2021 Medium-Term Business Plan Progress (FY2021-2023)

April 5, 2023
Seiji Izumisawa, President & CEO

Mitsubishi Heavy Industries, Ltd.
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<th><strong>Responding to the world’s diverse needs, contribute to decarbonization of both energy supply and demand in leadup to global achievement of Carbon Neutrality</strong></th>
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<tr>
<td></td>
<td><strong>Existing business growth</strong> : Steady progress in initiatives in Metals Machinery and other businesses addressing industry’s decarbonization needs</td>
<td><strong>Decarbonize existing infrastructure</strong>: World’s No. 1 market share in gas turbines.</td>
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<td><strong>Services expansion</strong> : Utilize DX and fill out services portfolio</td>
<td><strong>Build a CO₂ solutions ecosystem</strong> : Inquiries for CO₂ capture doubled YoY.</td>
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<td><strong>Profitability improvements</strong> : Review business portfolio, including reorganization of Thermal Power and others and organizational transformation</td>
<td><strong>Lead market creation efforts together with partners such as ExxonMobil.</strong></td>
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<td></td>
<td><strong>2021 Medium-Term Business Plan (MTBP) initiatives progressing according to plan with positive effects now being seen.</strong></td>
<td><strong>Smart Infrastructure</strong> : Pursue unique value offering with ΣSynx</td>
</tr>
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<td></td>
<td><strong>Fulfill the role expected of MHI as a leading company in nuclear power and defense.</strong></td>
<td><strong>New business opportunities appearing due to increased concern for national security as geopolitical risks surface.</strong></td>
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</tbody>
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I. 2021 MTBP Targets
2021 MTBP Targets

2021 MTBP Initiatives

Strengthen Profitability
- Grow existing businesses
- Expand services
- Execute profitability improvements and organizational transformation

Develop Growth Areas
- Boldly reallocate resources
- Strengthen growth investments
- Improve intragroup cooperation
II. Strengthen Profitability
Profit Bridge

- Drive forward 2021 MTBP initiatives in line with plan while flexibly responding to changes in operating environment to achieve 7% business profit margin target in FY2023

FY20 Normalized*

**92.0**

Services Expansion

**83.0**

Recovery from COVID Pandemic, Existing Business Growth (Net of Materials Cost Inflation)

**95.0**

Profitability Improvements, Organizational Transformation

**10.0**

±X Forex Effects, One-Time Items, Growth Investments, Others

FY23 Target (billion yen)

**7% Business Profit Margin**

*FY20 normalized business profit calculated by subtracting one-time items (incl. SpaceJet and MVOW -¥38.0 bn) from FY20 actual business profit (¥54.0 bn)
Initiatives Toward Achievement of FY23 Targets

- Steady progress in initiatives laid down in 2021 MTBP with positive effects now being seen
- Continue pursuing these initiatives in FY23 toward achievement of 2021 MTBP targets

### Achievements (1Q FY21 – 4Q FY22)

**Recovery from COVID Pandemic**
- Logistics, Thermal & Drive Systems (LT&D) recovered to pre-COVID levels during FY21
- In Aero Engines, strengthened internal manufacturing capabilities and growing business with expansion of production facilities (Nagasaki and Komaki)
- Aero Structures still recovering, continuing fixed cost optimization

**Existing Business Growth**
- Business grew through steady progress in efforts to address decarbonization needs in GTCC, Metals Machinery, and others

**Services Expansion**
- Expanded services businesses through DX and shifting of resources
- Strengthened LT&D services hubs and grew market share in equipment leases and rentals

**Profitability Improvements and Organizational Transformation**
- Revised business portfolio (Naval Ships, Off-Shore Wind, Machine Tools, and others)
- Reorganized Thermal Power businesses (consolidated manufacturing facilities, downsized European business unit)
- Sold certain European Metals Machinery operations
- Reached basic agreement with Mitsubishi Electric to form Power Generator Systems JV

### Effects FY20 → FY23

- **Revenue**: +¥380.0 bn
- **Business Profit**: +¥95.0 bn

- **Revenue**: +¥220.0 bn
- **Business Profit**: +¥83.0 bn

- **Business Profit**: +¥10.0 bn
  (Benefits from fixed cost reductions and others)
Achievements through FY22 (1/2)

Recovery from COVID Pandemic

**LT&D**

- Recovered to pre-COVID levels in FY21
- Increasing sales prices to compensate for rising materials and logistics costs in a timely manner, minimizing impact

**Existing Business Growth**

**GTCC**

- Demand strong for gas-fired thermal power due to low environmental impact and high demand for electricity
- Turnover increased due to high customer rating of systems reliability

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**Aero Engines**

- Forecasted to surpass pre-COVID levels in FY22
- Based on increasing global MRO* needs, completed expansion work on engine repair facility (Komaki). Maintenance capacity will triple in future.

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**Metals Machinery**

- Active investments in green steel in Europe, US, Middle East, and Asia
- Leverage proprietary electric arc furnace and direct-reduction ironmaking technologies and know-how to respond to needs for high-spec, high-efficiency steelmaking facilities

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CAGR: Average growth rate from FY20 to FY22

*MRO: Maintenance, Repair, and Overhaul
Expanding services business turnover by maximizing customer value through DX and other initiatives

**GTCC**
- Expanded TOMONI® support organization to 5 HUBs, remotely monitoring over 100 units
- Proposing plant operational efficiency improvements using data obtained through TOMONI®

**Machinery Systems**
- Established remote services organization in North America utilizing AR, enabling response to customers’ urgent requests at any time

**Logistics Systems**
- Expanded direct sales area (~25% to ~35%) through new acquisitions by EQD
- Filled out services lineup including rentals, used equipment, and warehouse equipment

**Services Revenue (billion yen)**

- **GTCC**
  - FY19: ¥500.0 bn
  - FY20: ¥1,000.0 bn (+CAGR: +6%)
  - FY21: ¥1,500.0 bn (+CAGR: +11%)
  - FY22 forecast: ¥2,000.0 bn

- **Other services**
  - FY19: ¥500.0 bn
  - FY20: ¥1,000.0 bn
  - FY21: ¥1,500.0 bn
  - FY22 forecast: ¥2,000.0 bn

**Examples of Initiatives**

- **GTCC**
  - Expanded TOMONI® support organization to 5 HUBs, remotely monitoring over 100 units
  - Proposing plant operational efficiency improvements using data obtained through TOMONI®

- **Machinery Systems**
  - Established remote services organization in North America utilizing AR, enabling response to customers’ urgent requests at any time

- **Logistics Systems**
  - Expanded direct sales area (~25% to ~35%) through new acquisitions by EQD
  - Filled out services lineup including rentals, used equipment, and warehouse equipment

**Notes**
- 1 Augmented Reality
- 2 Equipment Depot: acquired as subsidiary in 2019
III. Develop Growth Areas
Develop Growth Areas

- Announced commitment to achieve Carbon Neutrality in 2040 (MISSION NET ZERO)
- Promoting decarbonization of energy supply through Energy Transition together with energy conservation, automation, and decarbonization of energy demand with Smart Infrastructure
III-1. Energy Supply
Energy Transition
**Recent Developments in the Energy Transition**

Forecasting rapid acceleration of Energy Transition, where Europe has previously led, mainly in US

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Governmental Support</th>
<th>Monetary Amount</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>US</strong></td>
<td>Inflation Reduction Act (IRA) (2022)</td>
<td>$369 bn budget includes $270 bn in tax incentives to combat global warning</td>
<td>Hydrogen/Ammonia • $8 bn budget (10 years) • Hydrogen production: Tax credits up to 30% CAPEX. Max tax credit $3/kg-H(_2) (10 years).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CCUS • $3 bn budget (10 years) • CO(_2) capture: Tax credits up to 30% capex. Tax credits of $85/t-CO(_2) for storage and $180/t-CO(_2) for DAC* (12 years).</td>
</tr>
<tr>
<td><strong>EU</strong></td>
<td>Fit for 55 REPowerEU (2021, 2022)</td>
<td>Public/private investment ~€1 tr</td>
<td>Hydrogen/Ammonia • Additional €27 bn in investment planned in EU (through 2030) • Set threshold for GHG emissions from hydrogen production (3t-CO(_2)/t-H(_2))</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CCUS • €10 bn in investments planned by 2030 in EU • Building CCUS hub and cluster at North Sea oil fields, suitable sites for CO(_2) storage</td>
</tr>
<tr>
<td><strong>Japan</strong></td>
<td>Green Transformation (GX) Basic Policy (2022)</td>
<td>Public/private investment ¥150 tr, incl. ¥20 tr in government funds</td>
<td>Hydrogen/Ammonia • ¥7 tr in public/private investment (10 years) • Considering creation of system to supplement differences in fuel prices and/or support systems for supply point infrastructure improvements</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CCUS • Execute ¥4 tr and ¥3 tr in public/private investments for CCS and CCU, respectively (10 years) • Build CCUS value chain in Asia by 2030 through CCUS business legislation and governmental cost-sharing</td>
</tr>
</tbody>
</table>

*Direct Air Capture*
Reducing, capturing, and eliminating CO₂ is one path to decarbonizing thermal power. Another path is to reduce CO₂ emissions by maximum utilization of nuclear power, a carbon-free energy source (Slides 30 and 31).
Decarbonize Existing Infrastructure

- Respond to needs for conversion from coal-fired thermal power to low-carbon gas-fired thermal power
- Achieved No. 1 market share in CY22 due to high evaluation of gas turbine reliability, ability to install CO₂ capture plants in future, and ease of hydrogen conversion. Maintain high market share while aiming to increase turnover.

**MHI Market Share in Main Regions (unit: GW)**

<table>
<thead>
<tr>
<th>Region</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>5 GW</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>China</td>
<td>17 GW</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ME</td>
<td>4 GW</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SE Asia</td>
<td>4 GW</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NA</td>
<td>6 GW</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SA</td>
<td>8 GW</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**MHI Global Market Share**

<table>
<thead>
<tr>
<th>Year</th>
<th>Market Share (GW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>40 GW</td>
</tr>
<tr>
<td>2022</td>
<td>50 GW</td>
</tr>
</tbody>
</table>

**MHI Revenue (billion yen)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>400</td>
</tr>
<tr>
<td>2020</td>
<td>500</td>
</tr>
<tr>
<td>2021</td>
<td>600</td>
</tr>
<tr>
<td>2022</td>
<td>700</td>
</tr>
</tbody>
</table>

Pie chart: market share in main regions 2019-2022 avg. (McCoy Power Report)
Bar graph: market size (capacity base) trends 2019-2022
Amid tailwinds from public CCUS incentives around the world, pursuing overall power plant optimization including CO2 capture facilities.

Hydrogen gas turbine development has met the first criteria of the EU Taxonomy (development progressing ahead of competitors).

**Ammonia Mixed Firing Boiler**

- 20% Mixed Firing
- 50%+ Mixed Firing (Gi Fund)

**Hydrogen Gas Turbine**

- In coal-fired thermal power, developing >50% ammonia mixed firing technology with goal of commercialization in first half of 2030s

GTCC + CO2 Capture

- Awarded Front End Engineering Design (FEED) study for CO2 capture plant applied to an LNG-fired GTCC power plant in Alberta, Canada
- Supporting customers’ decarbonization efforts with both GTCC and CO2 capture

- In lead up to commercialization in 2025, completed successful combustion test with 50% hydrogen mix, thereby meeting EU Taxonomy goals
- Development progressing in line with plan toward 100% hydrogen firing in large frame gas turbines in 2030
Realize a CO₂ Solutions Ecosystem

- Working to build a CO₂ solutions ecosystem connecting diverse emissions sources with storage and utilization providers
- Respond to CO₂ capture needs of diverse industries by leveraging long track record
- Accelerating efforts to build a value chain together with our partners

**CCUS Digital Platform**

1. **Grow CO₂ capture market**
   - Chemicals
   - Steelmaking
   - Thermal Power
   - Cement
   - Waste-to-Energy
   - Biomass Power
   - DAC

2. **Adapt to variety of capture sources**

3. **Establish CO₂ value chain**
   - Agriculture & Industry
   - Fuel Synthesis
   - Chemicals
   - Mineralization
   - Food & Beverage

Emissions Sources: Transport
Pipelines
On-Shore Storage
Liquefaction
Off-Shore Storage
Transport
Utilization

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(1) Grow CO₂ Capture Market

- Inquiries strong especially in Europe and US on back of IRA. Feasibility studies doubled since FY21.
- Aiming to grow business by responding to CO₂ capture demand mainly in US, which has high probability of further growth going forward

Global Inquiries

(CO₂ capture volume)

<table>
<thead>
<tr>
<th>(Mton)</th>
<th>FY20</th>
<th>FY21</th>
<th>2022/12</th>
</tr>
</thead>
<tbody>
<tr>
<td>~27 Mton/year*</td>
<td></td>
<td></td>
<td>2x growth</td>
</tr>
</tbody>
</table>

~53 Mton/year*
incl. from US
~30 Mton/year

Source: MHI data based on interpretation of IEA World Energy Outlook 2022 Net Zero scenario

CO₂ Capture Volume Needed for Net Zero Scenario (US)

(CO₂ capture volume)

<table>
<thead>
<tr>
<th>(Mton)</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>+450 Mton</td>
<td>900 Mton</td>
<td>1.2 Gton</td>
<td></td>
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</tbody>
</table>

Tailwinds from IRA

Incl. initial investment for capture, liquefaction, transport, and storage as well as operating costs (~$65/ton [source: GCCSI Report], calculated at ¥135/$)

Required expenses

¥0.3 tr
¥4 tr

* MHI calculation of yearly CO₂ capture volumes assuming 300 days of operation/year
(2) Adapt to Variety of Capture Sources

- Pursuing improvements and standardization of CO₂ capture process for use in diverse industries (including hard-to-abate sectors)
- Executing validation testing with ArcelorMittal and other diverse partners

## Executing Validation Testing with Multiple Partners

<table>
<thead>
<tr>
<th>Industry</th>
<th>Partner</th>
<th>Validation Timing/Results</th>
</tr>
</thead>
</table>
| Steelmaking   | **ArcelorMittal and Others** | - Signed collaboration agreement (Oct ‘22)  
- PreFeed for each emissions source using MHI 0.3t/day mobile unit  
- After completing first round of validation, will begin conceptual design of commercial scale capture for steelmaking plants  |
|               |                              | **Table:**  
|               | Emission Source | Site          |
|               | Blast furnace        | Ghent, Belgium |
|               | Rolling mill reheat furnace | Ghent, Belgium |
|               | Direct reduction furnace | North America |
| Cement        | **Tokuyama**         | - Validation period: end Jun 2022 – end May 2023  
- Evaluation: Accumulation behavior of exhaust gas impurities, effect of absorbent degradation |
| Waste-to-Energy| **Yokohama City**   | - Validation period: Jan 2023 – Mar 2024  
- Evaluation: Accumulation behavior of exhaust gas impurities |
| Gas Engines   | **In-House**         | - Validation period: end Jul 2022 – end May 2023  
- Evaluation: Accumulation behavior of exhaust gas impurities |

- Signing ceremony in UK with ArcelorMittal and others

- Modular CO₂ capture system (mobile unit)
(3) Establish CO₂ Value Chain

- Formed alliance with ExxonMobil in 2022. Working to establish organization to provide solutions for entire value chain and to accelerate development of projects around globe.
- Building CO₂ solutions ecosystem by linking diverse emissions sources with storage and utilization providers

**Global: Partnership with ExxonMobil**

- Joint technological development on CO₂ capture processes and project development using this technology
- Enables end-to-end CCS solutions from capture to storage for industrial customers by combining MHI’s CO₂ capture technology with ExxonMobil’s pipeline transport and underground storage technology

**Japan: Joint Study on Value Chain Businesses**

- Japanese government promoting long-term CCS roadmap including CAPEX and OPEX subsidies
- Plan for domestic CCS efforts to develop rapidly with 3-5 projects representing different combinations of CO₂ emissions source, transport method, and CO₂ storage region selected.
- MHI plans to execute joint study as CCS provider with INPEX and others in FY23
Build a Hydrogen Solutions Ecosystem

- Developing world’s largest hydrogen hub in Utah with American partners
- Project will produce hydrogen with renewable electricity, store it in underground salt domes, and supply hydrogen to nearby power station
- Received ~$500 mn loan guarantee from US Department of Energy in June 2022. Aiming for start of commercial operation in 2025
III-2. Energy Demand
Smart Infrastructure
Smart Infrastructure

- Offer customers automation, optimization, and high reliability with easy, one-stop solutions

Customer Pain Points

One-Stop Solutions

1. Intelligent Logistics
2. Refrigerated Warehouses
3. Data Centers

Intelligently Connect

Energy Systems
- Power Generation Equipment

Plants & Infrastructure Systems
- ITS
- Mechanical Parking Garages
- Environmental Testing Equipment

Logistics, Thermal & Drive Systems
- External Partners
- Natural Refrigerant Chillers
- AGV/AGF

Aircraft, Defense & Space
- Defense Systems
- Ships, Aircraft

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1 Read “Sigma Syncs”

ITS: Intelligent Transport Systems
AGV: Automated Guided Vehicle
AGF: Automated Guided Forklift
Realizing Our Customers’ DX Aspirations with SynX

- Proven track record of proprietary digital products accumulated in existing product lines enables us to provide agile digital solutions
- Based on this track record, deliver functionality and added value meeting customer needs in new growth areas

<table>
<thead>
<tr>
<th>Proprietary Digital Products</th>
<th>Installations</th>
<th>Existing Product Areas</th>
<th>One-Stop Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIASYS Netmation 4S machinery control</td>
<td>Control power generation equipment and marine vessels</td>
<td>1,000-</td>
<td>Auxiliary systems integration</td>
</tr>
<tr>
<td>TOMONI remote monitoring and maintenance</td>
<td>Monitoring power plants around the world</td>
<td>100-</td>
<td>Operational data access</td>
</tr>
<tr>
<td>InterSePT cyberattack protection</td>
<td>Protect important infrastructure</td>
<td>10-</td>
<td>Cooling and power source monitoring</td>
</tr>
<tr>
<td>SynX Supervision image monitoring and audio commands</td>
<td>Automate steel mills</td>
<td>-10</td>
<td>Remote monitoring and support</td>
</tr>
</tbody>
</table>

Deliver agile digital solutions for use cases throughout industry

New functions for each area
- Integrated control
- Operator-machine coordination
- Thermal simulation
- Total engineering
- Integrated operation management
- Energy optimization
- Operation optimization
- Design complexity
- Optimization planning
- Reliability and efficiency

Main customer pain points
- Labor shortages
- Operation difficulty

Added value provided
- Automation

New growth areas
1. Intelligent Logistics
2. Refrigerated Warehouses
3. Data Centers
Integrate ΣSynX into AGFs and Warehouse Control Systems (WCS) to drive warehouse logistics automation.

- **Integrate ΣSynX into AGFs and WCS** to improve functionality including object detection and recognition, automated control, human-machine coordination, and integrated control.
- **Expand automation** to areas including storage/retrieval and loading/unloading zones, aiming to automate all of warehouse logistics.
- **Started joint validation** of automated picking solution with Kirin Group in November 2022.

### MHI Revenue Targets

- **FY30:** ¥50.0 bn/yr
- **FY23-30 ttl:** ¥150.0 bn

**Expanded automated tasks** in steps (1), (2), and (3):

1. **Picking**
   - Automate picking tasks equivalent to 10 workers.
2. **Storage & Retrieval**
   - Automated conveyance at same speed as human worker.
3. **Loading & Unloading**
   - Automated loading and unloading of trucks.

**Steps for automation**:

- **(1) Picking**
- **(2) Storage & Retrieval**
- **(3) Loading & Unloading**
Refrigerated Warehouses

- Propose optimal facilities for new construction projects based on operational analysis using total engineering and thermal simulations.
- Achieved ~1.5-month (10%) decrease in construction time of warehouse for Kyoto Salted and Dried Fish Wholesale Cooperative (completed Jan 2023).
- Improved cooling efficiency and reduced power usage through equipment and operational optimizations.
- Grow business within Japan while keeping an eye on demand in international markets (Southeast Asia).

**MHI Revenue Targets**

- FY30: ¥15.0 bn/yr
- FY23-30 ttl: ¥75.0 bn
- Expansion outside Japan (incl. SE Asia)

**Completed warehouse for Kyoto Salted and Dried Fish Wholesale Cooperative**

- Construction chillers logistics systems

**Operational analysis with thermal simulations**

- Chiller output, power consumption, warehouse temperature, product temperature, etc.

**Total engineering**

- Utilize component choice simulations, etc.

**MHI construction & operation DB**

- Refrigerated Warehouses
- Logistics Systems

**Construction complete**

- Basic plan & design
- Detailed design & construction
- Operational analysis
- Operational improvement & modification
- Optimization

**MHI**

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3 Data Centers

- Energy conservation, decarbonization, and stable operation are challenges for data centers
- MHI offers high-reliability, high-efficiency power supplies, cooling and monitoring systems, and integrated controls in one stop

### The expanding data center market

<table>
<thead>
<tr>
<th>Year</th>
<th>Power generators</th>
<th>Cooling systems</th>
<th>DCIM/BMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2022</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Market Size by Region (2030)

- Americas: 4
- Japan: 3
- APAC: 2
- EMEA: 1

### Value offered in one stop

#### Reduce power use, decarbonize

- Zero-carbon power sources (small-large)
  - Hydrogen power generation systems (under development)
  - Renewable power sources + BESS
  - UPS (planning integration)

#### Advanced cooling systems

- Chillers
- Immersion cooling (under development)
- Chip cooling (under development)

#### Reduce maintenance costs, stabilize operation

- Operation monitoring
- DCIM
- Stand-by power generators

### Our goal

- High availability systems
  - Contribute to 99.999% availability rate
- High energy efficiency
  - PUE <1.11
    - (35% improvement vs. standard 1.7)
- Zero CO₂ emissions
  - 2030 revenue target >¥100.0 bn

### Validating next-generation cooling technologies

- Achieve >90% cut in cooling power use²

Source: MHI estimates based on Arizton “Data Center Construction Market Global Outlook & Forecast” and others

DCIM: Data Centre Infrastructure Management, BMS: Building Management System, BESS: Battery Energy Storage System

1 Index of data center power conservation (Power Usage Effectiveness) = data center facility total energy use ÷ IT component energy use
2 Joint validation with KDDI and NEC Networks & System Integration Corporation
IV. New Business Opportunities in the Changing Operating Environment
Nuclear Power’s Contributions to Energy Security and Carbon Neutrality

- Nuclear power is a carbon free, large-scale, stable power source. Viewed through the lens of energy security, utilization of nuclear power will be essential to achieving Carbon Neutrality by 2050.
- Supporting restarts aiming to achieve safe and stable operation of existing plants. Providing regularly scheduled maintenance work for restarted plants and continuing efforts to establish the nuclear fuel cycle.
- Contribute to achieving stable, carbon-neutral energy supply by accelerating commercialization of Advanced Light Water Reactor SRZ-1200, which will boast some of world’s highest standards of safety.

**PWR/BWR restart support**

**Establishing the nuclear fuel cycle**

**Components export**

**Commercialization of Advanced Light Water Reactor SRZ-1200**

**MHI Revenues (billion yen)**

- Fuel cycle, Components export, others
- New plants
- BWR
- PWR

<table>
<thead>
<tr>
<th>Year</th>
<th>PWR</th>
<th>BWR</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY15-17</td>
<td></td>
<td></td>
<td>150</td>
</tr>
<tr>
<td>FY18-20</td>
<td>200</td>
<td>50</td>
<td>250</td>
</tr>
<tr>
<td>FY21-23</td>
<td></td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>FY30</td>
<td></td>
<td></td>
<td>300</td>
</tr>
</tbody>
</table>

1 1200 refers to electric generation output, 1,200 MW, i.e., 1.2 GW

2 3-year average
Nuclear Power’s Contributions to Energy Security and Carbon Neutrality

- Jointly developing advanced light water reactor with Japan’s four PWR electric utilities.* ~80% of basic design for standard plant SRZ-1200 complete.
- In order to acquire and improve data for permissions, executing full-scale tests through opportunities provided by governmental projects. Going forward, will complete basic and detailed design for individual plants, aiming for commercialization in mid-2030s.

SRZ-1200 Development Schedule (MHI estimates)

<table>
<thead>
<tr>
<th>Year</th>
<th>‘20</th>
<th>‘25</th>
<th>‘30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Validation Testing (Government Projects)</td>
<td>Standard Plant Design (4 electric utilities)</td>
<td>Conceptual Design</td>
<td>Consideration of plant systems specifications for permissions</td>
</tr>
<tr>
<td>Individual Plants</td>
<td>Basic Design</td>
<td>Testing</td>
<td>Full-scale testing for newly designed components</td>
</tr>
<tr>
<td></td>
<td>Design of specific plants considering individual conditions including site</td>
<td>Start construction</td>
<td>Commercial operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Detailed Design</td>
<td>Manufacture/Construction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basic Design</td>
<td>Operation</td>
</tr>
</tbody>
</table>

In response to growing momentum towards strengthening national defense, Japan’s Defense Buildup Program has been expanded extensively.

As a leading company in defense, MHI is pursuing a wide variety of initiatives to support the safety and security of the nation.

**Defense Buildup Program Expenses and Contents**

<table>
<thead>
<tr>
<th>7 Major Programs</th>
<th>Stand-off Defense Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Integrated Air and Missile Defense Capabilities</td>
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<tr>
<td></td>
<td>Unmanned Defense Capabilities</td>
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<tr>
<td></td>
<td>Cross-domain Operation Capabilities</td>
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<tr>
<td></td>
<td>Mobile Deployment Capabilities/Civil Protection</td>
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<tr>
<td></td>
<td>Command and Control/Intelligence-related Functions</td>
</tr>
<tr>
<td></td>
<td>Sustainability and Resiliency</td>
</tr>
</tbody>
</table>

- Reinforcing Defense Production Base
- Research and Development
- Improvements to Bases
- Training Costs, Fuel, Others

**MHI Initiatives**

- **Stand-off Defense Capabilities**
  - Development and mass production of upgraded missile systems

- **Integrated Air and Missile Defense Capabilities**
  - Joint development and production of SM-3 with US

- **Unmanned Defense Capabilities**
  - Unmanned aerial vehicle coordination and control technologies
  - Unmanned surface vehicle technologies

- **Cross-domain Operation Capabilities**
  - Continuous manufacture of new-type frigates
  - Development and mass production of combat vehicles

- **Sustainability and Resiliency**
  - Operation support to improve operational availability of fighter jets and helicopters

**Defense Buildup Program Expenses and Contents**

- ~¥43.5 tr*
- ~¥17.2 tr*

**'01 Medium-Term Defense Program** (FY2019-2023)

**Defense Buildup Program** (FY2023-2027)

*Contract amount (non-personnel costs) for new programs*

V. MISSION NET ZERO Initiatives
Steadily reducing CO₂ emissions in lead up to 2030 target and Net Zero in 2040

**Scope 1 & 2**

- **Scope 2**
  - 2014: [Graph not shown]
  - 2022 forecast: [Graph not shown]
  - -47% reduction (vs. 2014)

- **Scope 1**
  - 2014: [Graph not shown]
  - 2022 forecast: [Graph not shown]
  - [Graph not shown]

**Scope 3 + reductions from CCUS**

- **Mton CO₂**
  - 2019: [Graph not shown]
  - 2022 forecast: [Graph not shown]
  - 2025 target: [Graph not shown]
  - 2030: [Graph not shown]
  - 2040: [Graph not shown]
  - -50% (vs. 2019)

- **kton CO₂**
  - 2014: [Graph not shown]
  - 2022 forecast: [Graph not shown]
  - 2030: [Graph not shown]
  - 2040: [Graph not shown]
  - -50% (vs. 2014)

**Forecasting 47% reduction in ‘22 (vs. ‘14)** due to energy conservation, decrease in carbon intensity of Japan’s power supply (incl. nuclear restarts), and installation of decarbonized power sources.

**Going forward, will apply lessons learned during decarbonization solutions validation testing at Mihara Carbon Neutral Factory (going live April 2024) to other facilities, achieving Net Zero in ‘40**

**Reducing CO₂ emissions from use of MHI products**

**Following in-house development and validation of fuel conversions, energy conservation, electrification, and CCUS, will encourage speedy commercialization, achieving Net Zero in ‘40**
MISSION NET ZERO Initiatives

- Developing and validating variety of solutions in-house in lead up to MISSION NET ZERO achievement
- Leverage knowledge gained in this process to build actual business

Mihara Machinery Works
Carbon Neutral Factory
Systems validation incl. solar power and electrification

Takasago Machinery Works
Hydrogen gas turbine development and validation, hydrogen production development

Nagasaki Dockyard/R&I Center
Ammonia combustion development, hydrogen production development, CO₂ capture development

Yokohama Hardtech Hub
(Automated picking solutions validation)

MHIET Sagamihara Machinery Works
(Validation of CO₂ capture from gas engines)

- CO₂ reduction at time of commercialization
- ~65%
- ~90%
- ~100%
- ~100%
- ~100%
VI. Conclusion
Conclusion

During the 2021 Medium-Term Business Plan, MHI Group has moved forward with various initiatives while responding flexibly and quickly to changes in the operating environment, and we are now realizing the benefits of these efforts. In FY23, we will further expand on these accomplishments to achieve a 7% business profit margin.

As we develop growth areas in both the energy supply and demand sides in the leadup to achievement of global Carbon Neutrality, new business opportunities are emerging with increased governmental support for decarbonization and greater momentum toward strengthening national security.

In order to seize these opportunities, we will continue reviewing our business portfolio and accelerate the shift of resources into growth areas, ensuring a strong future trajectory for the company.
VII. Appendix

(FY2022 highlights by business)
FY22 Highlights

### Energy Systems

#### Achieved World’s Top Market Share in Gas Turbines
- Completed expansion work at aero engine maintenance shop
- Planning to double commercial engine MRO capacity from 5 units per month by 2026 and to eventually triple this in future

#### Announced Joint Development on Advanced Light Water Reactor SRZ-1200 with 4 PWR Electric Utilities
- Jointly developing basic design for Advanced Light Water Reactor SRZ-1200 standard plant, which will achieve the world’s highest standards of safety, with four PWR electric utilities* in Japan
  

#### Construction Finished on 5 Specialized Security Facilities, Expanding Support for BWRs
- Completed construction of Specialized Security Facilities at Mihama 3, Genkai 3 & 4 and Oi 3 & 4, which are required under new regulatory standards
- Leveraging track record in PWRs to extend support to BWRs

#### Expansion of MHIAEL Aero Engine Facility in Komaki, Aichi to Meet Increasing Demand
- Completed expansion work at aero engine maintenance shop
- Planning to double commercial engine MRO capacity from 5 units per month by 2026 and to eventually triple this in future

#### World’s Largest Hydrogen Mixed Firing Validation Test
- Successfully completed world’s largest hydrogen fuel blending test with 20% mixed fuel at existing high-efficiency, large-frame GTCC facility in US

#### Signed MOU for Electricity Generation with Clean Fuels
- Multiple MOUs signed for introduction of mixed combustion of hydrogen, ammonia, and biomass in thermal power plants in total of seven countries
- Supporting energy decarbonization to achieve Net Zero targets
Plants & Infrastructure Systems

**FY22 Highlights**

### ExxonMobil Alliance Expands CO₂ Capture Lineup
- Formed alliance with petrochemical major ExxonMobil. End-to-end solutions from CO₂ capture to storage now possible.
- Commercialized modular CO₂ capture system. Our wide lineup of products, including large-scale plants, is now being used in diverse industries.

### LNG-Fueled Ferry Completed
- First ferry in Japan to be equipped with high-performance dual fuel engine capable of using LNG and fuel oil was completed.
- Reduces CO₂ emissions by more than 20% per calorific value compared to conventional fuel oil and SOx emissions to nearly zero.

### Promoting Green Steel Including for Environmental Benefits
- Third MEROS (dry exhaust gas treatment system) delivered to an Italian steelworks began operation.
- Seven systems total were ordered for the same steel plant, with construction of the remaining four underway.
- The systems eliminate toxic substances from exhaust emissions and greatly improve air quality.

### Contributing to Engineering Industry Development with Execution of International Projects
- Three overseas projects were awarded Engineering Commendation Awards by the Engineering Advancement Association of Japan:
  - Uzbekistan Fertilizer Plant Project
  - Manila MRT-3 Rail Line Maintenance and System Rehabilitation Project
  - US Large-Scale Polyethylene Plant Construction Project

### Participating in Waste-to-Energy Projects via Public-Private Partnership Schemes
- Completed construction of one of the world’s largest waste-to-energy facilities in Singapore. MH! Group is participating in waste-to-energy business via a public-private partnership scheme.
- Began 25-year operation and maintenance service period.

### Delivered Large Retractable Roof Drive Mechanism (New Nippon Ham Fighters Stadium)
- 24 drivetrains open and close the ~10,000-ton roof.
- System detects real-time changes in load due to effect of snow and automatically controls speed of drive mechanism.
- Newly developed integrated management support tool helps user operate drive mechanism remotely.
**FY22 Highlights**

**Logistics, Thermal & Drive Systems**

**Participated in Real-World Validation Test of Fuel Cell-Powered Forklift**

- Participated in customer’s validation test using a fuel cell-powered forklift. Achieved carbon-neutral cargo handling.

**Received Two Demand Side Management Awards**

(Chairman’s Award and Promotion Award to Air-Cooled Heat Pump Chiller and ATES, Respectively)

**High-efficiency air-cooled heat pump chiller MSV2**

- Modular connection enables multiple units to be installed together and is compatible with various heat loads. Contributes to power load leveling.

**Aquifer Thermal Energy Storage (ATES) system**

- Stores and uses underground heat, an untapped resource.
- Takes into account underground heat balance and achieves significant energy savings.

**AI Human-Detection Alarm System**

- Hemispherical cameras mounted on the mast and overhead guard detect people in various positions with AI, triggering warning lamps to prevent collisions.

**Launched JHT-Y/YI, a New Series of Large-Capacity Centrifugal Chillers with Low-GWP Refrigerant (Jun 2022)**

- Uses HFO-1234yf refrigerant, which has extremely low environmental impact with GWP* less than 1 and zero ozone depletion.
- A new type of compressor enables high performance in the entire capacity range which varies according to chiller output.

*GWP: Global Warming Potential

**Development of Hydrogen and Ammonia Engines Contributing to Carbon Neutrality**

- Working toward finalization of hydrogen mixed firing production model specs.
- Validation testing of 100% hydrogen firing and ammonia mixed firing engines underway. Commercialize in a timely manner responding to infrastructure development status and customer needs.

**Developed Double Scroll Turbocharger for Low-Noise Vehicles**

- Developed double scroll turbocharger with improved noise performance, which has been confirmed for use in a customer’s next-generation vehicle.
- Improved both fuel efficiency and output while maintaining aerodynamic performance and reducing noise levels by 13 dB compared to conventional products.
FY22 Highlights

Aircraft, Defense & Space

Delivered Frigate “Mogami”
- This is the namesake of the Mogami class of frigate. Planning to continue delivery of this class of frigate in the future.

H-IIA Launch Vehicle
- Successfully launched Intelligence Gathering Satellite (IGS)-Radar 7 with H-IIA launch vehicle No. 46.

Japan, UK, and Italy Jointly Developing Next-Generation Fighter
- The Japanese government announced that the next-generation fighter will be jointly developed with the governments of UK and Italy.
- MHI will continue to work diligently to develop the next-generation fighter and contribute to Japan’s national security.

Naming and Launch of Patrol Vessel “Hateruma”
- Mitsubishi Heavy Industries Maritime Systems (MTS) held a naming and launch ceremony at its Tamano Shipyard for 1,000-ton patrol vessel “Hateruma,” built for the Japan Coast Guard.
- This is the second naming and launch ceremony for the new company MTS, which started operations in October 2021.

Naming and Launching Ceremonies for Submarine “Jingei”
- Kobe Shipyard held a naming and launch ceremony for 3,000-ton submarine “Jingei” built for the Japan Ministry of Defense.
- Leveraging technological synergies in defense equipment spanning land, air, and sea, this advanced submarine boasts superior functionality as well as technical and cost performance.

Recycling Carbon Fiber Composite Waste into Home Appliances
- Reusing processed waste material from Boeing 787 composite aircraft wings into parts for Mitsubishi Electric cordless stick cleaners.
- Contributing to mitigation of environmental impact and protection of global environment by being the first to build a supply chain that includes reuse of difficult-to-recycle carbon fiber waste material into a mass-manufactured product.

Delivered Frigate “Mogami”

H-IIA Launch Vehicle

Japan, UK, and Italy Jointly Developing Next-Generation Fighter

Naming and Launch of Patrol Vessel “Hateruma”

Naming and Launching Ceremonies for Submarine “Jingei”

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