Power Systems Business Operation

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1. Major Product Action Items

Major Product Action Items

Capture growth opportunities through continuous R&D and production capability enhancement

<table>
<thead>
<tr>
<th>Year</th>
<th>Pilot plant</th>
<th>Commercial production verification</th>
<th>Commercial production</th>
<th>Lithium-ion batteries</th>
<th>New products</th>
</tr>
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<tbody>
<tr>
<td>2007</td>
<td>Establishing a 1,600 MW production capacity</td>
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<td>2008</td>
<td>Developing offshore wind turbines</td>
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<tr>
<td>2009</td>
<td>Expanding production capacity</td>
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<td>2010</td>
<td>Domestic demonstration plant</td>
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<td></td>
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<tr>
<td>2012</td>
<td>IGCC</td>
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</table>

- **GTCC**: Gas Turbine Combined Cycle
- **IGCC**: Integrated Coal Gasification Combined Cycle

Synergy of environment-related investments and economic recovery

Expand production capability for expanding demand of clean energy

Coal-utilization through gasification technologies

Expand market share by competitiveness on J-series gas turbines

Impact of economic stagnation

Impact of economic stagnation

Product breakdown (sales)

(2007=100)

New products, etc.

Renewable Energies

GTCC

Coal utilization

Lithium-ion batteries

New products

Wind turbines

Renewable energies

Pilot plant

Commercial production verification

Commercial production

2,600 MW production capacity

IGCC

Coal utilization
2. FY2008 Overview & Special Measures for FY2009

FY2008 Overview & Special Measures for FY2009

<table>
<thead>
<tr>
<th>FY2008 Overview</th>
<th>FY2009 Special Measures</th>
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</table>
| **Order Received:** | **Short term drop in the overall market / Early recovery in the energy/environment sector.**
| Decline under impact of economic crisis | ⇒ Continuous investment for rising demand in the future |
| (suspended/deferred projects, contract cancellation) | |
| **Sales/Profits:** | |
| Increases in both sales and profits (growth in plant construction, after-sale service operation) | **Securing sound financial status in the short term** |
| **Main Achievements:** | **(1) Improve cost competitiveness** |
| • Development completion of J-series gas turbines (largest capacity and highest-class efficiency) | • Strengthening of procurement capability (SCM optimization, etc.) |
| • 2,000 hours of continuous operation at Nakoso IGCC demonstration plant | • Low-price procurement through simplified or standardized specifications |
| • Continuous growth in wind turbine business | • Tight budget controls for existing project |

SCM: Supply Chain Management
3. Product Portfolio

MHI Power Systems Product Portfolio

- **Renewable Energy**
  - Wind turbines
  - Capture opportunities of replacement of existing turbine
  - Entry into Chinese market through collaboration with Harbin Power Equipment
  - Concentrate into growth markets (India)
  - Increase production capability to 50-units/year in 2012 to meet possible demand soar after economic recovery

- **Smart Grid**
  - Solar-PV
  - Rechargeable batteries
  - GTCC
  - Start verification of commercial production
  - Accelerate commercialization through demonstrated reliability and improved efficiency
  - Realize new market by utilizing low-grade coal

- **Coal Utilization**
  - High-efficiency in thermal power generation
  - Expansion into natural gas and coalmine methane gas markets

- **Nuclear energy**
  - Nuclear Power Plant
  - Development of 70-inch class blade
  - Capture opportunities of replacement of existing turbine
  - Entry into Chinese market through collaboration with Harbin Power Equipment

- **Green New Deal**

- **Global warming**

- **Energy security**

Smart Grid: An advanced grid systems that boosts efficiency in energy usage and facilitates systematic linking renewable energy systems
Global GTCC Operations

Worldwide orders to date: 535 Units

Brisk sales of gas turbines in 1400-1500°C class, Rising presence within large scale gas turbine industry

USA: M501F began operation in 2008 at Xcel Energy High Bridge

Russia: Order from TGK-8 for M701F

Spain: Order from ENDESA for M701F (2 units)

Europe: M501G1 began operation in 2008 at ENMAX

Turkey: Order from ENERJISA for M701F (2 units)

Qatar: Order from RGPC for M701F (8 units)

Korea: Order from POSCO for M501S (2 units)

Indonesia: Order from PLN for M701F (3 units)

Singapore: Order from Senoco Power for M701F (2 units)

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009

Gas turbine deliveries completed (to date, 2009)

Order placements are firm due to chronic power shortages.

Expansion in natural gas-fired power generation is promising thanks to continuing discoveries of natural gas fields.

Demand is robust for high-efficiency GTCC as a measure against global warming.

Replacement demand exists for aged thermal power plants

The gas turbine market is growing along with expansion in infrastructure improvement.

USA: M501F began operation in 2008 at Xcel Energy High Bridge

Chile: M701F began operation in 2008 at San Isidro II

Order placements are firm due to chronic power shortages.

Winner of 2008 “Best Gas-Fired Project” award from “Power Engineering Magazine” for achieving world’s highest level of power generation efficiency

Deliveries has been steadily completed. Expansion of maintenance business = Stable profit growth

4. Operational Initiatives by Product
## Action to Expand Share in GTCC Market (1)

Expand market share through launch of J-series (1600°C) gas turbines

<table>
<thead>
<tr>
<th>National Project</th>
<th>1700°C CC</th>
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<tbody>
<tr>
<td><strong>J-series</strong></td>
<td></td>
</tr>
<tr>
<td>M701J CC</td>
<td>670</td>
</tr>
<tr>
<td>M501J CC</td>
<td>460</td>
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<tr>
<td><strong>G-series</strong></td>
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<tr>
<td>M701G CC</td>
<td>498</td>
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<tr>
<td>M501G CC</td>
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<tr>
<td><strong>F-series</strong></td>
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<td>M701F CC</td>
<td>465</td>
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<tr>
<td>M501F CC</td>
<td>285</td>
</tr>
<tr>
<td><strong>D-series</strong></td>
<td></td>
</tr>
<tr>
<td>M701DA CC</td>
<td>213</td>
</tr>
<tr>
<td>M501DA CC</td>
<td>167</td>
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</table>

- CC efficiency: well above 60% (world’s highest level)

- 50% reduction in CO2 emissions compared with conventional coal-fired generation manufactured by MHI

### Kepco decided to apply M501J (6 units)

- at Himeji Power Station No.2:
- First unit scheduled to begin operation in October 2013

- Contributing to prevention of global warming with high-efficiency gas turbines made in Japan

CC output/efficiency: power generation output/efficiency as combined cycle incorporating generation by steam turbine
4. Operational Initiatives by Product

Action to Expand Share in GTCC Market (2)

Strategies to achieve 30% global market share

Worldwide gas turbine order placements
2008: 70 GW

Large-scale units: approx. 50%

- Enhancement of production capacities at domestic factories
- Consideration to establish overseas production base
- Launch of J-series gas turbines

Volume of large-scale gas turbine orders

- MHI
- Others

Gas turbine annual production capacity: 24 units
30 units (2007~)
36 units (2009~)
50 Units (2012~)

Increase in production capacity

Action to Expand Share in GTCC Market (2)

- Fuel diversification
- Small and medium-scale gas turbines

Achieving 30% plus global share for total market

30% share of large-scale gas turbine market = more than 20% share of global market
Clean Coal Technology

IGCC

- The IGCC demonstration plant delivered to Clean Coal Power R&D Co. (CCP) has achieved 2,000 hours of continuous operation.
- In recognition of that achievement, CCP received Prime Minister’s Award of the 38th Japan Industrial Technology Grand Prize.
- Target on higher efficiency, verification of higher reliability

Verification of higher reliability

Higher efficiency

15% reduction in CO2 emissions compared with conventional coal-fired plant manufactured by MHI
Clean Coal Technology

Superiority of IGCC with low-grade coal

Known reserves of high- and low-grade coal are nearly equal. Today, high-grade coal holds a majority of coal production. Cheap low-grade coal to be utilized more from now on.

Worldwide coal reserves
847.5 bn tons

Low-grade 49% (subbituminous, lignite)
High-grade 51% (anthracite, bituminous)

USA
Russia
China
India
South Africa
Australia
Europe
Indonesia
Others

Conventional coal-fired
Gasification furnace

High-grade
Low-grade

The lower the grade, the greater the volume

Base: 1

Nearly equal volume even with low-grade coal

2.4X

1.06X

In future, we will develop competitive IGCC independent of coal grade.

Worldwide coal production

(100 mil ton/year)

Low-grade accounts for about ¼ of total production

Source: WEC Survey of Energy Resources 2007
Wind Turbine Business (Global)

- Market expanding rapidly
  - (2008 = 28GW, JPY5 trn / +3.4-fold in past 5 yrs)
- Despite impact from financial crisis, firm expansion expected in medium/long term

Global market

New wind turbine installations

Penascal wind farm in Texas began operation in May 2009, MWT92/2.4 x 84 units: 201.6MW
4. Operational Initiatives by Product

**Wind Turbine Business (USA)**

- New installations in 2008: 8.4GW (near 1/3 of global), 6,000 units
  Cumulative installations: 25GW, 30,000 units (equivalent to 1.3% of power demand)

- Obama Administration pushing “Green New Deal.” US Dept. of Energy (DOE) has announced “20% Wind Energy by 2030”
  This plan said wind power is to meet 20% of total US demand by 2030. (Equivalent to 15GW/yr, total: 305GW)

- Production tax credit (PTC): $ 2/kWh tax credit on wind power generation, effective through 2012.

- Nacelle factory in US under consideration to prepare for further expansion of US market.

**MW Installed by State**

- Wyoming
  - 110MW
  - 150 units
- Colorado
  - 221MW
  - 221 units
- Oregon
  - 93MW
  - 125 units
- California
  - 430MW
  - 981 units
- Hawaii
  - 9MW
  - 37 units
- Arizona
  - 15MW
  - 15 units
- New Mexico
  - 290MW
  - 290 units
- Texas
  - 1046(+550)MW
  - 928(+344) units
- May 2009
  - () = under construction

**Total US installations:**
- 2,214 MW, 2,747 units

**“20% Wind Energy by 2030” by DOE**

- Annual and cumulative wind installations by 2030

**MHI wind turbine installations**

- Total US installations: 2,214 MW, 2,747 units

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Offshore Wind Turbines

• Large-scale offshore projects are started in Europe: 33MW in UK, 30MW in Germany, etc.
• Offshore offers favorable wind conditions, higher capacity factor than land installations.
• Super-large-scale turbines well-enjoy scale merit in offshore applications.

• MHI is sole manufacturer with wind turbines and ships/marine equipment capability.
• A design office has been set up in Europe for developing 5MW class offshore wind turbines.
• In Japan, participating in NEDO offshore wind turbine demonstration project.
Lithium-ion Batteries

- MHI recognized lithium-ion batteries as key components of MHI’s business.
- Verification of commercial production line for future commercialization based on technology accumulated through grid connection in wind power generation
- Start application in hybrid forklifts.

4. Operational Initiatives by Product

Industrial vehicles

Hybrid construction machinery

Battery forklifts

Lithium-ion rechargeable battery

Grid connected storage systems for energy supply stabilization

Smart grid, Power storage

Residential/business use

Automotive industry

Electric vehicles

Plug -in HEV

Eco-house

UPS

MHI affiliate products (including Group companies)
In 2009, a market has been slowdown in Europe under the impact of the economic crisis. However global market growth is projected as grid parity* is realized in near future.

**Strength domestic sales due to significant expansion of subsidy system**
- Public sector industrial use
- Schools (37,000)
- Mega-solar planned by power companies

**Strengthening of cost competitiveness**
- Accelerated cost reductions toward achievement of grid parity

*Grid parity: Generation of electricity at cost equivalent to that of grid power generation*
4. Operational Initiatives by Product

MPS: Enhancing Global Business Structure with Three Business Bases (MPSs)

- MPS
- Engineering
- Manufacturing
- Services

MPS: Mitsubishi Power Systems

Red: changes from 2008
Dotted Lines: Projects under consideration

JV: Joint Venture, BTG: Boiler/Turbine/Generator

[Diagram of MPS business bases with various partners and subsidiaries, including:
- Dongfang Gas Turbine (Partner/Turbine manufacturing)
- Wartsilla (Partner/DG licensing)
- TianLing Energy Technology (JV/Engineering)
- Nanjing Services (Subsidiary/GT Services)
- Harbin (Partner/Turbine and boiler manufacturing)
- Shenyang Pump Engineering (JV/Pump manufacturing)
- Doosan Heavy Industries & Construction (Partner/Turbine manufacturing)
- Vien Tek (JV/Wind turbine manufacturing)
- Cormetec (JV/Denitration equipment manufacturing)
- MHI Dongfang Gas Turbines (JV/GT services)
- MHI
- Hangzhou Steam Turbine (Partner/Turbine manufacturing)
- MPSE (Subsidiary/GT Services)
- MPSS (Subsidiary/GT Services)
- INITEC (Partner/Engineering)
- E Center in India (Subsidiary/Engineering)
- P.T.POSSI (JV/GT Services)
- MPSAP (Subsidiary/Engineering)
- MTS (Partner/Engineering)
- CTCI (Partner/Engineering)
- OSC (Subsidiary/GT Service base)
- CBC (Subsidiary/Boiler manufacturing)
- MPSE territory
- MPSAP territory
- MPSA territory]
4. Operational Initiatives by Product

Global Service Operations

Network shift from Japan to local bases (joint operation with local management)

- **Americas region:** Enhancement of MPSA service functions
- **Europe/Middle East region:** Expansion of MPSE service network (acquisition of maintenance partners)
- **Asia region:** Strengthening of Japanese network and local bases

**Acquisition of Maintenance Partners NV in Belgium**

- **Zwijndrecht Plant**
  - Headquarters: Antwerp, Belgium
  - Sales: Approx. JPY 6.7 billion (FY2008)
  - Employees: 317 (field service staff: 100)

**Establishment of global network**

**M701F Users Conference**

- Participating plants: 19
- Participating users: 37
4. Operational Initiatives by Product

Business Development into Growing Markets (India)

Growth of India thermal power generation market

Establishment of India JVs & their activities

- In 2007, two JVs, as shown below, were established in India, that supply high-efficiency boiler sand turbines to the local market, so that they will contribute to India economic development and environmental improvement.
- In 2008, the turbine JV received an order from Krishnapatnam for two 800MW units.
- In future, GTCC equipment might be supplied from the JVs.

L&T-MHI Turbine Generators Private Ltd. (JV)

- Large-size steam turbine
- Turbine factory construction in progress
- Start operation in 2010

L&T-MHI Boilers Private Ltd. (JV)

- Large-size coal-fired boiler
- Boiler factory construction in progress
- Start operation in 2010

Map showing countries like India, Bangladesh, Sri Lanka, Indonesia, China, Bhutan, Myanmar.
4. Operational Initiatives by Product

Gas Engines

Business Expansion in the gas engine growing markets:
Wind Turbine Back-up, Coalmine Methane, Heat Pump + Co-generation, etc

Heat pump+co-generation
(Russia, Ukraine)

To prevent global warming higher efficiency is being achieved by combining the waste heat from gas co-generation and a heat pump.

Wind power generation back-up power supply
(North America)

Sales of quick-start gas engines (100% load within 5 min) are to be expanded (400MW/yr) for around 50MW distributed allocation.

Coalmine methane (China)

Use of coalmine methane became mandated starting from 2007 (11th 5-year plan).
Sales expansion will be carried out using the NEDO model plant in Liaoning Province (commercial operation in October 2009) as a PR base.

130 bil m³ (Equivalent to 200 mil tons CO₂)

MACH Gas Engines
(Equivalent to 6.5GW)

Rapid increase in wind power

System instability

Thermal Power Generation
4. Operational Initiatives by Product

Nuclear Turbine Initiative

New nuclear turbine rotor shop at Takasago Works
(Start operation in August 2009)

Development of 70-inch class last blades for large-scale nuclear power plants

Potential Market:
• Steam turbine and its auxiliaries for new plant construction projects in North America, Europe and etc.
• Rotor replacement for existing nuclear plants.

Action for new plant construction in China

Pursue new plant construction in collaboration with Harbin Power Equipment

Collaboration on Sanmen unit 1/2 and Haiyang unit 1/2 nuclear power plant construction projects (total: 4 units)

• Harbin Power Equipment: Production of non-rotating portion of turbine/generator system’s main equipment
• MHI: turbine blades and rotors