Air-Conditioning & Refrigeration Systems
Business Operation

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1. Introduction to Air-Conditioning & Refrigeration Systems (1)

* Domestic - Overseas sales ratios are based on FY 2010 results (consolidated). Market size: MHI estimate.

**Air-conditioners (PAC/RAC)**

- **PAC**
  - “Beaver” Brand
  - Made-to-order products
  - Mass produced products

- **RAC**
  - By far the top niche player in a large market
  - [Global market size: 2010] approx 8 trillion yen plus hot water supply, heating market is 2 - 3 trillion yen
  - Domestic-overseas sales ratio

**Centrifugal Absorption Liquid Chiller (CALC)**

- Easily the largest share in domestic market
  - [Global market size: 2010] approximately 0.2 trillion yen
  - Domestic-overseas sales ratio

**Automotive thermal systems (CAC)**

- No. 2 in the world for scroll compressors and electric compressors
  - Domestic-overseas sales ratio

**Transport refrigeration units (TRU)**

- Easily the largest share in domestic market
  - [Global market size: 2010] approximately 0.2 trillion yen
  - Domestic-overseas sales ratio
1. Introduction to Air-Conditioning & Refrigeration Systems (2)

* Figures shown are FY 2010, consolidated.
2. Summary of FY 2010 (1)

**Orders received**
- FY 2010 Beginning of term estimate: 140.0
- 2009: 138.4
- 2010: 159.1
- Increase of 19.1 billion yen

**Net sales**
- FY 2010 Beginning of term estimate: 140.0
- 2009: 137.4
- 2010: 158.1
- Increase of 20.7 billion yen from previous fiscal year. (+18.1 billion yen from beginning of term estimate)

**Operating income**
- FY 2010 Beginning of term estimate: -6.0
- 2009: -9.9
- 2010: -2.3
- Loss decreased by 7.6 billion yen compared to previous term (+3.7 billion yen from beginning of term estimate)

- Although unfavorable exchange rates and increase of material costs had effects, increased sales, cost reduction, and cuts in various expenses resulted in a significant improvement from the previous term.

Loss decreased by 7.6 billion yen compared to previous term (+3.7 billion yen from beginning of term estimate)
2. Summary of FY 2010 (2)

The market for air-conditioners bottomed out in 2009 and began to rise in 2010, fueled by the economic recovery in Europe and America after the Global Financial Crisis, the effects of extreme heat wave of last summer, and the growth in China and other emerging Asian markets.

With growth in demand and the recovery of automobile manufacturers, MHI’s net sales increased to 115% of the previous year. However, profitability was squeezed by the high yen rate, the price hike in copper and aluminum market. This was offset by increased amount of sales, cost cutting, and a reduction in expenses, and operating income improved 7.6 billion yen year on year.

The strategy for FY2011 is being pursued with a concentration on the following:
(1) Creation of a light, nimble business structure.
(2) Operate as the dominant niche player.
2. Summary of FY 2010 (3)

- **PAC/RAC**
  - Overall, demand is trending higher, led by emerging countries. RAC has shown especially large growth both in Japan and overseas. In addition, in China, the world’s largest market, MHI’s exclusive sales network K-POINT increased the number of dealers beyond the original plans. (144 stores as of end May, 2011)

- **CAC**
  - With the rebound in the production of automobile manufacturers, electric compressors for EV and HEV for both domestic and overseas markets have grown. Have also succeeded in developing new customers in emerging countries. Also continuing sales activities for new European customers.
    - * EV/HEC = Electric Vehicles / Hybrid Electric Vehicles

- **TRU**
  - Although the truck subsidy system was terminated, the domestic truck refrigeration unit (TRU) market grew to 104% of the previous year, supported by steady demand for freezer and refrigerated trucks. MHI maintained its leading domestic share by expanding its sales with the introduction of a new series of compact, lightweight, high-performance TRU with low operating noise all those achieved by a new 3D compressor.

- **CALC**
  - Limited investment by IT, semiconductor and home appliance manufactures due to the recession caused a considerable contraction in the domestic centrifugal chiller market. Net sales decreased, although MHI retained the largest market share. However, orders increased, with orders from Sky Tree in Japan, and from Heart of Doha, Qatar, among others. In addition, the world’s first centrifugal-driven Water to Water Centrifugal Heat Pump ETW (Heat Recovery Type), was released.
3. Prospects for FY 2011 (1)

**Orders received**
- FY 2014: 240.0 billion yen (actual result)
- Expand sales focusing on high-performance models, capitalizing on global move to reduce CO₂ emissions.

**Net sales**
- FY 2014: 240.0 billion yen (actual result)
- Improve earnings based on increased sales and cost-cutting activities.

**Operating income**
- FY 2014: 11.0 billion yen (actual result)
- Increase sales and cost-cutting activities.
3. Prospects for FY 2011 (2)

**PAC/RAC**
- Respond to China and Asian emerging country demand and aim to boost market share in existing markets of Europe and Japan.
- Started sales of commercial-use heat pump-type water heater to respond to wide range of demand from household to industrial use.

**CAC**
- Although the decrease of auto production is expected following the Great East Japan Earthquake, MCC in the US is scheduled to resume production this autumn, and investment is planned to bolster production of electric compressors for EV and HEV.

**TRU**
- Almost all models had undergone model changes by the end of previous year. Concentrating on expanding sales of these energy saving, high-performance models.

**CALC**
- Focusing on expanding the overseas market as well as continuing the expansion of service business in the domestic market.

**Overall**
- On the whole, increase in sales achieved in overseas business, mainly with PAC/RAC and CAC.
- Maintain and expand domestic share of TRU and CALC as the base, and focus especially on overseas deployment of CALC.

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![Diagram](image-url)

**2010 Consolidated Sales Forecast for Air-Conditioning & Refrigeration Systems**

- Sales index forecast for 2011 when 2010 = 100
- PAC/RAC: 117
- TRU: 104
- CAC: 112
- CALC: 106

**2010 Consolidated Sales Forecast for Air-Conditioning & Refrigeration Systems**

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**Basic Policy**
- Taking advantage of global environmental regulations as a rare opportunity, promote global sales of high-performance, high value-added products that make a major contribution to environmental conservation, and develop a business that will play a role in MHI’s energy and environmental business.
- To this end, as a niche manufacturer of air conditioning and refrigeration systems with a scale suited to its own management resources, MHI will work to acquire and maintain its position as the dominant niche player in specific business domains.

**Reform process**
- Convert fixed costs to variable costs using overseas facilities (reform of production formation).
- Shift from management based on sales/profit to a diversified management structure that includes B/S and C/F (adopt ROIC as a management indicator).

**Growth process**
- To achieve a low-carbon society, enter the environment and energy fields (Air /Water to Water Heat Pump, CAC for EV/HEV), which are growing around the world.
- Change from independent management to cooperation with partners to accelerate business development and disperse business risks.
5. Specific Approaches (1) Reform process (i)
FY 2010 “Reform process”
(Presentation material for Business Operation Meeting for FY 2010)

✓ Adopting reforms to optimize production and improve fund efficiency

Reform of production structure

- Pursuing the world’s optimum production
  - Use overseas facilities that can flexibly respond to changes in demand.
    → Convert fixed costs to variable costs.
  - Improve production of air-conditioners at overseas facilities.
    (Global sourcing from MACO and China-regional sourcing from MHAQ)
  - Continue to increase the local sourcing ratio at overseas plants.
  - Partial outsourcing for spare parts supply.

ROIC improvement

- Inventory reduction
  - Supply chain rationalization
    Build a system of direct delivery from overseas plants to distributors in each market.
  - Shorten production lead time through innovative activities in manufacturing in the entire company. (Application of the yatai system of MACO to TRU products).

- Fund efficiency improvement
  - Share investment with business partners by reconsidering the make-or-buy decisions.
  - Collect funds earlier by reducing lead-time.

* The yatai system: A production system in which, in principle, one worker assembles a product in a cell location, which adds flexibility to production schedule / production volume changes.
5. Specific Approaches (1) Reform process (ii)
Reform of Production Structure

Concentrate production of “global model air-conditioner products, except for China” from Japan (Biwajima) and China (MHAQ) to Thailand (MACO) and achieve production efficiency and cost reduction.

- **MHAQ (China)**
  - Shift global model PAC to MACO, continue production of PAC for China.
  - PAC/RAC production
    - 2009: 100
    - 2010: 111
    - 2012: 128

- **MJA (China)**
  - Continue production of RAC for China.
  - PAC/RAC production
    - 2009: 100
    - 2010: 100
    - 2012: 152

- **Biwajima (Aichi Prefecture)**
  - Shift global model PAC to MACO, continue production of TRU and compressors.
  - PAC/RAC production
    - 2009: 100
    - 2010: 113
    - 2012: 38

- **MACO (Thailand)**
  - Concentrate on production of PAC and RAC global models, except for China.
  - PAC/RAC production
    - 2009: 100
    - 2010: 141
    - 2012: 200

Figures in chart are index with 2009 as 100.
5. Specific Approaches (1) Reform process (iii) ROIC Improvement

Efforts are focused mainly on improving production lead time to reduce inventory.

**Months of inventory held**

<table>
<thead>
<tr>
<th>Year</th>
<th>Index with 2009 as 100</th>
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<tbody>
<tr>
<td>2009</td>
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<tr>
<td>2010</td>
<td>85</td>
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<tr>
<td>2011</td>
<td>75</td>
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<table>
<thead>
<tr>
<th>Year</th>
<th>Index with 2010 as 100</th>
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<tr>
<td>2010</td>
<td>100</td>
</tr>
<tr>
<td>2011</td>
<td>117</td>
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**Details of activity:**

1. Shift from make-to-stock production to made-to-order production with an inventory cover system using RINKS (Refrigeration Integrated Keikaku System), a production management system developed jointly by Air-Conditioning & Refrigeration Systems and Technology & Innovation Headquarters.

2. Adopted Yatai production, instead of line production, enabling a flexible response to fluctuations in demand. (horizontal deployment of production method adopted at MACO (Thailand)).
5. Specific Approaches (2) Heat Pump Business (i)
FY 2010 “Growth process (1) Heat Pump”
(Presentation material for Business Operation Meeting for FY 2010)

✔ Focus on air/water to water heat pump hot water supply systems and centrifugal chillers, which are currently niche but which will be growth products in the future.

**Heat pump hot water supply**

<table>
<thead>
<tr>
<th></th>
<th>Household use</th>
<th>Industrial use</th>
</tr>
</thead>
<tbody>
<tr>
<td>European heat pump market</td>
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<tr>
<td>2009</td>
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<td>2014</td>
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- High-performance products at the highest level offering a variety of applications from household to industrial use will be provided.
- MHI sells household heat pump hot water supply systems in Europe in cooperation with NIBE, the large heater manufacturer.
  MHI also seeks collaboration with major power companies and local heat pump manufacturers.
- A dedicated sales team will be set up to boost heat pump sales. Group and power companies will implement collaborative projects.

**Centrifugal chillers**

<table>
<thead>
<tr>
<th></th>
<th>Achieved COP 7.0., the world’s highest efficiency</th>
<th>CALC overseas businesses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>400Rt, cold water 17ºC/7ºC</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td></td>
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<tr>
<td>2014</td>
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</table>

- In Europe, started sales cooperation with multiple partners and received inquiries for MHI turbo chillers for chillers for power plants abroad.
- In Asia, the Singapore office will lead the effort to increase sales to serve demand for chiller replacement through service activities primarily for existing Japanese customers.
- For customers who use the products for a relatively long period of time, MHI’s high-efficiency units have an advantage in LCC evaluation compared with cheaper overseas products.

**Life Cycle Cost** refers to the total cost including the initial cost and running cost.

* Household heat pump hot water supply systems heat water by collecting heat in the air just like air-conditioners, which allows a substantial reduction in CO₂ from the conventional combustion water heaters. Consequently, they are expected to experience rising demand as energy saving products.
5. Specific Approaches (2) Heat Pump Business (ii)

By shifting from conventional combustion (boilers, gas systems) system to heat pump (electric) system, substantial CO₂ reductions and energy savings can be achieved. With a product line-up ranging from household to industrial use, look to expand the business.

**Household use for Europe**
8-16 kW

- ~8 kW
- 9 kW ~ 16 kW (max 11 kW)

Cooling, heating and hot water supply system
Air heat source heat pump hot water supply

(R410A)

**Industrial use**
627 kW~

- Compared to heavy fuel oil boilers:
  - Energy saving: 70% less *
  - CO₂ reduction: Approx. 70% less

- Waste heat recovery warm water heat pump
  - ETW (R134a)

**Industrial use**
30~480 kW

(30 kW x 16 units)

- Developed a heat pump hot water supply system fitted with the world’s first new 2-stage scrotry (screw-rotary) compressor using CO₂ as refrigerant. This unit maintains its performance even down to an external temperature of minus 7ºC, and can be used down to external temperatures of minus 25ºC.
- In addition, achieved intermediate season COP of 4.3, leading the industry in the 30 kW class, with high efficiency year round.

**Scrotry compressor**

- Improved performance under low external temperatures by increasing coolant recirculation amount.

- By integrating “scroll,” which is efficient with a high pressure ratio, and “rotary,” efficient with a low pressure ratio into one unit, achieved high efficiency under all operating conditions.
5. Specific Approaches (2) Heat Pump Business (iii)-1

Feature 1
Technological breakthrough in operating performance under low external temperature conditions with the adoption of two stage “Scrotyr” CO\(_2\) compressor.

Feature 2
Uses CO\(_2\), a natural coolant, and has achieved a COP 4.3 rating, leading the industry in the 30 kW class.

Feature 3
The 30 kW rating is exempted from High Pressure Gas Safety Act restrictions.

Feature 4
By connecting a maximum of 16, 30 kW units, able to respond to a maximum of 480 kW hot water load

Suitable for cold weather regions where heat pump hot water systems are uncommon.

Excels in both energy saving and environmental friendliness. Global warming coefficient: CO\(_2\) = 1, R410A = 2090

Combines the strengths of broad application with ease of after-sales service.
5. Specific Approaches (2) Heat Pump Business (iii)-2

**Feature 5**
**Improved operability** with the adoption of a touch panel type remote

**Feature 6**
16 unit coupled control is possible, making it adaptable for large facility use.

**Feature 7**
**Compatible with remote monitoring system!**
Allows quick response to failures and by monitoring running data, enables user to schedule the parts replacement in advance.

By analyzing operation log, energy savings proposals suited for each season may be made.

Touch panel controller
Field test being conducted at three locations, focused on cold weather locations.

- **Use**: Boiler water feed humidification
  - **Equipment outline**: 30 kW x 1 unit + Heat exchanger
  - **Installed location**: Hokuriku area
  - A low external temperature, high humidity area, characteristic to the coastal areas facing the Sea of Japan.

- **Use**: Hot water supply for kitchen and wash rooms
  - **Equipment outline**: 30 kW x 1 unit + Heat exchanger
  - **Installed location**: Doto area of Hokkaido
  - A very cold area where the highest temperature of the day below minus 20ºC is not uncommon.

- **Use**: Hot water supply for kitchen and bath
  - **Equipment outline**: 30 kW x 1 unit + sealed tank
  - **Installed location**: Northern part of Iwate Prefecture
  - An area subject to very heavy snow in Tohoku.
5. Specific Approaches (2) Heat Pump Business (iv)-2

Around the field test site, Doto area, Hokkaido

[System configuration]
30 kW heat source machine: 1 unit
Sealed hot water holding tank: 500 liters x 5 units

[Use]
Hot water supply for kitchen and wash rooms
Performance does not deteriorate until the outside temperature falls below minus 7°C

- 30kW at -7°C

[Outlet hot water temp: When outlet is 90°C at inlet water of 5°C]

Able to supply 90°C hot water even at minus 25°C

COP 2.8 at -7°C
5. Specific Approaches (2) Heat Pump Business (vi) -1

■ Influence of the Great East Japan Earthquake on heat pump hot water system

1. With the instability of power supply within Japan, there are risks of adverse conditions confronting efforts at expansion, especially in the Kanto area.

2. Globally however, the shift from boilers (combustion type) to heat pump hot water supply (electric type) to cut down CO$_2$ is steadily advancing, and there is no change to the fact that the global market is on a growing trend.

3. With its high energy conservation and CO$_2$ reduction effect, the drive to expand sales for “Q-ton,” the second to none product, especially in the very cold areas, through collaboration with boiler manufacturers, will continue, using diverse sales and service routes such as energy conservation consultants, engineering companies, local air conditioning and plumbing contractors, and others.

4. MHI has selected Europe and Korea as initial areas for promoting the expansion of sales, to make up for the headwind in Japan.
5. Specific Approaches (2) Heat Pump Business (vi) -2

[Europe]
(1) Start sales from December 2011.
(2) Plan to send first sales promotion team during June-July, 2011 for market survey and sales promotion activities.
(3) Key sales promotion targets are UK, France, Germany, Spain, and Sweden, where energy conservation advantages can be expected.

[China]
Warm water/hot water market is large but priority is low for the following reasons:
- Small energy conservation merit (difference between fossil fuel and electricity cost).
- Unstable infrastructure (voltage fluctuation).
- Boiler cost is extremely low.

[Japan, etc.]
16%

Europe: 47%

[Europe]
(1) Start sales from December 2011.
(2) Plan to send first sales promotion team during June-July, 2011 for market survey and sales promotion activities.
(3) Key sales promotion targets are UK, France, Germany, Spain, and Sweden, where energy conservation advantages can be expected.

[North America]
Warm water/hot water market is large but priority is low for the following reasons:
- Regulatory barriers are high.
- Sales and service network not established.
- Boilers are popular and their price is low.

[China]
Warm water/hot water market is large but priority is low for the following reasons:
- Small energy conservation merit (difference between fossil fuel and electricity cost).
- Unstable infrastructure (voltage fluctuation).
- Boiler cost is extremely low.

[North America]
29%

[Korea]
The same specification as the Japanese market can be applied to respond to the market.
(2) Of the agents for PAC/RAC and CALC, cooperation is being made with companies that are able to design, construct, and maintain the system and promotion is conducted.

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[China]
Warm water/hot water market is large but priority is low for the following reasons:
- Small energy conservation merit (difference between fossil fuel and electricity cost).
- Unstable infrastructure (voltage fluctuation).
- Boiler cost is extremely low.
5. Specific Approaches (3) Automotive Thermal System operations (i) FY 2010 “Growth process (3) Automotive Thermal Systems”

- Promote the scroll compressor (QS, electric driven), currently in the minority with automotive thermal systems but expected to grow in the future.

**QS Compressors (scroll)**
- Addition of volume by the global compact car program of auto manufacturers.
- Expand into emerging countries where new demand is set to rise.

**Electric compressors (scroll)**
- Sustained support for existing customers to gain additional programs and secure next programs.
- Win business from major automakers.
- Approach new automakers that plan to produce EV/HEV.

**Electric water heater**
- Promote as an EV/HEV-compatible heating device together with electric compressors.
- Focus on development for small packaging, performance improvement, weight reduction, and cost reduction.

**Sales of MHI’s automotive thermal systems**

**Scroll compressor market and MHI’s share**

Market forecast for CAC scroll and electric compressors

(MHI estimate) 50% Market share of MHI Scroll Compressors

35% Demand for Scroll Compressors

20% Market share of MHI electric compressors

7% Demand for electric compressors
Currently gearing up to win orders for QS compressors (belt driven), electric compressors, and PTC heaters for eco-cars (EV and HEV), demand for which is expected to keep growing. Also enhancing production facilities. In addition, we have completed development of a heat pump system that enables cooling and heating under external temperatures of minus 10°C. Sales will now be getting underway.

- Have obtained orders from emerging countries such as India and Brazil. Developing new customers for Asia and China, etc.
- Plan to upgrade production facilities for electric compressors for EV and HEV, where production is rising, by the second half of FY 2011.
- Suspended production of compressors for automotive thermal systems from 2009 but having won a large order, will resume production in 2011.
- Concentrate on increasing share for US and domestic clients. (Large order won for USA). Succeeding with European manufacturers will be the big task going forward.

Matsusaka Plant

Europe, US and Japan market

MCC (USA)
5. Specific Approaches (4) Air Conditioning Operations (i)
FY 2010 “Growth Process (2) Air Conditioning Operations”
(Presentation material for Business Operation Meeting for FY 2010)

- Promote multi-function systems with high added value in the air-conditioner market in China, which is set to grow in the future.

- Define a high-end product strategy and establish brand strategy.
- Increase the number of exclusive dealers (K-Point) (200 locations by 2012).
- Increase the number of products for residential houses of the new affluent class, in addition to buildings and luxury homes.

- Establish a new AC & refrigeration company (May 2010 –)
- Adopt personnel and wage systems geared to local conditions in China.
- Employ a Chinese person as the general manager of organization

Sales channels in China

Expand air conditioning operations in China

Strengthen sales promotion [K-Plan]

- Define a high-end product strategy and establish brand strategy.
- Increase the number of exclusive dealers (K-Point) (200 locations by 2012).
- Increase the number of products for residential houses of the new affluent class, in addition to buildings and luxury homes.

Establish a new AC & refrigeration company (May 2010 –)

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- Employ a Chinese person as the general manager of organization

Sales channels in China

- General agency
- Equipment dealers, stores
- Mass retailers

Employ companies from different industries

Offer via a franchise system

Air-conditioner sales in China

Approx. 1.7 times

‘10 ‘14

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5. Specific Approaches (4) Air Conditioning Operations (ii)

MHI’s exclusive sales network K-POINT is growing as planned, with 144 stores opened as of end of May 2011.
6. Summary

- Aim to be an air conditioning and refrigeration manufacturer that plays a role in MHI’s environment business and contribute to protecting the environment.

- Establish a light, nimble structure, operating as a dominant niche player

Thank you very much for your attention.
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 decisions. 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.