan in about four and a half years since the last event held in September 2018, it was well attended by about 200 shipowners and others involved in the marine sector.

27 companies participated from Japan, and customers visited these companies' booths after their presentations. We also had the opportunity to have conversations with numerous customers during the reception and the event. Restrictions imposed by COVID-19 are mostly being relaxed around the world, and we are actively resuming direct communication with our customers.

We will take this event as an opportunity to further strengthen our relationship with our customers in the Taiwan.



Our presentation  
(Mr. Kuzu, Senior Executive Vice President)



Attending customers at our booth



Seminar room

## MET TURBOCHARGER SERVICE NETWORK

### MET After Sales Service Bases in South Africa

A global network of authorized repair agents consisting around the world, has been established for MET Turbochargers. Swift and appropriate servicing can be ensured around the world through this framework. This issue introduces our authorized repair agents in South Africa.



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### The MRL-5 Retractable Fin Stabilizer (Initial Order Intake)

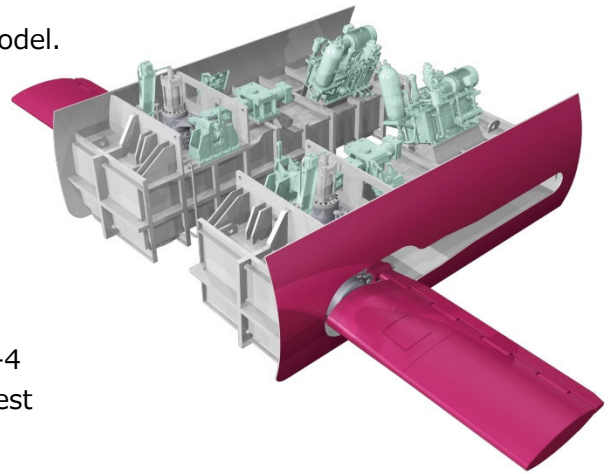
MHI-MME received its initial order for two units of the MRL-5 type (fin area 15m<sup>2</sup>/fin) retractable fin stabilizer, which is our largest model. The two units are in production for delivery in 2024 and 2025, respectively.

A fin stabilizer is a marine equipment designed to reduce rolling motion during the voyage, improve comfortability for passengers and crew, as well as to prevent cargo from collapsing.

It is mostly installed in ships such as ferries, cruise ships, and RORO ships.

Previously, the largest model we have manufactured was the MRL-4 type (fin area: 12 m<sup>2</sup>/fin), but the MRL-5 exceeds that as the largest model we have ever received orders for.

Leveraging the momentum from this latest order for the MRL-5, we will continue building on our track record of installation on large vessels to enable more comfortable and safe voyages around the world.



## BOILER NEW PRODUCT

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### The MC-EF Series Multi-fueled Fired Donkey Boiler (Initial Order Intake)

MHI-MME has received initial orders for two types of the small-capacity, multi-fueled fired donkey boiler MC-EF series.

One order is for the MC-80EF, which is for an LNG-fueled container ship built in an overseas shipyard, and the other is for the MC-50EF, which is for an LNG-fueled car carrier built in a Japanese shipyard.

The development of the small-capacity, multi-fueled MC-EF type boiler was completed in 2021 and is a scaled-down and dual-fuel version of the previously developed mid-capacity cylindrical boiler (25t/h to 35 t/h) for tankers.

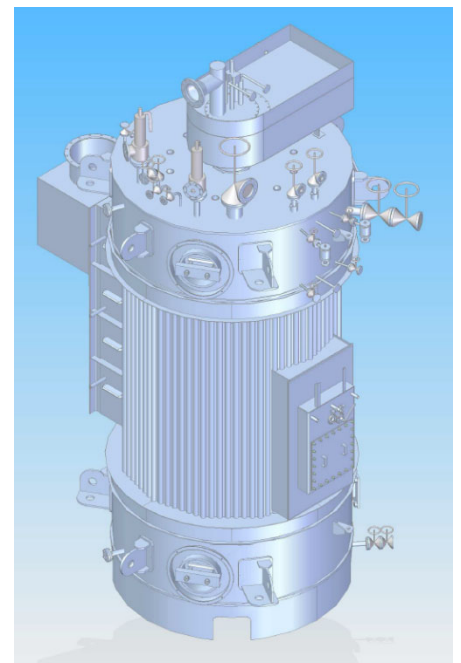
In order to meet the Boil Off Gas (BOG) treatment volume required for LNG-fueled ships, we have a lineup that ranges from 5t/h to 8t/h (equivalent to 322kg/h to 516kg/h of BOG treatment volume) in steam evaporation.

This boiler is designed to be able to safely treat the BOG output from the fuel tank in a free-flow condition.

In addition, the Gas Valve Enclosure (GVE) may be provided to meet the International Gas Fuel ship safety code (IGF code).

Both boilers for these projects will be manufactured by Marukin-Sato Shipbuilding & Iron Products Co., Ltd. in Japan, but boilers for overseas shipyards will be manufactured mainly by our Chinese licensee, CSSC Jiujiang Boiler Co., Ltd. for the next project.

The demand for LNG-fueled ships are expected to increase going forward as a bridge until fuels such as ammonia and hydrogen become practical, within the context of the transition of ship fuels for the decarbonization of the maritime industry. MHI-MME will provide not only large-capacity boilers, but also small-capacity boilers that meet the needs of our customers.







## Shanghai Office

### Mitsubishi Heavy Industries Shanghai

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In 2012, the Marine Machinery and Engine division began its operation based in Shanghai, China to provide prompt and proper service to our Chinese customers. Currently, our four-person team, supporting ship owners, design houses, shipyards, engine manufacturers and licensees in China on a daily basis.

The office is located in the Zhongshan Park area in the western center of Shanghai, on the 22nd floor of Raffles City, a commercial complex with a garden in Changning.

The Zhongshan Park area is conveniently located where subway lines 2, 3, 4 cross.

### Message from New General Manager: Du Jianting

I was assigned to Shanghai in April of this year, succeeding the former General Manager, Shigeki Wakasugi. For the past 14 years, I have been involved in the alliance and sales of ship engines and marine equipment for mostly China.

A characteristic of Chinese customers is that they are looking for more human connections.

I believe that providing support that is close to the customer, when there is an incident, will lead to accumulating good experience using our products, and that it is very important to foster and maintain a good relationship of trust.

This is my second assignment following my previous assignment to Shanghai in July 2016. The Chinese market environment has changed greatly from six years ago, such as the recent expansion and reopening of Chinese shipyards, increased orders for LNG carriers and ships using new fuels such as methanol.

In this context, I would like to utilize my past knowledge and join forces with my local colleagues to provide customer support with a high level of satisfaction through quick footwork. I look forward to working with you.

### Message from Departing General Manager: Shigeki Wakasugi

After my 3-and-a-half-year assignment in Shanghai, I will be transferred to MHI-MME Tokyo branch office as of April 2023. Looking back to October 2019, Covid-19 became a pandemic within a few months of my assignment to Shanghai.

My expatriate life was at the mercy of the infection situation, as traffic to and from the country was disrupted, and severe restrictions on activities and lockdowns were imposed.

I would like to take this opportunity to thank all our customers and partners for their cooperation, the hard work of my local colleagues, and the support from Japan, which has enabled me to continue my work under these circumstances.

Now that China no longer has restrictions on activities, the country's economy is expected to become even more active, and China is becoming an increasingly important market for ships and shipbuilding.

The new general manager of the division, Mr. Du, and all of our members will continue to do their best for our customers and stakeholders in China. We look forward to your continued support. Thank you very much.

## As the Mitsubishi Heavy Industries Group, we will work to achieve zero GHG emissions

Fiscal year 2023 has started. During the past three years, various trade shows and organization events were mostly cancelled due to COVID-19, but as the living with COVID environment has become more common, the number of various events are increasing. Along with the resuming of these activities, the economy is also showing signs of recovery.

In the United States and Europe, special preventive measures and entry restrictions against COVID-19 have been completely lifted, and it appears that economic activity has returned to its pre-COVID state. However, the methods and means of economic activity have changed in form, and companies are experimenting to adapt to the after-COVID days.

Last year, we heard a lot about "geopolitical risk." It was a year that the world was disrupted by new uncertainties associated with geopolitical risks, such as supply issues and raising prices of energy and food, loss of business opportunities due to tighter export restrictions, triggered by Russia's invasion of Ukraine. The market environment surrounding the shipping and shipbuilding industry is recovering in terms of orders for new ship buildings, particularly container ships and LNG carriers. However, it does not appear to be on a quick recovery track due to the short-term impact of rising fuel prices and stricter environmental regulations (EEXI, CII compliance, etc.), as well as the assessment of future carbon-free fuels and the approach to bridge fuels in the meantime. Therefore, it is anticipated that the market environment will level off for a while, and then gradually recover.

MHI-MME is further accelerating the study and development of new technologies and solutions with rapidly increasing customer interests and needs, such as CO2 emission reduction and future GHG zero emissions. As the movement toward carbon neutrality and zero emissions progresses to counter the threat of global climate change, we believe the biggest challenge is developing and applying new products and systems in response to the transition to new fuels.

We have already announced that we are a founding member of the Mærsk Center, a research organization that promotes the decarbonization of the maritime industry, and we are participating in various projects to obtain information on rules and regulations ahead of time and to gain insights on future directions.



The entire MHI Group is strengthening its efforts to develop and commercialize new technologies and solutions to achieve future zero GHG emissions as well as to demonstrate its function as a system integrator. We are also promoting group-wide activities to reduce CO2 emissions and achieve net-zero emissions across the entire value chain.

In this issue of MEET NEWS, we have shown some actual cases. We will quickly share such cases with you as verification tests progress so we can contribute as quickly as possible to CO2 emission reductions and zero GHG emissions in the future. We hope that you will consider and adopt these cases in your businesses.

**TOSHIAKI HORII** President & CEO  
Mitsubishi Heavy Industries Marine Machinery & Equipment