



# Energy & Environment

As the core business of the MHI Group, we will simultaneously pursue short-term earnings and medium-to-long-term growth to contribute to the Company's business scale expansion and increased profitability.

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Domain CEO, Energy & Environment



### Strengths

- Accommodate almost all methods of power generation
- Engineering prowess accumulated in diverse plant businesses, etc.
- **Thermal** High efficiency, high output, energy saving  
Broad-ranging product lineup, encompassing small, medium-sized, and large
- **Nuclear** Highest levels in the world in safety technologies and product quality

### Opportunities

- **Thermal** Expanding demand due to falling natural gas prices
- **Thermal, renewable energy** Increased need for efficient thermal and wind power generation systems, etc.
- **Chemical plants** Growing capital investment in gas-producing countries

### Weaknesses

- **Thermal** Low profitability relative to major overseas competitors
- **Nuclear** Little experience in constructing new plants overseas

### Threats

- **Thermal** Overwhelming overseas presence of two major competitors



### Net sales

FY2014 **¥1,599.5** billion → FY2017 (target) **¥2,000.0** billion

### Operating income

FY2014 **¥162.6** billion → FY2017 (target) **¥240.0** billion



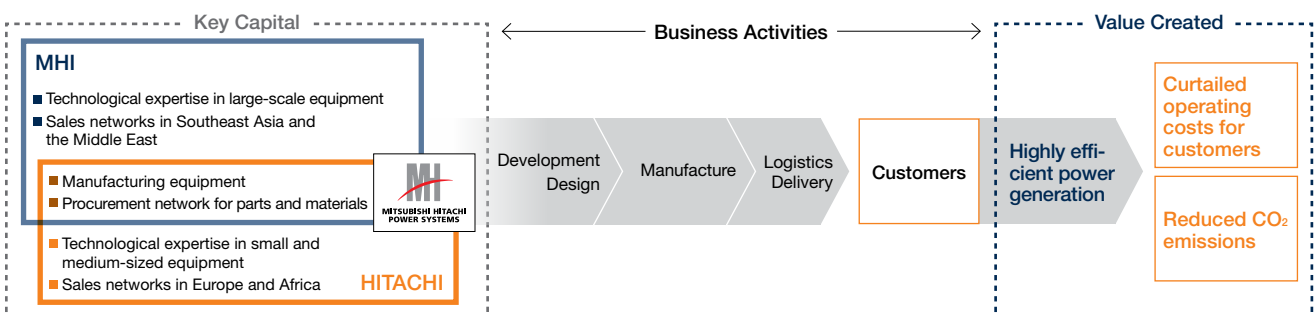
## Operating Environment

Spurred by economic expansion in emerging countries and population growth, global energy demand is expected to continue rising, with 37% growth forecast by 2040.\* In thermal power generation, we are seeing marked growth in demand for systems fueled by natural gas as its price falls. Demand also remains robust for new construction of thermal generation systems fired by coal, for which reserves are abundant. However, fierce global competition is unavoidable, given the market presence of so-called megaplayers.

Meanwhile, a new international framework of climate-change countermeasures is being prepared to succeed the Kyoto Protocol. Against this backdrop, calls to curb greenhouse gas emissions from power generation are growing more pronounced, and expectations are high for high-efficiency thermal power generation systems; nuclear power generation, which does not emit CO<sub>2</sub>; carbon capture and sequestration (CCS) and other technologies to counter global warming; and power generation systems using renewable energy, such as offshore wind power generation. Also, particularly in gas-producing countries, construction continues to expand for fertilizer and other chemical plants that enable higher crop production.

\* Source: IEA, "World Energy Outlook 2014"

### Sample Business Model: Thermal Power Generation



## Focus Strategies of the 2015 Medium-Term Business Plan

As a business domain central to the MHI Group's business expansion and profitability, we are simultaneously pursuing short-term earnings and medium-to-long-term growth, implementing three core strategies in this regard. The first is the thorough strengthening of our competitiveness. We are developing some of the world's most efficient large-scale gas turbines. By combining this technology with Mitsubishi Hitachi Power Systems' extensive lineup of small and medium-sized gas turbines, we will be able to respond swiftly to growing global demand as the price of natural gas falls. We are also reinforcing our highly profitable service business by strengthening service bases, centered on Southeast Asia. In nuclear power, we will contribute to the restarting of existing plants in Japan and stage a worldwide rollout of the ATMEA1\*<sup>1</sup> as a global strategic reactor.

Second, we will cultivate synergies, both within our domain and among domains. By allocating human resources flexibly in response to market fluctuations, we will maximize the sharing and application of our expertise in engineering, procurement, and construction (EPC) and after-sales services. In addition, we will work to maximize efficiency by consolidating bases through organizational restructuring and M&A activity, thereby restructuring group companies and eliminating overlapping work functions.

Our third strategy is expanding into new fields as a way to achieve longer-term growth. Specifically in the oil & gas business,\*<sup>2</sup> we anticipate long-term global demand growth due to population increases and economic expansion. In addition to our domain, we will foster cooperation among all the domains of the Company involved in this business to take advantage of the Company's products and technologies from upstream to downstream operations. By building a business model tailored to our needs, we aim to grow our scale of operations in the oil & gas business from the current level of around ¥100 billion to approximately ¥300 billion within three years. In the distributed power business, we will collaborate with the Machinery, Equipment & Infrastructure domain with the aim of expanding our scale of operations in this category to more than ¥300 billion within three years, from around ¥190 billion at present. In our joint venture with Vestas Wind Systems A/S, of Denmark, we are making steady progress in attracting overseas orders in the offshore wind power generation business. Within three years, we intend to boost this business from the current scale of approximately ¥40 billion to around ¥100 billion.

\*1. A state-of-the-art nuclear reactor developed by ATMEA, a joint venture between MHI and AREVA SA, of France

\*2. A business in which we will provide a one-stop offering to meet customer demand related to oil and natural gas

## R&D Case Study: Fuel Cell Combined Power Generation System

By combining gas turbine combined-cycle (GTCC) generation with a solid oxide fuel cell (SOFC), we are pursuing R&D on a triple combined-cycle system. We have already developed and carried out demonstration tests of a high-efficiency hybrid power generation system combining the high-temperature exhaust gas from SOFC generation, which has a low environmental impact when fueled by natural gas, with a micro gas turbine. The new development applies this arrangement to

large-scale thermal power plants by converting fuel with 70% efficiency through three stages: an SOFC, which runs at high temperature, a gas turbine, and a steam turbine. We aim to commercialize this setup as an ultrahigh-efficiency fuel cell combined power generation system, which we expect to contribute substantially to global warming reduction by curtailing CO<sub>2</sub> emissions, and to the stable supply of electricity.

### ■ Main Projects

Announcement	Delivery	Project
January 2015	2018	Order received for GTCC generation system for Canada
December 2014	2017	First order received by MHI Vestas for V164-8.0MW commercial offshore wind power generation facility, the world's largest in terms of output
October 2014	2016	Full turnkey order received for geothermal power generation plant for Mexico
September 2014	-	Order received to create the world's most advanced coal-fired thermal plants as a Fukushima recovery project
August 2014	2018	Order received to build a large-scale fertilizer plant for a state-owned chemical company in Turkmenistan
July 2014	2017	Order received for world's largest CO <sub>2</sub> capture system for a Japan-U.S. joint enhanced oil recovery (EOR) project
June 2014	2018	Order received for supercritical pressure steam turbines and generators for Egypt's largest thermal power plant
May 2014	2015	First order for next-generation UEC50LSH-Eco marine diesel engine developed by MHI-MME

### ONE HIGHLIGHT

#### Order Received for World's Largest CO<sub>2</sub> Capture System for a Japan-U.S. Joint Enhanced Oil Recovery (EOR) Project

In July 2014, MHI received an order for the world's largest post-combustion CO<sub>2</sub> capture systems for EOR in U.S. state of Texas that is being promoted primarily by NRG Energy, Inc., a leading U.S. independent power producer (IPP), and JX Nippon Oil & Gas Exploration Corporation (JX Nippon). The project involves the separation and capture of CO<sub>2</sub> from flue gas emitted from a coal-fired power generation plant owned by the NRG Group and injection of the CO<sub>2</sub> into a nearby oil field to boost crude oil production. MHI will license CO<sub>2</sub> capture technology to Petra Nova CCS I LLC, a joint venture between NRG Energy and JX Nippon. Mitsubishi Heavy Industries America, Inc., will form a consortium with a U.S. construction company and undertake an EPC role of the CO<sub>2</sub> capture plant.

MHI's CO<sub>2</sub> capture technology is the KM CDR Process<sup>®</sup>, which uses a proprietary KS-1<sup>TM</sup> high-performance solvent for CO<sub>2</sub> absorption and desorption that was jointly developed by MHI and the Kansai Electric Power Co., Inc. The process is characterized by its significant reduction in energy use, and its outstanding performance is highly regarded in Japan and overseas, making MHI an industry leader in CO<sub>2</sub> capture plants.