Power Systems Business Plan

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Senior Executive Vice President,
President and CEO of Power Systems,
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June 5, 2018
Mitsubishi Heavy Industries, LTD
Contents

1. Business Overview
2. 2018 Medium-Term Business Plan
4. Individual Business Strategies
5. Power Systems – Mission Statement:
   “POWER & ENERGY SOLUTION PROVIDER”
1. Business Overview
   1-1. FY 2017 Sales Overview
   1-2. FY2017 Major Projects

2. 2018 Medium-Term Business Plan


4. Individual Business Strategies

5. Power Systems – Mission Statement:
   “POWER & ENERGY SOLUTION PROVIDER”
1-1. FY 2017 Sales Overview

**Renewable Energy**
- Offshore Wind Turbines*
- Power Generation Pumps
- Chemical Plant Pumps
- Water Jet Pumps

**Nuclear Power**
- Pressurized Water Reactors (PWR)
- Nuclear Fuel Cycle

**Marine Machinery**
- MET Turbochargers
- Marine Boiler & Turbine

**Gas / Coal / Geothermal**
- Gas Turbine Combined Cycle (GTCC)
- Clean coal, IGCC
- Aero-derivative Gas Turbines
- Geothermal Power Generation
- Environmental Plants
- Organic Rankine Cycle Systems

**Compressors**
- For Chemical Plants
- For Power Plants
- For Oil & Gas Applications

**Aero Engines**
- V2500

* MHI Vestas Offshore Wind (MVOW), which operates offshore wind power generation facilities, is not included in the graph because it is an affiliate accounted for by the equity method.

FY2017 Net Sales ¥1,493.9 billion

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1-2. FY2017 Major Projects

### Highly Efficient Gas Turbines
- **Thailand**
  - Received order of Advanced GTCC

### Environmentally Friendly Technologies
- **Serbia**
  - Received order of world’s largest flue gas desulfurization (FGD) system

### Zero Emission Power
- **Japan**
  - Received first order of a SOFC-MGT hybrid system for industrial-use distributed power

### Fuel-Efficient Aircraft Engines
- **Poland**
  - Received order of Advanced GTCC
- **Germany**
  - Received order for 31 units of V164-8.0MW offshore wind turbines (Order received by MVOW)

**GTCC:** Gas Turbine Combine Cycle  **SOFC:** Solid-Oxide Fuel Cell  **MGT:** Micro Gas Turbine
1. Business Overview

2. 2018 Medium-Term Business Plan
   2-1. Review of 2015 Medium-Term Business Plan
   2-2. 2018 Medium-Term Business Plan
   2-3. Turbomachinery Synergies
   2-4. Power & Energy Solution Business


4. Individual Business Strategies

5. Power Systems – Mission Statement:
   “POWER & ENERGY SOLUTION PROVIDER”
2-1. Review of 2015 Medium-Term Business Plan

Challenges in FY2015 Medium-Term Business Plan

- Orders received & Net sales: Rapid market change in power business
- Operating income: Imbalance between business scale and fixed costs

Achievements of 2015 Medium-Term Business Plan

- Launch of power & energy solution business
- Creating synergies among turbo machinery businesses
- Improved financial foundation (reduced working capital, shortened CCC)

Opportunities

- New business development by power & energy solutions coexisting with growing renewable energy
- Efforts of synergies among turbo machinery businesses
- Continue to pursue PMI activities while steadily executing the many projects on hand.

**Working Capital & CCC**

<table>
<thead>
<tr>
<th>Year</th>
<th>Working Capital</th>
<th>CCC (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Orders received**

- 2016: 1,726.3
- 2017: 1,437.5

**Net sales**

- 2016: 1,448.4
- 2017: 1,493.9

**Operating income** (In billion yen)

- 2016: 108.1
- 2017: 108.9

PMI: Post Merger Integration  CCC: Cash Conversion Cycle

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2-2. 2018 Medium-Term Business Plan (1/2)

Targets

Gas / Coal / Geothermal
Compressors
Aero Engines
Nuclear Power
Renewable Energy
Marine Machinery

Orders received

Net sales

Operating income / EBIT

<table>
<thead>
<tr>
<th>Year</th>
<th>Orders received</th>
<th>Net Sales</th>
<th>Operating income / EBIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>1,726.3</td>
<td>1,448.4</td>
<td>108.1</td>
</tr>
<tr>
<td>2017</td>
<td>1,437.5</td>
<td>1,493.9</td>
<td>108.9</td>
</tr>
<tr>
<td>2018</td>
<td>1,500.0</td>
<td>1,600.0</td>
<td>125.0</td>
</tr>
<tr>
<td>2020</td>
<td>1,800.0</td>
<td>1,900.0</td>
<td>135.0</td>
</tr>
</tbody>
</table>

(YF) After IFRS
### Initiatives for Achieving Earnings Targets

| Gas/Coal/Geothermal Power | • Efficient execution and profit improvement for order backlog  
| | • Expand services business  
| | • Improvement work for existing facilities  
| | (e.g. reduce carbon emissions, higher efficiency)  
| | • Digitalization, -Optimize O&M, etc.  
| | • Reorganization of domestic & overseas bases through PMI  
| Nuclear Power | • Promote and ensure safety of construction and compliance with new domestic regulatory requirements.  
| | • Carry out various maintenance works after restart  
| | • Support completion of nuclear fuel cycle process facilities  
| | • Support stabilization of Fukushima Nuclear Power Plant  
| | • Strengthen risk management for overseas projects  
| Aero Engines | • Expand business volume in response to robust commercial aircraft demand  
| | • Promote the engine overhaul and repair business  
| Renewable Energy (MVOW, Pumps, etc.) | • Strengthen competitiveness in response to the expansion of the offshore wind turbine market  
| Others (Compressors, Turbomachinery Synergies, Power & Energy Solution Business, etc.) | • Increase orders for new compressors and services in preparation of an upturn in the oil & gas market  
| | • Promote synergies within a broad range of MHI group turbo machinery technologies  
| | • Develop unique businesses within the Power & Energy Solution Business function  

### Earnings Targets (In billion yen)

- **Gas/Coal/Geothermal Power**  
  - **FY 2018:** 135.0  
  - **FY 2020:** 190.0

**Note:** Impact of IFRS conversion is negligible.
2-3. Turbomachinery Synergies

Expanding natural gas production and applications for a low-carbon society

- Mitsubishi Heavy Industries Compressor Corporation
- MHPS
- LNG production solutions
- H-100 GT-driven LNG compressor train

Oil & gas related products business

- MHPS
- LNG to Power
- Powership equipped with H-25 GTs

Uptake of renewable energies

- MHPS
- Flexible power generation to support renewable energies
- Mitsubishi Heavy Industries Aero Engines, Ltd.

MHPS: Mitsubishi Hitachi Power Systems, Ltd.
2-4. Power & Energy Solution Business

Comprehensive Management System Utilizing AI/IoT

For power plants

Energy Supply

For large energy users

Energy Users

ENERGY SUPPLY CHAIN

Mitsubishi Hitachi Power Systems

MHPS-TOMONI™ *1

- Flexible operation
- Performance improvement
- O&M optimization

Mitsubishi Heavy Industries

ENERGY CLOUD® *2

- Administration support
- O&M support
- EMS, optimal utilization system
- Failure detection, Improved reliability

EMS: Energy Management System

*1 MHPS-TOMONI™ is a trademark of Mitsubishi Hitachi Power Systems Ltd.
*2 ENERGY CLOUD® and related logomarks are registered trademarks of Mitsubishi Heavy Industries, Ltd. In Japan.
1. Business Overview

2. 2018 Medium-Term Business Plan

   3-1. MHI FUTURE STREAM
   3-2. Power Systems – Mission Statement
   3-3. Challenges of Expanding Renewable Energy Use
   3-4. Power Systems Strategies Toward a Carbon-Free Society
   3-5. Future Energy Infrastructure
   3-6. Solutions for Achieving “+2°C Scenario” for Climate Change

4. Individual Business Strategies

5. Power Systems – Mission Statement:
   “POWER & ENERGY SOLUTION PROVIDER”
3-1. MHI FUTURE STREAM

Under “MHI FUTURE STREAM,” MHI aims to:
- Resolve complex and difficult social issues of today and the near future
- Take on challenges of the distant future
- Carry out continuous reforms to make MHI a company always in demand by humanity and society

SDGs
Realization of a sustainable world

SUSTAINABLE DEVELOPMENT GOALS

- Carbon-free
- Social infrastructure innovation
- Co-existence, co-prosperity
- Future mobility and logistics
- National security systems
- Space development

Response to climate change, urbanization, aging population, etc.

Society where all human beings can live with peace of mind

Take on challenges of the distant future

MHI’s businesses

Today → Near future → Distant future

A new set of initiatives under the 2018 Business Plan focused on MHI’s future
3-2. Power Systems – Mission Statement

Why?
Provide stable clean energy solutions for a sustainable society

What?
Provide decarbonizing solutions (low carbon / zero emissions)

How?
Focus strategy around 3E+S in the future (2030s, 2040s, and 2050s)

Who?
MHI Power Systems can provide advanced technologies & integrate multiple solutions

MHI as a “POWER & ENERGY SOLUTIONS PROVIDER” of the future
While wider use of renewable energy is essential, a stable backup power supply is also indispensable.

### Challenges of Expanding Renewable Energy Use

**Australia: Wide-reaching power outage results in suspension of major resource operations and disruptions to public transportation.**
- In September 2016, a severe storm hit the state of South Australia and a large power outage occurred (wind power-generated electric power, which accounts for about half of the state's electricity supply, was cut off and lines from neighboring states were also interrupted).

1. A storm damages power transmission lines

2. Unable to flexibly adjust power output due to minimum utility frequency requirements. Wind-generated power equivalent to 460MW is automatically cut off from the grid.

3. Attempts are made to offset the decrease in wind power generation with system interchanges, but the degree of power loss is too great and results in an automatic shutoff of lines to neighboring states (to ensure operation of those grids).

4. Attempts to use gas-fired thermal power to make up for the loss of electricity from wind power generation and from the grid could not be carried out in time.

Wind power generation accounts for about 50% of electricity supply; stable backup power supply is insufficient. → Balance between renewable energy and backup power supply is crucial.

※ It takes about 2 minutes for the interconnection line to shut off after the loss of wind power supply.
3-3. Challenges of Expanding Renewable Energy Use (2/2) — time constraints, uneven regional distribution

Compensate for imbalance between renewable energy output fluctuations and power demand with more enhanced and flexible operation of thermal power and other stable power sources.

**Time Constraints**

Provide power with stable power supplies alone

- Gas/Coal Power
- Hydro Power
- Nuclear Power
- Wind Power

Promote renewable energy

- Wind Power
- Solar Power

Output of stable power sources can be readily adjusted to respond to demand fluctuations.

Due to the large fluctuation in renewable energy output, supply must be adjusted with stable power sources.

**Uneven Regional Distribution**

High volume power-consuming areas that are distant from renewable energy fields require stable sources of power of a fixed scale.

- Japan: Suitable for solar power
- U.S.A: Suitable for wind turbines
- Germany: Power-consuming area

Suitable for solar power

Suitable for wind turbines

Power-consuming area
3-4. Power Systems Strategies Toward a Carbon-Free Society (1/2)

Challenges of Paris Agreement, Capping Climate Change at less than +2°C

To achieve the goals of the Paris Agreement, the following are needed in addition to more widespread use of renewable energy:

- Promotion of highly energy-efficient equipment and systems
- CCS and CCUS plants for recycling CO2 produced as emissions
- Fuel conversion toward using lower-carbon fuels

Need for integration of sophisticated power generation equipment and systems with a wide range of technologies

CCS: Carbon dioxide Capture Storage
CCUS: Carbon dioxide Capture, Utilization and Storage

(Reference: IEA World Energy Outlook 2017)
3-4. Power Systems Strategies Toward a Carbon-Free Society (2/2)

Regional initiatives to Achieve Paris Agreement → Combination of Renewable Energy and Low-Carbon Power Supply (gas/nuclear energy)

<table>
<thead>
<tr>
<th>Area</th>
<th>Power consumption volume</th>
<th>Industrial CO2 emissions volume (from fossil fuels)</th>
<th>Solutions</th>
</tr>
</thead>
</table>
| Developed Country (OECD) | *Power consumption volume: stable* | *Sharp reduction needed to achieve 2°C Scenario* | **Promote shift in energy mix to low-carbon power supplies:**  
  - Aggressive adoption of renewable energy  
  - Coexistence with low-carbon power sources  
  - Offer CO2-free power systems  
**Promote energy efficiency improvement with energy management:**  
  - Fuel economy engines  
  - ENERGY CLOUD  
  - CCS/CCUS plants |
|                       | ![Graph](2015 2030 Actual Draft basis 2°C Scenario) | ![Graph](2015 2030 2°C Scenario) |                                                                                               |
| Emerging Country      | *Power consumption volume: increase* | *Maintain CO2 emission volume at current level* | **Respond to increasing power demand and low-carbonization:**  
  - Provide highly efficient facilities powered by clean energy  
  - Renovate existing facilities to cut carbon emissions, promote fuel conversion  
**Promote energy efficiency improvement with energy management:**  
  - ENERGY CLOUD  
  - CCS/CCUS plants |
|                       | ![Graph](2015 2030 Actual Draft basis 2°C Scenario) | ![Graph](2015 2030 2°C Scenario) |                                                                                               |
3-5. Future Energy Infrastructure (1/3)

Energy Infrastructure to Maximize use of Renewable Energy (CY2020～: Developed Country)

Challenges
1. Rapid penetration of renewable energy
2. High cost of energy storage

- Nuclear Power
- Offshore Wind Power
- Geothermal Power Generation
- Biomass
- Solar Power
- Geothermal Power Generation
- GT + ESS (EMS)
- GT + ESS (EMS)
- Major Urban Area
- High efficiency urban-type CHP

Large Energy Users
- Utilizing Captive Power Plant
- Aggregation Service

Power Generation
- Binary/Waste Heat Recovery Generation
- Quick start large-capacity GT
- Quick start distributed power-type GT
- High efficiency large-capacity IGCC

EMS Utilizing storage batteries

ESS: Energy Storage System
CHP: Combined Heat & Power

Safe and stable low-CO2 emitting base power source

Total Management
3-5. Future Energy Infrastructure (2/3)

Economical and Small Low-Environmental Impact Energy Infrastructure (CY2020~: Emerging Country)

Challenges
1. Increasing population
2. Increasing energy consumption by industries

High efficiency large-capacity USC + AQCS
Powership
Industrial Complex — CHP — Energy Management
Power Generation (Binary / Waste Heat Recovery Generation)
SOFCE
Geothermal Power Generation

Total Management
AQCS: Air Quality Control system
3-5. Future Energy Infrastructure (3/3)

Ultimate Energy Infrastructure for a Sustainable Earth (2030 and beyond)

- **Main Power**
  - Advanced Nuclear Power
  - Offshore Wind Power
  - Total Management

- **Auxiliary Power**
  - Methane production
  - Quick start distributed power-type GT

- **Plant Factory**
  - GT + ESS (EMS)
  - IGCC
  - SOFC

- **Power Generation**
  - Binary / Waste Heat Recovery Generation
  - Fixed site / High efficiency
  - USC + AQCS + CCS

- **Synthetic Fuel**
  - H2
  - Derived from Renewable Energy

- **CO2 Cycle**
  - Effective Utilization of CO2
  - CO2 Compressor

- **Effective Utilization of CO2**
  - Methane

- **Methane**
  - High efficiency large-capacity GT

- **CO2 Derived from Renewable Energy**
  - High Efficiency Power Generation
  - Safe and stable low-CO2 emitting base power source

- **Major Urban Area**
  - High efficiency urban-type CHP

- **Total Management**
  - GT + ESS (EMS)
### 3-6. Solutions for Achieving “+2°C Scenario” for Climate Change (1/3)

<table>
<thead>
<tr>
<th>Sharply lower carbon emissions</th>
<th>Utilize and complement renewable energy</th>
<th>Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>High efficiency large-capacity GTCC</td>
<td>Quick start distributed power-type GT</td>
<td>System Hybridization</td>
</tr>
<tr>
<td>GT fueled by Hydrogen/Ammonia/Methane</td>
<td>Offshore Wind Turbine</td>
<td>GTCC+SOFC (Triple Combined Cycle)</td>
</tr>
<tr>
<td>IGCC</td>
<td>Distributed Geothermal Power Plant/Biomass</td>
<td>Power &amp; Energy Solution Business (Utilizing AI/IoT)</td>
</tr>
<tr>
<td>SOFC</td>
<td>CCS &amp; CCUS</td>
<td>Draft business investment plan together with customer.</td>
</tr>
<tr>
<td>Nuclear Power</td>
<td></td>
<td>Participate in asset management, including financing.</td>
</tr>
</tbody>
</table>

- **GTCC**: GT fueled by Hydrogen/Ammonia/Methane
- **IGCC**: IGCC
- **SOFC**: SOFC
- **Nuclear Power**: Nuclear Power
- **SYSTEM HYBRIDIZATION**: GTCC+SOFC (Triple Combined Cycle)
- **POWER & ENERGY SOLUTION BUSINESS (UTILIZING AI/IOT)**: Draft business investment plan together with customer. Participate in asset management, including financing.
### 3-6. Solutions for Achieving “+2°C Scenario” for Climate Change (2/3)

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Key Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2018-2020</strong></td>
<td>- Quick start distributed power-type GT&lt;br&gt;- Reaches full load in 5 minutes&lt;br&gt;- Reduces NOx emissions</td>
</tr>
<tr>
<td><strong>2020-2030</strong></td>
<td>- Next-Generation GT&lt;br&gt;- CC Efficiency 65%+&lt;br&gt;- Mixed-fuel combustion&lt;br&gt;- Development &amp; testing</td>
</tr>
<tr>
<td><strong>After 2030 (CY)</strong></td>
<td>- Next-Generation GT&lt;br&gt;- CC Efficiency 67%+&lt;br&gt;- Efficiency reaches 70% + when combined with SOFC&lt;br&gt;- Mono-fuel combustion plants&lt;br&gt;- Commercialization</td>
</tr>
</tbody>
</table>

- **CO₂ Zero**
- GT: Gas Turbine  CC: Combined Cycle
3-6. Solutions for Achieving “+2°C Scenario” for Climate Change (3/3)

2018-2020
- Promote AQCS

2020-2030
- Combine CCS & CCUS plants

After 2030 (CY)
- Ammonia mixed-fuel plant

- Commercialization
- More economical
- Triple Combined Cycle Integrated with SOFC

- Restart operation of light water reactor (in compliance with new regulations)

- Fusion Reactor

Credit © ITER Organization, http://www.iter.org/
1. Business Overview

2. 2018 Medium-Term Business Plan


4. Individual Business Strategies
   4-1. Mitsubishi Hitachi Power Systems
   4-2. Nuclear Energy Systems
   4-3. Mitsubishi Heavy Industries Compressor
   4-4. Mitsubishi Heavy Industries Aero Engines
   4-5. Mitsubishi Heavy Industries Marine Machinery & Equipment (MET Turbochargers)
   4-6. Mitsubishi Vestas Offshore Wind (Offshore Wind Turbine)

5. Power Systems – Mission Statement:
   “POWER & ENERGY SOLUTION PROVIDER”
4-1. Mitsubishi Hitachi Power Systems

Circumstances

• Market for new coal-fired power plants is shrinking due to sharp increase in environmental awareness and growing use of renewable energy
• Firm need for low environmental impact gas-fired power as a stable source of power supply

Challenges

• Adapt business structure to respond to changes in the circumstances (products, services, management systems and resources)

Solutions

• Promote and enhance functionality of clean energy products toward realizing a low-carbon/carbon-free society
• Provide solution services by utilizing the newest digital/software technologies
• Expand business sphere with effective utilization of technologies and resources
• Optimize management systems and resource allocation in line with expansion of business sphere and transition to new structure

Scale of market for new gas/coal power plants

<table>
<thead>
<tr>
<th>(GW)</th>
<th>150</th>
<th>100</th>
<th>50</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY15</td>
<td>150</td>
<td>110</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>FY16</td>
<td>100</td>
<td>100</td>
<td>50</td>
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<tr>
<td>FY17</td>
<td>50</td>
<td>80</td>
<td>40</td>
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<td>FY18</td>
<td>40</td>
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<td>FY19</td>
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<tr>
<td>FY20</td>
<td>20</td>
<td>50</td>
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<td>0</td>
</tr>
<tr>
<td>FY21</td>
<td>10</td>
<td>40</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>FY22</td>
<td>0</td>
<td>30</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>


Demand for gas-fired plants to increase after demand for coal-fired plants decreases

Orders & Net Sales

Scale of sales growing as orders are already in the pipeline

<table>
<thead>
<tr>
<th>(FY)</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orders received</td>
<td>20</td>
<td>22</td>
<td>24</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td>Net sales</td>
<td>15</td>
<td>18</td>
<td>20</td>
<td>22</td>
<td>25</td>
</tr>
</tbody>
</table>

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4-1. Mitsubishi Hitachi Power Systems

Respond to changes in the circumstances by expanding the business sphere and by adapting the new business structure.

**Software**
- Improve Operability
- Utilize MHPS-TOMONI
- Utilize AI
- Optimize O&M
- Upgrade Lower NOx emissions
- Increase Output

**Hardware**
- Continue to develop products with aim of achieving low-carbon/carbon-free society

**Power Generation Applications**

**Non-Power Generation Applications**
- Aircraft engine repair (Aircraft)
- Marine SOx Scrubber (Ship)
- Mechanical drive applications (Oil & Gas)

ESCO: Energy Service Company

**Value creation**
- ICT
- O&M
- Performance enhancement

**Supply side**
- Engineering
- Parts replacement
- Manufacturing
- EPC

**Demand side**
- Engineering
- O&M
- ICT
- Performance enhancement

ESCO: Energy Service Company
4-1. Mitsubishi Hitachi Power Systems  Digital Solution

Aim to Achieve Optimal Operations by 2030s

Optimize Operations Management based on Supply/Demand Estimates

Automated autonomous operation

Advanced O&M

O&M support

O&M monitoring

Optimization of overall efficiency (group management level)

Remote operation (labor saving, more reliable)

Longer intervals between inspections

- Early detection, automated warnings for malfunctions/anomalies and recovery measures
- Operating life extension measures, placing orders for spare parts

Performance improvement and optimization (equipment and plant levels)

Shorter schedule for regular inspections

Higher operating ratios and productivity improvement

Preventive maintenance, Short-term peak operation, Eco operation, Recommend replacement parts during regular maintenance, Lower minimum load, Increase rate of load change

Data gathering & evaluation (digitalization)

Time Axis

Current

2030s

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Transition from Product Manufacturing to Value Creation
Work Together with our Customers to Provide Solutions with Value for our Customers

ESCO
(Japan/Taiwan/Germany)

MHPS-TOMONI
(Japan/China/Philippines/Mexico)

GT-ESS
(U.S.A.)

Shorten inspection period (Japan)

Upgrade GT _ Lower NOx emissions (Japan)

Utilize AI
(Japan/Taiwan)

Optimize O&M
(Japan/Philippines)

Large-scale plant rehabilitation, output increase
(Saudi Arabia/Iraq/Egypt)
4-1. Mitsubishi Hitachi Power Systems
Nuclear Turbine, Generator, Reactor Pressure Vessel (1/2)

Major Product Technologies

- **PWR**
  - Steam Turbine, Heat Exchanger
- **BWR**
  - Generator
- **Plant Engineering**
  - Various Technologies
- **RPV**
  - World’s leading RPV Manufacturing Capacity

Japanese market

【Strengthen expansion of after-sales services】
- Support plant restarts
- Increase reliability (extend lifespan, improve performance)
  (20~22% power supply configuration by 2030)

Overseas market

【Approach regions seeing expansion in demand】
- Supply turbines to countries where demand is growing
  (China, India, etc.)
- Respond to rebuilding demand in developed countries

Leading-edge technology

**74 inch blade**

Performance results of leading systems

Performance and reliability verification technologies

**74 inch blade**

World’s largest High Speed Balance (HSB)

PWR: Pressurized Water Reactors  BWR: Boiling Water Reactors  RPV: Reactor Pressure Vessel  ST: Steam Turbine  Gen.: Generator
The company’s performance history and market trends *

*Energy, Electricity and Nuclear Power Estimates for the Period up to 2050, © IAEA, 2017
Regional classification based on M.49 UN area code system.

Nuclear Power Capacity Results and Forecast
Unit: GW(e) : CY2016(Results)

- North America: 116
- Central and South America: 10
- Central and South Asia: 207
- Eastern Europe: 103
- Western, Eastern, and Southern Europe: 50
- Northern, Western, and South Korea (China, Japan, South Korea, etc.): 34
- Japan: 40
- South Korea: 16
- China: 6
- Taiwan: 1
- Pakistan: 2
- Slovenia: 1
- Spain: 1
- USA: 1
- Mexico: 2
- Central and East Asia: 99
- South Asia: 8
- West Asia: 0.4
- Africa: 1.9

Nuclear Turbine, Generator, Reactor Pressure Vessel (2/2)

Extensive record of delivering systems to customers for over 40 years

RPV: Reactor Pressure Vessel  ST: Steam Turbine  Gen.: Generator

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4-1. Mitsubishi Hitachi Power Systems
Restructuring of Coal Power Systems Business

Promote structural shift to increase added value and to be ready for scale-down of coal-fired power systems business from 2021
Study the 2018 Medium-Term Business Plan to implement necessary initiatives

Efficiently complete projects / improve earnings

- Reduce fixed costs
- Improve business management efficiency
- Utilize digital technologies
  - Plant automation
  - Utilize AI to pass on technical skills
  - Digital marketing

Sales (Gas/Coal)

(Billion yen)

<table>
<thead>
<tr>
<th>Year</th>
<th>Gas-fired</th>
<th>Coal-fired</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>1,000</td>
<td>500</td>
</tr>
<tr>
<td>2018</td>
<td>1,000</td>
<td>500</td>
</tr>
<tr>
<td>2019</td>
<td>1,000</td>
<td>500</td>
</tr>
<tr>
<td>2020</td>
<td>1,000</td>
<td>500</td>
</tr>
<tr>
<td>After 2021</td>
<td>-30%</td>
<td>500</td>
</tr>
</tbody>
</table>

Expiration effort

Operating margin

(FY)

<table>
<thead>
<tr>
<th>Year</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018-2020</th>
<th>After 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>4%</td>
<td>8%</td>
<td>12%</td>
<td>16%</td>
<td>20%</td>
<td>24%</td>
</tr>
</tbody>
</table>

Worker reallocation

(number of people)

<table>
<thead>
<tr>
<th>Year</th>
<th>2018.4</th>
<th>2020</th>
<th>After 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>20,000</td>
<td>-30%</td>
<td>10,000</td>
</tr>
<tr>
<td>Overseas</td>
<td>10,000</td>
<td>-10%</td>
<td>5,000</td>
</tr>
</tbody>
</table>

- Reallocation resources to growth businesses
- Focus on gas-fired power, renewable energy, digital/solutions businesses

<table>
<thead>
<tr>
<th>Type</th>
<th>Change</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>Natural attrition + hiring restraint</td>
<td>-5%</td>
</tr>
<tr>
<td></td>
<td>Reallocation, job changes</td>
<td>-15%</td>
</tr>
<tr>
<td>Overseas</td>
<td>Company / works reorganization*</td>
<td>-10%</td>
</tr>
</tbody>
</table>

(* Mainly Boiler / Steam Turbine)
4-2. Nuclear Energy Systems (1/2)

### Circumstances
- **Domestic**: Positioned as key base load power supply
- **Overseas**: Nuclear power generation needs increasing, especially in emerging countries

### Challenges
- Seek for world's highest level of safety
- Strengthen product competitiveness (cooperation with French companies, etc.)
- Make steady progress of maintaining and enhancing skilled nuclear technology

### Solutions
- Promote initiatives for conforming to new domestic regulation
  - Support preparation on waiting nuclear power plants restarting and large-scale renewal projects
  - Support successful completion of construction of nuclear fuel cycle facilities
- Support stabilization of Fukushima Daiichi Nuclear Plants (development of remote-controlled robots, etc.)
- Strengthen risk management for overseas projects (Sinop project in Turkey)
- Strengthen alliances with Orano and Framatome by investment

<table>
<thead>
<tr>
<th>Net Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Graph" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales (FY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>Actual</td>
</tr>
<tr>
<td>2020</td>
<td>Plan</td>
</tr>
</tbody>
</table>

Responding to all processes in nuclear energy cycle

- Reprocessing plant (Rokkasho)
- MOX fuel plant
- Spent fuel Light water reactor plant
- Fuel plant
- Mitsubishi Nuclear Fuel Co., Ltd. (MNF) (MOX: Mixed Oxide)
4-2. Nuclear Energy Systems (2/2)

2018 Medium-Term Business Plan (FY2018-FY2020)

- Make steady progress of maintaining and enhancing skilled nuclear technology in preparation for coming carbon–free society
- Promote initiatives for conforming to new regulations (severe accident management facilities, etc.)
- Develop large-scale renewal projects
- Support successful completion of construction of nuclear fuel cycle facilities

Medium to Long Term Business Outlook (CY2021-2030s)

- Make efforts for new plants, including Sinop project in Turkey
- Prepare for removal of fuel debris from Fukushima Daiichi Nuclear Plant
- Contribute to intermediate storage facilities for spent fuel
- Commitment to decommissioning projects into full scale activities
- Promote R&D for fast reactor and fusion technology
- Promote strategic maintenance planning for 60 years operation (continual attention to safety, improve reliability)
- Deepen collaboration between Japan and France

Credit © ITER Organization, http://www.iter.org/
4-3. Mitsubishi Heavy Industries Compressor (Compressor)

Circumstances
- Moderate recovery in plant construction demand since late 2017 as oil price stabilized
- Intensified Competition among players in oligopolistic market

Challenges
- Strengthen the business base to survive global competition
- Strengthen service business offerings

Solutions
- Tie-up offering with MHPS gas turbine to expand sales of compressor trains in Oil & Gas market
- Strengthen cost competitiveness and shorten delivery times to maintain top share in petrochemical market
  - Optimize procurement process
  - Improve manufacturing process (casing: cast steel → steel plate)
- Expand service business
  - Strengthen service bases (US, Saudi Arabia, South Korea, Russia)
  - Strengthen IT, online services (remote monitoring)

Market scale of compressor business
- Orders received
- Net sales

Orders & Net sales
- Declining oil prices
- Recovery trajectory

Service New Units
4-4. Mitsubishi Heavy Industries Aero Engines (Aero Engines)

Circumstances
- Growing market sustained by robust aircraft demand
- Further growth of engine MRO market

Challenges
- Response to continuous production increase
- Expand business scope

Solutions
- Mobilize resources available in the business domain
- AI/IoT initiatives for smart factories and Advancing in SCM
- Expands capability/resources for MRO and part repairs (GTF engine MRO, repair technology development)
- Enhance contribution in development programs thru cooperation to customer value (P&W, RR)

Business scope (Net sales)

Smiling Curve of Aero Engines business

MRO: Maintenance, Repair & Overhaul   SCM: Supply Chain Management
P&W: Pratt & Whitney   RR: Rolls-Royce   GTF: Geared Turbo Fan

Photo courtesy of Japanese Aero Engines Corporation
4-5. Mitsubishi Heavy Industries Marine Machinery & Equipment (MET Turbochargers)

**Circumstances**

- New shipbuilding market recovering since bottoming in 2016
- Stable market growth continuing for stationary engine segment

**Challenges**

- Maintaining market share of products for marine engines
- Step up pace for making inroads to new areas (turbochargers for power generation and mechanical drive engine applications)

**Solutions**

- To maintain market share while new shipbuilding market recovers, introduce a successor model of the large air flow-type turbocharger for low-speed marine engines
- Develop and release new models for power generation and mechanical drive engine applications (low cost, high compression ratio)
- Optimizing turbocharger design with the aim of having customers adopt them as their standard specifications (area indicated by red dashed line in exhibit to the right)

**Market structure & Target**

- Marine Turbocharger (MET-MB)
- Turbochargers for power generation and mechanical drive engines (MET-SRC)

**MET Turbocharger (Net sales)**

- For power generation and mechanical drive engines
- For low-speed marine engines

MET: Mitsubishi Exhaust gas Turbocharger
4-6. MHI Vestas Offshore Wind (Offshore Wind Turbine)

Circumstances
• Growing renewable energy becomes a prominent resource of electricity
• European market continuing to grow, and US, Taiwan, and Japan markets are expected to be emerging (around 4～6GW/year)
• The second largest share of offshore wind turbine market (cumulative market share)

Challenges
• Respond to market growth and strengthen competitiveness
• Further improve economic performance
• Adjust for the variable renewable energy

Solutions
• Respond to market growth by strengthening mass-production systems
• Introduce the world’s largest turbine, output 9.5MW, to the market (install in 2019)
• Add on higher value by combining with flexible power sources (e.g. small GT)

Offshore Wind Turbine Market
(Survey by research institutes)

Net sales (MVOW)

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1. Business Overview
2. 2018 Medium-Term Business Plan
4. Individual Business Strategies
5. Power Systems – Mission Statement:
   “POWER & ENERGY SOLUTION PROVIDER”
Power Systems - Mission Statement: Toward Realizing a Sustainable Society

POWER & ENERGY SOLUTION PROVIDER
MOVE THE WORLD FORWARD

MITSUBISHI HEAVY INDUSTRIES GROUP