Strategies for the Energy & Environment Business

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Executive Vice President
Energy & Environment Business

MITSUBISHI HEAVY INDUSTRIES, LTD.
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5. Summary
We humbly extend our heartfelt sympathies to all those affected by the Great East Japan Earthquake, and offer warm wishes for the swift recovery of the affected areas.

For its part, MHI intends to make a concerted effort to support earthquake disaster reconstruction.
1. The Role of the Sustainability Energy & Environment Strategic Planning Department
# The Role of the Sustainability Energy & Environment Strategic Planning Department

## Leading Role at MHI in Energy & Environment Business Development

- Formulates Medium-to-Long-Term Development Policies
- Makes Recommendations to Governmental and Industrial Circles
- Promotes the Creation of Business Opportunities on a Company-wide Basis

## Leading Role at MHI in Earthquake Disaster Reconstruction Support

- Support Related to the Fukushima Nuclear Power Plant
- Waste Disposal
- New Town Development
2. Initiatives for Earthquake Disaster Reconstruction
# Overview of the Great East Japan Earthquake
(Comparison with the Great Hanshin-Awaji Earthquake)

<table>
<thead>
<tr>
<th></th>
<th>Great Hanshin-Awaji Earthquake</th>
<th>Great East Japan Earthquake (data released as of May 10, 2011)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date and Time of Occurrence</strong></td>
<td>January 17, 1995 at 5:45:52 a.m.</td>
<td>March 11, 2011 at 2:46 p.m.</td>
</tr>
<tr>
<td><strong>Earthquake Type</strong></td>
<td>Inland Epicentral Earthquake (M7.2)</td>
<td>Offshore Epicentral Earthquake (M9.0)</td>
</tr>
<tr>
<td><strong>Damages</strong></td>
<td>Damage due to the collapse of buildings Damage due to fires</td>
<td>Damage due to the collapse of buildings Damage due to tsunami Damage due to incident at the Fukushima Daiichi Nuclear Power Plant</td>
</tr>
<tr>
<td><strong>Regions where Damage Occurred</strong></td>
<td>Region centered around Southeast Hyogo (Awaji/Hanshin districts)</td>
<td>Damage in Tokyo and nine prefectures including Iwate, Miyagi and Fukushima prefectures</td>
</tr>
<tr>
<td><strong>Casualties</strong></td>
<td>Deaths 6,434 people</td>
<td>14,786 people</td>
</tr>
<tr>
<td></td>
<td>Missing Persons 3 people</td>
<td>9,982 people</td>
</tr>
<tr>
<td></td>
<td>Injured 43,792 people</td>
<td>8,402 people</td>
</tr>
<tr>
<td><strong>Evacuees (Maximum)</strong></td>
<td>At least 300,000 people</td>
<td>At least 450,000 people</td>
</tr>
<tr>
<td><strong>Housing Damage</strong></td>
<td>Completely Destroyed 104,906 homes</td>
<td>83,586 homes</td>
</tr>
<tr>
<td></td>
<td>Partially Destroyed 144,274 homes</td>
<td>31,747 homes</td>
</tr>
<tr>
<td></td>
<td>Partially Damaged 390,506 homes</td>
<td>273,114 homes</td>
</tr>
<tr>
<td><strong>Fire Damage</strong></td>
<td>7,483 homes</td>
<td>265 cases</td>
</tr>
<tr>
<td><strong>Other Damage</strong></td>
<td>Roads 10,069 locations</td>
<td>2,126 locations</td>
</tr>
<tr>
<td></td>
<td>Bridges 320 locations</td>
<td>56 locations</td>
</tr>
<tr>
<td></td>
<td>Rivers 430 locations</td>
<td>4 locations</td>
</tr>
<tr>
<td></td>
<td>Landslides 378 locations</td>
<td>136 locations</td>
</tr>
<tr>
<td><strong>Amount of Rubble Produced</strong></td>
<td>Approx. 20 million tons</td>
<td>Approx. 24.9 million tons (Estimate for three prefectures of Iwate, Miyagi and Fukushima)</td>
</tr>
<tr>
<td><strong>Power Outages</strong></td>
<td>2.6 million cases</td>
<td>8.45 million households</td>
</tr>
<tr>
<td><strong>Total Amount of Damage</strong></td>
<td>Approx. 10 trillion yen</td>
<td>Approx. 25 trillion yen or more</td>
</tr>
</tbody>
</table>

Sources: Produced based on information from the Ministry of the Environment, Fire and Disaster Management Agency, National Police Agency, Wikipedia, etc.
MHI Response Status on Emergency and Temporary Measures

1) Restoration of damaged power plants
2) Support for the Fukushima Daiichi Nuclear Power Plant
3) Removal of rubble (shielded forklift trucks, mobile radiation shielded control rooms, etc.)
4) Other measures ("Mega-Float", etc.)

- Use of MHI-owned aircraft to transport medical supplies
- Transportation of emergency supplies via MHI helicopter
- Mobile radiation shielded control rooms
- Modification of “Mega-Float”
- Free loan of MHI-owned electric vehicles to electric power companies
- Large, special forklift trucks with shielded cabin
### Direction and Challenges in the Reconstruction Process Ahead

Apart from reconstruction of the disaster-affected areas, it is necessary to clarify energy problems and action plans for non-affected areas.

<table>
<thead>
<tr>
<th>Item</th>
<th>Direction of Response</th>
<th>Envisaged Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Problems</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response to power shortages as an immediate problem</td>
<td>Full load operation of conventional power generation.</td>
<td>● Securing power in the disaster-affected areas</td>
</tr>
<tr>
<td></td>
<td>Introduction of privately-owned power generating equipment</td>
<td>● Higher consumer-side costs due to increased demand for fossil fuels and the operation of in-house power generation</td>
</tr>
<tr>
<td></td>
<td>Responding to government calls to conserve electricity</td>
<td>● Increased costs for business operators due to the adoption of conventional power generating equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Sluggish business activity due to energy-saving measures</td>
</tr>
<tr>
<td>Review of long-term energy plans</td>
<td>Maintenance and promotion of nuclear power after a review of safety standards</td>
<td>● Rising unit price of power generation in the long term (The unit cost of generating power through conventional power generation and renewable energy is higher)</td>
</tr>
<tr>
<td></td>
<td>Higher percentage of conventional power generation</td>
<td>● Overconfidence in renewable energy (Photovoltaic power, wind power, etc. are more difficult to establish than major sources of electricity)</td>
</tr>
<tr>
<td></td>
<td>Adoption of renewable energy</td>
<td>● Increased CO₂ emissions</td>
</tr>
<tr>
<td><strong>Direction of Reconstruction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reconstructio n efforts in the disaster-affected areas</td>
<td>Restoration to former state</td>
<td>● Possibility of recurrence of disaster</td>
</tr>
<tr>
<td></td>
<td>Reconstruction with the provision of measures to prevent disaster recurrence</td>
<td>● Likelihood that residents, industries, etc. will not return to normal even if infrastructure is restored to its former state</td>
</tr>
<tr>
<td></td>
<td>Reconstruction with the provision of other added value</td>
<td>● What degree of investment costs for disaster prevention measures or added value are expected?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Is reconstruction being carried out in a manner consistent with the characteristics of the region?</td>
</tr>
<tr>
<td>Response for non-affected areas</td>
<td>Town revitalization with disaster prevention functions</td>
<td>● What degree of investment costs for disaster prevention measures or added value are expected?</td>
</tr>
<tr>
<td></td>
<td>Town revitalization accounting for diversification of dispersed power sources and communications, etc.</td>
<td>● Is reconstruction being carried out in a manner consistent with the characteristics of the region?</td>
</tr>
<tr>
<td></td>
<td>Town revitalization with the provision of other added value</td>
<td>● Burden of costs and recovery methods associated with response in non-affected areas.</td>
</tr>
</tbody>
</table>
2. Initiatives for Earthquake Disaster Reconstruction

Community Concept for Reconstruction

Concept of Smart Community from an Energy Perspective

Realization of a Low-carbon Society

- Coordinate with the existing energy infrastructure and implement energy management that accommodates the adoption of renewable energy on the consumer side and the utilization of unused energy.
- Promote and improve convenience of low-carbon transportation system, such as through the electrification of transportation and a modal shift from cars to public transportation.

Concept of community for disaster recovery utilizing Smart Community System

Robust
Integrated energy management that combines the existing energy infrastructure with dispersed power and DSM*.

Reliable
Traffic system that provides road information and gives priority to emergency vehicles even during an emergency.

Secure
Management to secure and supply the necessary energy even during an emergency.

Mitsubishi Heavy Industries, Ltd. owns all intellectual property rights concerning these materials.
### Features of the Reconstruction Project

- Variety of reconstruction plans based on regional characteristics
- Use of a wide variety of technologies
- Management of phased construction spanning long periods
- Coordination with many stakeholders
- Creation and management of requirement specifications
- Assurance of performance in terms of budget, work schedule and overall

### The key to success of the Reconstruction Project

Human resources and organizations equipped with project management & system integration techniques are essential

### MHI’s Strengths

- "Mitsubishi Heavy Industries, Ltd. owns all intellectual property rights concerning these materials."

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<table>
<thead>
<tr>
<th>Region</th>
<th>Regional Characteristics</th>
<th>Combinations of Renewable Energy Applied (Energy Efficiency Optimization)</th>
<th>Other Technologies Applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region A</td>
<td>Fishing</td>
<td>Wind</td>
<td>✓</td>
</tr>
<tr>
<td>Region B</td>
<td>Agriculture</td>
<td>Water</td>
<td>✓</td>
</tr>
<tr>
<td>Region C</td>
<td>Forestry</td>
<td>Biomass</td>
<td>✓</td>
</tr>
<tr>
<td>Region D</td>
<td>Tourism</td>
<td>Geothermal</td>
<td>✓</td>
</tr>
<tr>
<td>Region X</td>
<td>Industrial</td>
<td>Exhaust Heat</td>
<td>✓</td>
</tr>
</tbody>
</table>

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### Conceptual Image of Communities that Make Use of Regional Characteristics

- Wind Power Generation
  - Coastal Aomori Prefecture: Good location for excellent wind conditions
- Geothermal Power Generation
  - Vicinity of the Oonuma mountain range: Developable area with geothermal heat sources above a certain size
- Hydroelectric Power Generation
  - Vicinity of Iwaki-shi, Fukushima Prefecture, Iwate Prefecture and coastal areas of Miyagi Prefecture: The highest river basin in Tohoku region
- Photovoltaic Power Generation
  - Vicinity of Swabi-ku, Fukuoka Prefecture: Yearly average: 4.0 ~ 4.2 kwh/m²/d

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### Major Industry Abundant Energy Potential

- Fishing
- Agriculture
- Forestry
- Tourism
- Industrial

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### Combinations of Renewable Energy Applied

- Wind
- Geothermal
- Hydropower
- Solar

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### Uses

- Hot/Cold Heat Supply System
- Electrical Storage Device

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### Other Technologies Applied

- Electrical Storage Device
- Hot/Cold Heat Supply System

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### Yearly average: 4.0 ~ 4.2 kwh/m²/d (NEDO figures for annual slope exposure based on field tests)
Community facilities use a transportation system to connect the flat and coastal areas which are the site of activity during the day with higher ground that serves as a residential area and equipped to function (tsunami protection measure, self-sustaining power generation such as solar/wind power generation) as evacuation centers during an emergency.
3. Initiatives for the Energy & Environment Business
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MHI Initiatives for the Energy & Environment Business

Market Environment
- Review of government energy policies due to the earthquake
  (Nuclear power is needed, after utilizing the lessons learned from the earthquake and reviewing safety standards)
- In the medium-to-long term, the global tide of “transition to a low-carbon society” remains unchanged.

The Four Key Technological Fields for the Energy & Environment Business

- Carbon-free Energy
- Transportation and Logistics Systems
- High-efficiency power generation
- Energy Management

MHI’s Role
The provision of solutions that address the needs of the market with a wide array of product technologies and the integration capability.
3. Initiatives for the Energy & Environment Business

Key Technologies and System Integration

- Integrate key technologies that straddle multiple divisions and provide total solutions in the Energy & Environment Business.
- Contribute to safe, secure and comfortable community development.

**Resources**
- Low-carbon environment
- Renewable Energy
- Nuclear Energy
- Fossil Energy
- Direction of ideal society

**Energy Supply**
- Carbon-Free Energy
  - Wind Power
  - Concentrated Solar Power Generation
  - Nuclear Power Generation
  - Geothermal Power Generation
- High-efficiency Power Generation
  - GTCC: Gas Turbine Combined Cycle
  - IGCC: Integrated Coal Gasification Combined Cycle
  - Gas Engines
  - USC: Ultra Super Critical

**Energy Consumption**
- Transportation and Logistics Systems
  - MRJ: Mitsubishi Regional Jet
  - ITS: Intelligent Transport System
  - Eco Ships
  - ITS
- Energy Management
  - Electric Buses
  - Lithium Ion Batteries
  - Heat Pumps

**Total Solution**

**Key Technologies and System Integration**

- GTCC: Gas Turbine Combined Cycle
- IGCC: Integrated Coal Gasification Combined Cycle
- MRJ: Mitsubishi Regional Jet
- ITS: Intelligent Transport System
- HEMS: Home Energy Management System
- BEMS: Building Energy Management System

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### State of Progress for Each Project

<table>
<thead>
<tr>
<th>Project</th>
<th>Country</th>
<th>State of Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Smart Community</strong></td>
<td>India</td>
<td>Pre-feasibility study regarding development of the Changodar-Sanand district of Gujarat State, India completed. MHI has proposed the promotion electrification of the transportation infrastructure and the adoption of renewable energies in line with improvements to power generating facilities and the stage of economic development. In January 2011, a memorandum of understanding (MOU) regarding urban development was concluded between the state government and the Delhi-Mumbai Industrial Corridor (DMIC) development consortium. A feasibility study is scheduled to be conducted by March 2012.</td>
</tr>
<tr>
<td>China</td>
<td>Joined the Eco-city concept as a Project member. Proposing an electric and thermal energy management business in the region.</td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>Agreement reached to conduct demonstrations of an EV management center, power management, information system management, etc. in Malaga, Andalusia. A feasibility study will be completed by July 2011, with the demonstration project scheduled to be conducted by March 2016.</td>
<td></td>
</tr>
<tr>
<td>Keihanna Area</td>
<td>In addition to demonstrations of demand-side energy management, demonstrations of regional energy management including EVs and lifestyle-oriented aspects will be conducted by March 2015 at KEIHANNA, Kansai Science City in Kyoto Prefecture.</td>
<td></td>
</tr>
<tr>
<td><strong>Lithium Ion Battery Business</strong></td>
<td>Japan</td>
<td>Construction of the Nagasaki Plant finished in November 2010 ahead of a full-scale entry into the field. In February 2011 in Kyoto and March 2011 in Aomori, trial operations of electric buses carrying regular passengers were conducted.</td>
</tr>
<tr>
<td>Canada</td>
<td>In December 2010, MHI signed an MOU with the Manitoba Provincial Government concerning the expanded use of renewable energy and the development of related technologies. A three-year electric bus development and demonstration project commenced in May 2011.</td>
<td></td>
</tr>
<tr>
<td><strong>Concentrated Solar Power Generation</strong></td>
<td>Australia</td>
<td>Aiming for the early development and market launch of dry-type solar thermal power generation utilizing MHI’s gas turbine technologies, and the deployment of this type of power generation in desert regions. Experiments on heat receivers in conjunction with Australia’s CSIRO are currently under way.</td>
</tr>
<tr>
<td>Overseas Nuclear Power Plants</td>
<td>U.S., Southeast Asia, Middle East, Europe</td>
<td>There have been concerns over the impact of earthquakes, but MHI is continuing to provide support for locations in the U.S., Europe, Vietnam and Jordan.</td>
</tr>
<tr>
<td><strong>IGCC High-Efficiency GT</strong></td>
<td>Australia, U.S., China, Japan</td>
<td>Working on IGCC projects in Australia and China. Succeeded in the demonstrated operation of gas turbines with the world’s highest inlet temperature of 1,600°C. Attained 60% efficiency, a world high.</td>
</tr>
<tr>
<td><strong>Geothermal and Hydroelectric Power Generation</strong></td>
<td>Africa, Turkey</td>
<td>Working in conjunction with Iceland-based Reykjavik Energy on the development of geothermal power generation in Africa. Proposing a feasibility study for a electric power stability system that combines wind power generation with pumped-storage generation in Turkey.</td>
</tr>
</tbody>
</table>

DMIC: Delhi Mumbai Industrial Corridor  
IGCC: Integrated Coal Gasification Combined Cycle
3. Initiatives for the Energy & Environment Business

**Concepts for Smart-Adoption**

- Smart concepts are also applied to other public services, and being further developed.

<table>
<thead>
<tr>
<th>Input from End Points</th>
<th>Electric Power</th>
<th>Gas</th>
<th>Heat Supply</th>
<th>Water</th>
<th>Road Traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse power flow through photovoltaic power generation and Ene-farm</td>
<td>Injection of methane gas into city gas lines</td>
<td>Use of sludge carbides for fuel</td>
<td>Introduction of reclaimed water</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response to Load Fluctuations</th>
<th>Electric Power</th>
<th>Gas</th>
<th>Heat Supply</th>
<th>Water</th>
<th>Road Traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adoption of storage batteries, EVs Demand Management</td>
<td>Adjustment of hot-water supply times and hot-water storage</td>
<td>Adoption of high-efficiency heat sources on a small-to-medium scale, heat storage tanks</td>
<td>Tracking of changes in water treatment levels</td>
<td>Overall optimization of navigation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dynamic Control</th>
<th>Electric Power</th>
<th>Gas</th>
<th>Heat Supply</th>
<th>Water</th>
<th>Road Traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line duplexing and Distribution automation</td>
<td>-</td>
<td>-</td>
<td>Pipeline control</td>
<td>Autonomous distributed traffic signals</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>End-point Measurement Tools</th>
<th>Electric Power</th>
<th>Gas</th>
<th>Heat Supply</th>
<th>Water</th>
<th>Road Traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Metering</td>
<td>Smart Metering</td>
<td>Smart Metering</td>
<td>Smart Metering</td>
<td>Smart Metering</td>
<td>Probe information through in-car device</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inducing Consumers (Incentives)</th>
<th>Electric Power</th>
<th>Gas</th>
<th>Heat Supply</th>
<th>Water</th>
<th>Road Traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Pricing</td>
<td>Dynamic Pricing</td>
<td>Dynamic Pricing</td>
<td>Dynamic Pricing</td>
<td>Dynamic Pricing</td>
<td>ERP Automated Road Pricing System</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Payment and Billing Management</th>
<th>Electric Power</th>
<th>Gas</th>
<th>Heat Supply</th>
<th>Water</th>
<th>Road Traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common points, unified billing</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**MHI’s Strengths:** Not only various product technologies, but MHI also uses project management and system integration technologies to provide total solutions.
3. Initiatives for the Energy & Environment Business

**Major Smart Community Projects**

By the year 2020, between 300 and 400 projects worldwide worth 180 trillion yen will be planned or under way.

- **Major Asian Projects (excluding Japan)**
  - Delhi-Mumbai Smart Community (India / Gujarat, Maharashtra, Haryana)
  - Japan-China Lecheng Project (Hainan Island, China)
  - Eco-City (around Beijing)
  - Caofeidian International Eco-City (Tangshan City, China)
  - U-City Project (Inchon, South Korea)
  - Cheju Smart Grid Test Bed (Cheju, South Korea)

- **Major European Projects**
  - Iceland Zero CO2-emission Society (Throughout Iceland)
  - Amsterdam Smart City (Netherlands)
  - Telegestore Project (Throughout Italy)
  - Smart Grid Utility (Malta)
  - ENDESA / EV Infrastructure Building Project (Madrid and elsewhere in Spain)
  - Teza Tech Mediterranean Wide-area Project (Europe, Middle East, South Africa)

- **Major Middle Eastern Projects**
  - Masdar City (UAE)

- **Major U.S. Projects**
  - PG&E Smart Grid Demonstration Project (California)
  - Smart Grid City (Boulder, Colorado)
  - Con Edison Smart Grid Demonstration Project (New York State)
  - Pecan Street Project (Houston, Texas)
  - Energy Smart Miami (Miami, Florida)
  - Japan-US Smart Grid Joint Experiment (Albuquerque, New Mexico)
  - PG&E Smart Grid Demonstration Project (California)

- **Major Japanese Projects**
  - Next Generation Energy Social System Test Area (Kita-kyushu)
  - Next Generation Energy Social System Test Areas (Kyoto, Osaka, Nara Prefecture)
  - Green Crossover Project (Tsukuba, Ibaraki Prefecture)
  - Next Generation Energy Social System Test Area (Yokohama)

Source: Nikkei Ecology

Red Boxes: MRI presiding over implementation
Blue Boxes: MRI partially involved

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3. Initiatives for the Energy & Environment Business

**Smart Community Initiatives**

- Demand-side Management System
- Clean Water
- District Heating and Cooling
- Electric Power
- Storage battery monitoring
- Power feeding management
- EV Management Center
- Surface Transportation
- Quick Charger
- Renewable Energy
- Local Power Storage
- V2G: Vehicle to Grid

**Major Projects**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan (Keihanna)</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>India (Gujarat State)</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>China (Eco-City)</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td>✔</td>
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<td></td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Spain (Andalusia)</td>
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<td></td>
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</tr>
</tbody>
</table>

HEMS: Home Energy Management
BEMS: Building Energy Management
FEMS: Factory Energy Management

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3. Initiatives for the Energy & Environment Business

Smart Community: Life System Example (Keihanna)

➢ By building total solutions for water and waste materials that utilize existing infrastructure into a CEMS, realize a low-carbon community in both arterial and venous systems.

Arterial System Area

1. Reuse of waste water to fully utilize water
2. Conversion of sewage sludge into fuel
3. Conversion of waste materials into fuel
4. Conversion of biomass into fuel and fertilizer
5. Manage low-carbon generation and energy conservation in both systems with CEMS

Venous System Area

Total Solution for Water and Waste Materials

- Biomass
  - Methane Fermentation
  - Gasification
  - Conversion into Fuel
- Household Waste
  - Raw fuel reclamation
  - Waste-to-Energy
- Sewage Sludge
  - Digestion
  - Carbonization
- Sewage and Waste Material Recycling
- Water Recycling Equipment

* CEMS: Community Energy Management System

* CEMS: Community Energy Management System

* Mitsubishi Heavy Industries, Ltd. owns all intellectual property rights concerning these materials.
By combining EVs into a CEMS as a type of energy equipment, realize energy management such as the smooth charging of EVs, peak cut, and so on.
4. New Initiatives on a Company-wide Basis
4. New Initiatives on a Company-wide Basis

**Company-wide Initiatives (Water Business)**

Market forecast to be worth approx. **86 trillion yen** by 2025 (METI estimate)

(Breakdown) Volume Zone (Traditional area of water supply and sewage) 74 trillion yen
Growth Zone (Recycling, desalination, industrial water/sewage) 12 trillion yen

MHI will aim for business expansion by primarily targeting the Growth Zone.

<table>
<thead>
<tr>
<th>Business Field</th>
<th>Operational Field</th>
<th>Materials/Component Supply Consulting Construction and Design</th>
<th>Management and Operation Services</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean Water</td>
<td></td>
<td>19 trillion yen</td>
<td>20 trillion yen</td>
<td>39 trillion yen</td>
</tr>
<tr>
<td>Seawater Desalination</td>
<td></td>
<td>1 trillion yen</td>
<td>3 trillion yen</td>
<td>4 trillion yen</td>
</tr>
<tr>
<td>Industrial Water / Industrial Sewage</td>
<td></td>
<td>5 trillion yen</td>
<td>1 trillion yen</td>
<td>6 trillion yen</td>
</tr>
<tr>
<td>Recycled Water</td>
<td></td>
<td>2 trillion yen</td>
<td></td>
<td>2 trillion yen</td>
</tr>
<tr>
<td>Sewage</td>
<td></td>
<td>21 trillion yen</td>
<td>14 trillion yen</td>
<td>35 trillion yen</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>49 trillion yen</td>
<td>38 trillion yen</td>
<td>86 trillion yen</td>
</tr>
</tbody>
</table>

: Volume Zone (Markets set to double or more)

<table>
<thead>
<tr>
<th>Operational Field</th>
<th>Corresponding Technology</th>
<th>Activated Sludge Treatment</th>
<th>Filtration</th>
<th>Condensation of Precipitation</th>
<th>MBR (UF Membrane)</th>
<th>Advanced Sewage Treatment (Activated Carbon Treatment, Ozone Treatment)</th>
<th>Seawater Desalination (RO Membrane)</th>
<th>Sludge Treatment (Dehydration / Drying / Incineration / Carbonization)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean Water</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Seawater Desalination</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
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<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Recycled Water</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Sewage</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

* MBR: Membrane Bio Reactor, UF: Ultra Filtration, RO: Reverse Osmosis

MHI possesses all of the necessary technologies.
An example of Water Business (Total Solution for the Water Cycle)

### Use of Renewable Energy as Auxiliary Power
- Seawater Desalination Facilities
- Industrial Water Production Facilities
- Industrial Waste Water Treatment Facilities
- Clean Water Production Facilities
- Recycled Water Treatment Facilities
- Ultrapure Water Supply Facilities
- High-functionality Water Production Facilities
- Ultrapure Water Production Facilities
- Sewage Treatment Facilities
- MBR Sludge disposal, etc.

### Selection of Optimum Treatment Process based on the System

<table>
<thead>
<tr>
<th>Method</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>RO membrane</td>
<td>Electric Power</td>
</tr>
<tr>
<td>Flash Process</td>
<td>Heat</td>
</tr>
</tbody>
</table>

### Desalination Methods
- RO membrane
- Flash Process

### Water Treatment Technologies

#### EMS
- Total Solution for the Water Cycle

#### Water Resources
- Rivers
- Sea

#### Technologies
- Technologies that produce water efficiently
- Water-making technologies required based on intended use
- Technologies that increase water utilization rates
- Technologies that clean wastewater

### Water Treatment Technologies (Example)

- Seawater Desalination Facilities
  - Filtration
  - RO membrane
  - Coagulating sedimentation, etc.
- Industrial Water Production Facilities
  - Activated carbon treatment, MBR, etc.
- Industrial Waste Water Treatment Facilities
  - Pressure flotation, solids contact clarifier, etc.
- General Waste Water Treatment Facilities
- Ultrapure Water Production Facilities
- Semiconductor Plants, etc.
- Ion-exchange resin, RO membrane, UV treatment, etc.
- MBR: Membrane Bio Reactor
- RO: Reverse Osmosis

### Cities / Towns
- Use of Recycled Waste Water
- Activated sludge treatment, filtration, RO membrane, MBR, etc.
- Life system Wastewater Treatment facilities
- Treated Wastewater
- MBR Sludge disposal, etc.

### Total Solution for the Water Cycle
- Fresh Water
- Waste Water
- Reuse
- RO membrane
- Flash Process
- Heat

4. New Initiatives on a Company-wide Basis
4. New Initiatives on a Company-wide Basis

Company-wide Initiatives (Biomass)

Concept for Biomass Utilization

- Use of biomass based on regional characteristics
- Effective utilization of organic resources for energy and products
- Revitalization of local forestry industry and economy

- Lumber mills
- Furniture factories
- Chip mills
- Wood waste biomass
- Remaining materials from forestry areas
- Factory scrap wood

Final Cutting

Tree Thinning

Remaining Materials from Forestry Area

Treetop Branches

Lumber from Thinning

Satellite Information

Information Utilization

Rice paddies, farmland, pasture

Biomass Utilization Plant

Provision of forest management / agricultural information

Power Generation

Direct Combustion

Carbonization, conversion into gasification fuel

Power Generation

Methane Fermentation

Moisture-controlled dehydration

Compost

Ammonia recovery / recycling

Compost Creation

Vegetable/flower growing facilities

Agricultural Produce Processing Plants

Sale of Agricultural Produce

Electric power selling

Carbide Gas

Hot water supply

Waste heat, electric power, compost, carbide

Greenhouse gas monitoring

Crop status, weather information

Appropriate thinning locations, etc.

Dairy Farmland

Livestock Excreta

Collection / Receipt

Mitsubishi Heavy Industries, Ltd. owns all intellectual property rights concerning these materials.
4. New Initiatives on a Company-wide Basis

An example of biomass (MHI’s Achievements)

**Food**
- Local Government: Processing waste from school and other provided lunches
- Food Companies: Bean sprouts, bean curd refuse etc. (solids)

**Livestock Excreta**
- Pasture: Dairy cattle shed, Beef cattle/nursery shed, Chicken coop
- Food processing company: Coffee grounds

**Biological Power Shizukuishi**

**Power Generation Facilities**
- Desulphurization equipment
- Gas holder
- Gas engine generator (Capacity: 250 kW x 1 unit)

**Methane Fermentation Facilities**
- Methane Fermentation Tanks

**Receiving Facilities**
- Approx. 52 tons / day

**Compost Conversion Equipment**
- Primary fermentation tank
- Secondary fermentation tank
- Stock yard

**Income from Sale**
- Compost: Fields, fed crop, etc. Approx. 29 tons / day
- Liquid Fertilizer: Used in pastures Approx. 52 tons / day
- Selling of Electricity Approx. 2,000kWh / day

**Electric Power**
- Self Use Approx. 2,000kWh / day

**Pasture**
- Jointly operated with Koiwai Agriculture & Stockfarming, Shizukuishi Town, and others since April 2006.
5. Summary
Summary

Fulfillment of Company-wide Functions

The Sustainability Energy & Environment Strategic Planning Department will continue to fulfill company-wide functions assuming a leading internal role in the development of the Energy & Environment Business and support for earthquake reconstruction efforts, and will promote business development and reconstruction support.

Contributing to Community Development Based on Regional Characteristics

With regard to support for earthquake reconstruction efforts, MHI will apply a wide range of its product technologies in a flexible manner and contribute to development of robust & resilient community against disasters based on regional diversity.

Development of New Business Areas with Future Growth Prospects

Regarding development of the Energy & Environment Business, we will continue to challenge aggressively the development of new business areas with future growth prospects such as smart communities, the water business and biomass.

Provision of Total Solutions

We will continue to provide total solutions in the Energy & Environment Business area by using Project Management and System Integration technologies which are strengths of MHI Group.
Forecasts regarding future performance in these materials are based on judgment made in accordance with information available at the time this presentation was prepared. As such, those projections involve risks and insecurity. For this reason, investors are recommended not to depend solely on these projections for making investment decision. It is possible that actual results may change significantly from these projections for a number of factors. Such factors include, but are not limited to, economic trends affecting the Company’s operating environment, currency movement of the yen value to the U.S. dollar and other foreign currencies, and trends of stock markets in Japan.