

# Power Systems Business Operation

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 **MITSUBISHI HEAVY INDUSTRIES, LTD.**

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## **1. Major Product Action Items**

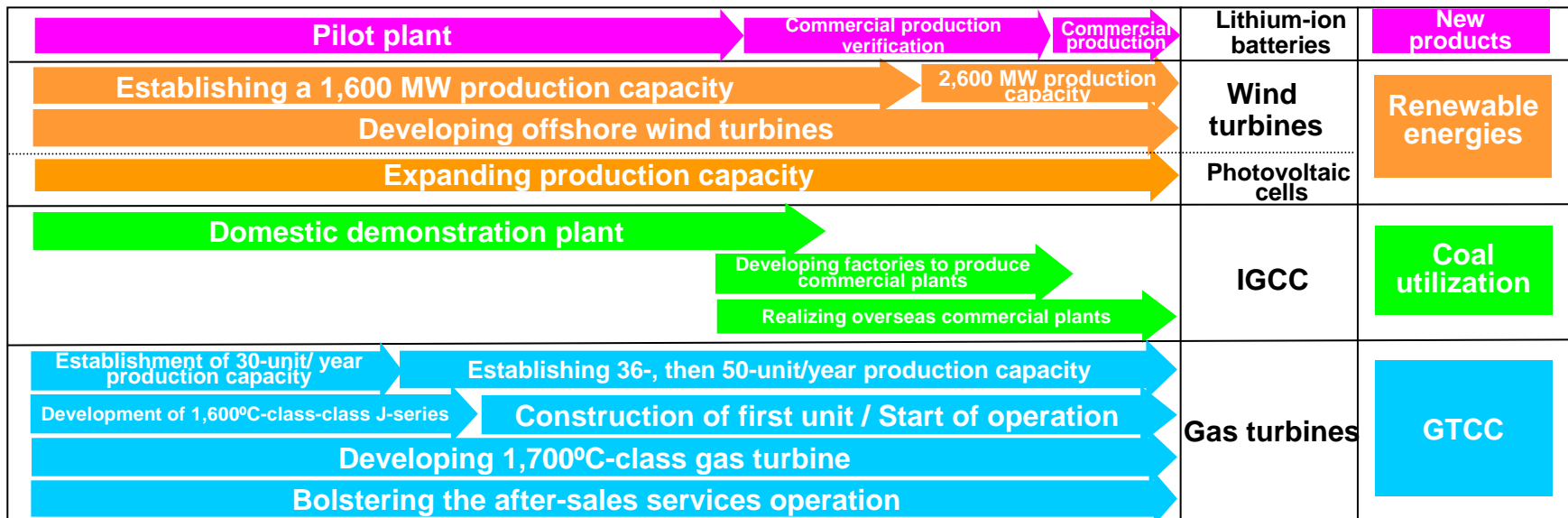
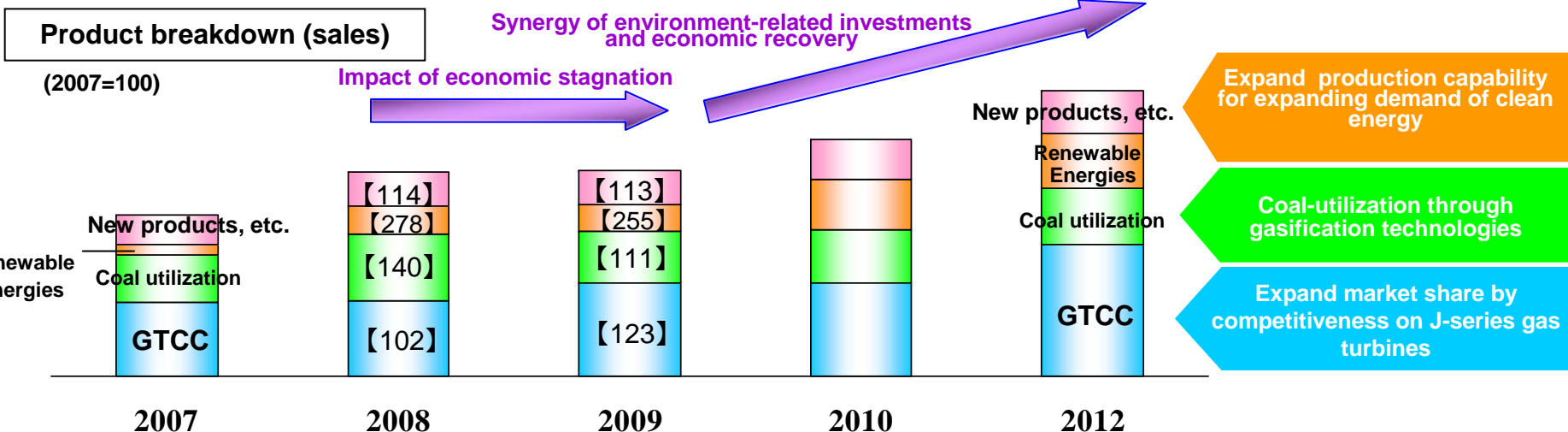
## **2. FY2008 Overview & Special Measures for FY2009**

## **3. Product Portfolio**

## **4. Operational Initiatives by Product**

# Major Product Action Items

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



GTCC: Gas Turbine Combined Cycle

IGCC: Integrated Coal Gasification Combined Cycle

# FY2008 Overview & Special Measures for FY2009

## FY2008 Overview

### Order Received :

Decline under impact of economic crisis  
(suspended/deferred projects, contract cancellation)

### Sales/Profits :

Increases in both sales and profits (growth in plant construction, after-sale service operation)

### Main Achievements:

- Development completion of J-series gas turbines (largest capacity and highest-class efficiency)
- 2,000 hours of continuous operation at Nakoso IGCC demonstration plant
- Continuous growth in wind turbine business

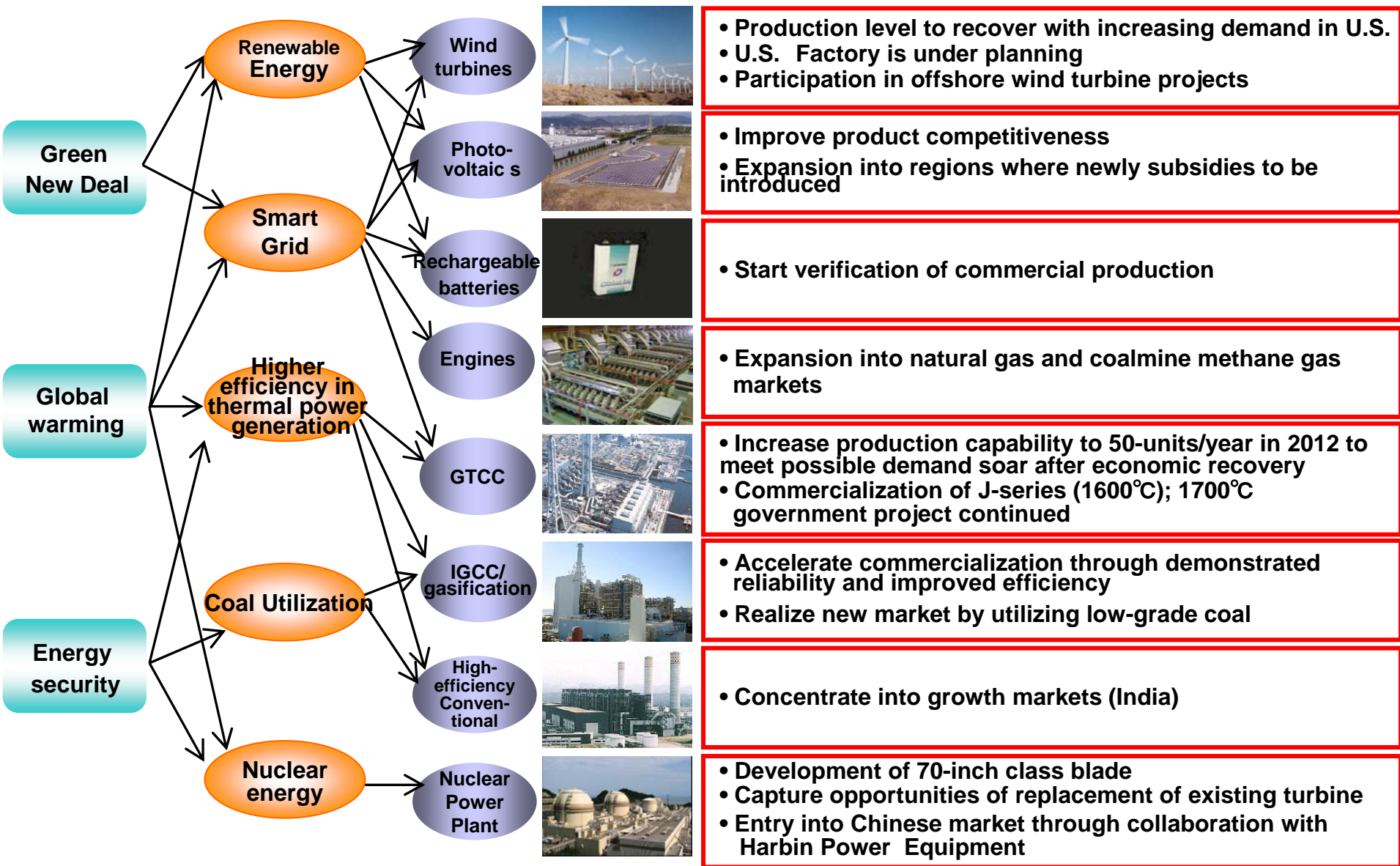
## FY2009 Special Measures

Short term drop in the overall market / Early recovery in the energy/environment sector.  
⇒ Continuous investment for rising demand in the future

Securing sound financial status in the short term

- (1) Improve cost competitiveness
  - Strengthening of procurement capability (SCM optimization, etc.)
  - Low-price procurement through simplified or standardized specifications
  - Tight budget controls for existing project
- (2) Sustain business volume
  - Shift to after-sale services by assigning key resources
- (3) Actions to currency fluctuation
  - Accelerate global sourcing / production

# MHI Power Systems Product Portfolio



- Production level to recover with increasing demand in U.S.
- U.S. Factory is under planning
- Participation in offshore wind turbine projects

- Improve product competitiveness
- Expansion into regions where newly subsidies to be introduced

- Start verification of commercial production

- Expansion into natural gas and coalmine methane gas markets

- Increase production capability to 50-units/year in 2012 to meet possible demand soar after economic recovery
- Commercialization of J-series (1600°C); 1700°C government project continued

- Accelerate commercialization through demonstrated reliability and improved efficiency
- Realize new market by utilizing low-grade coal

- Concentrate into growth markets (India)

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

# 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**

Replacement demand exists for aged thermal power plants

**Russia: Order from TGK-8 for M701F**

**Ukraine: Order from KCC for M701**

**Canada: Order from ENMAX for M501G1 (2 units)**

**Turkey: Order from ENERJISA for M701F (2 units)**

Along with market recovery, demand is expanding for gas turbines using blast-furnace gas at steelworks.

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



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

**Spain: Order from ENDESA for M701F (2 units)**

**Saudi Arabia: Order from ARAMCO for M501F (2 units)**

**Korea: Order from POSCO for M501S (2 units)**

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

**Qatar: Order from RGPC for M701F (8 units)**

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



**Indonesia: Order from PLN for M701F (3 units)**



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

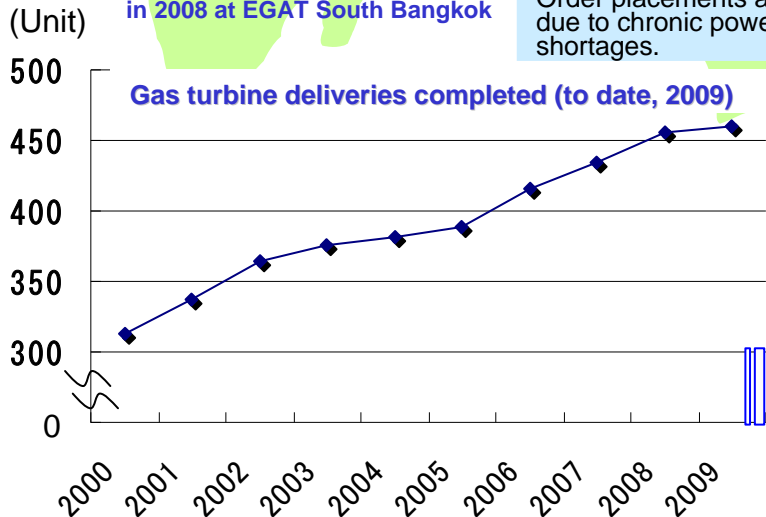


**Chile: M701F began operation in 2008 at San Isidro II**

**Thailand: M701F began operation in 2008 at EGAT South Bangkok**

Order placements are firm due to chronic power shortages.

**M701G2 began operation in 2008 at TEPCO Kawasaki Thermal Power Station Group 1**  
**Winner of 2008 "Best Gas-Fired Project" award from "Power Engineering Magazine" for achieving world's highest level of power generation efficiency**

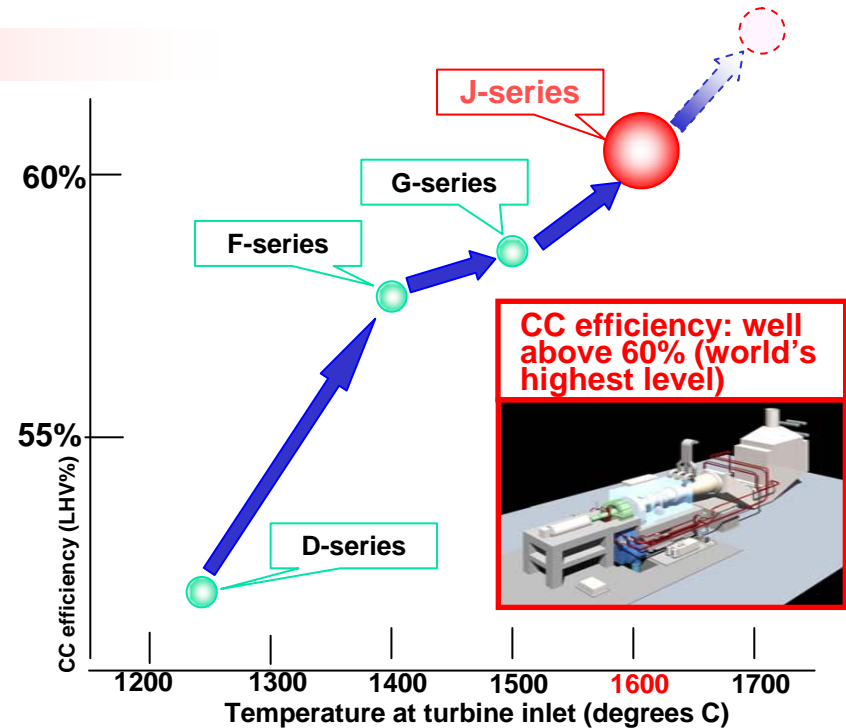
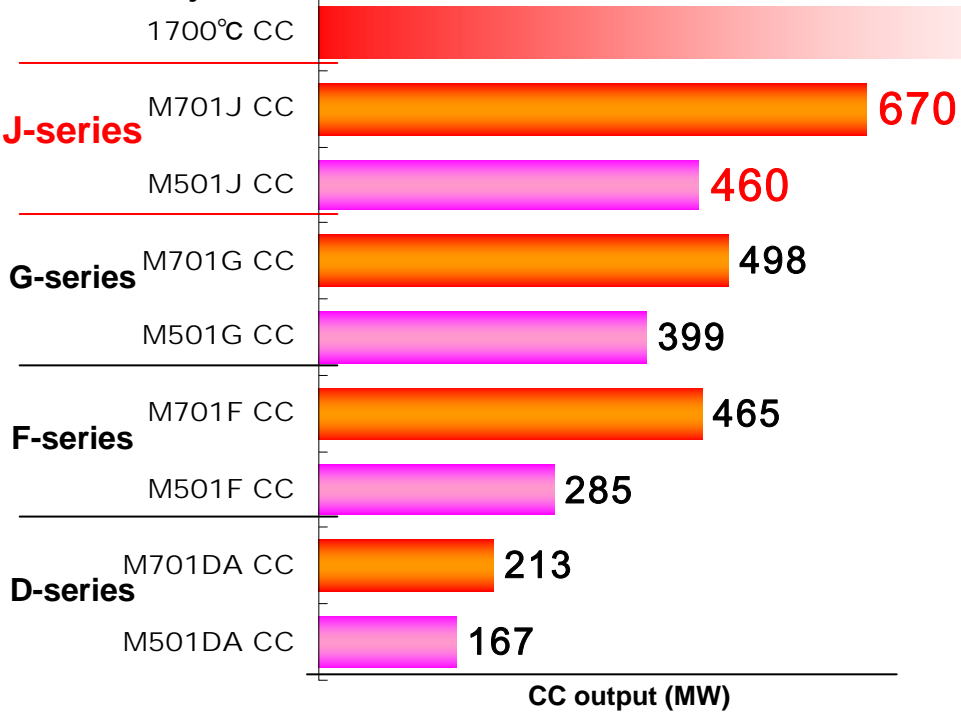


**Deliveries has been steadily completed .  
Expansion of maintenance business =  
Stable profit growth**

# Action to Expand Share in GTCC Market (1)

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

## National Project



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



**Kepeco 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**



Conceptual drawing of Himeji Power Station No.2

# 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. 60%

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

- Fuel diversification
- small and medium-scale gas turbines

[GW]

45

30

15

Others

MHI

Volume of large-scale gas turbine orders

2004

2005

2006

2007

2008

Future

12%

23%

Over 30%

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

10%

Over 20%

Gas turbine annual production capacity: 24 units

30 units (2007~)

36 units (2009~)

50 Units (2012~)

Increase in production capacity

Achieving 30% plus global share for total market



# Clean Coal Technology

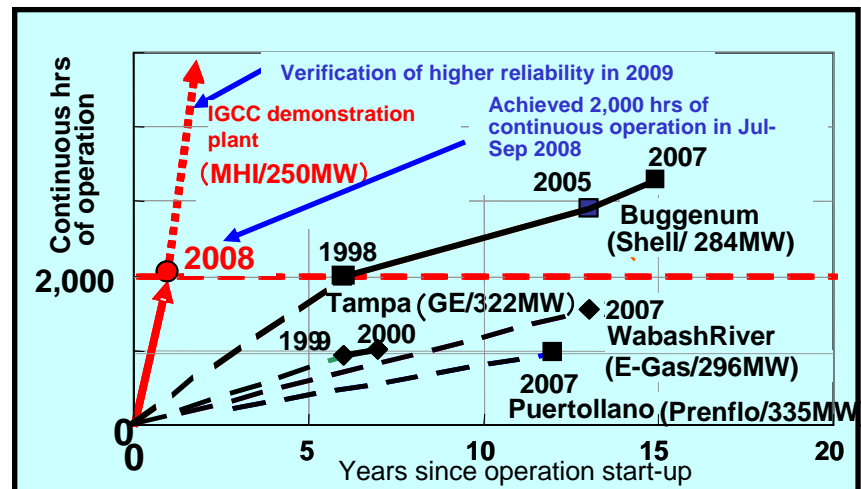
## 《IGCC》

- 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

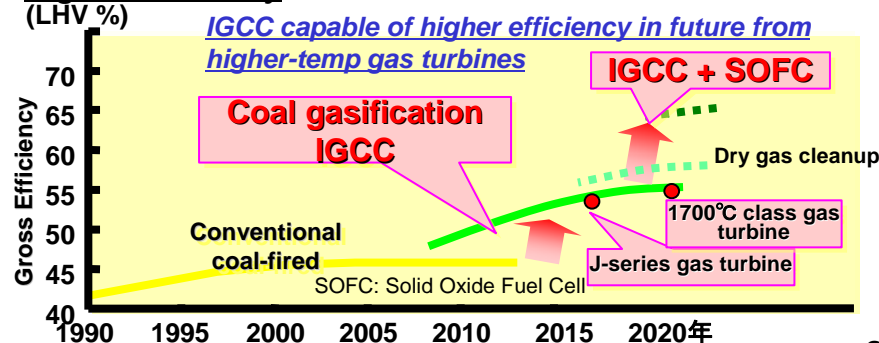


CCP president H. Onishi receiving award

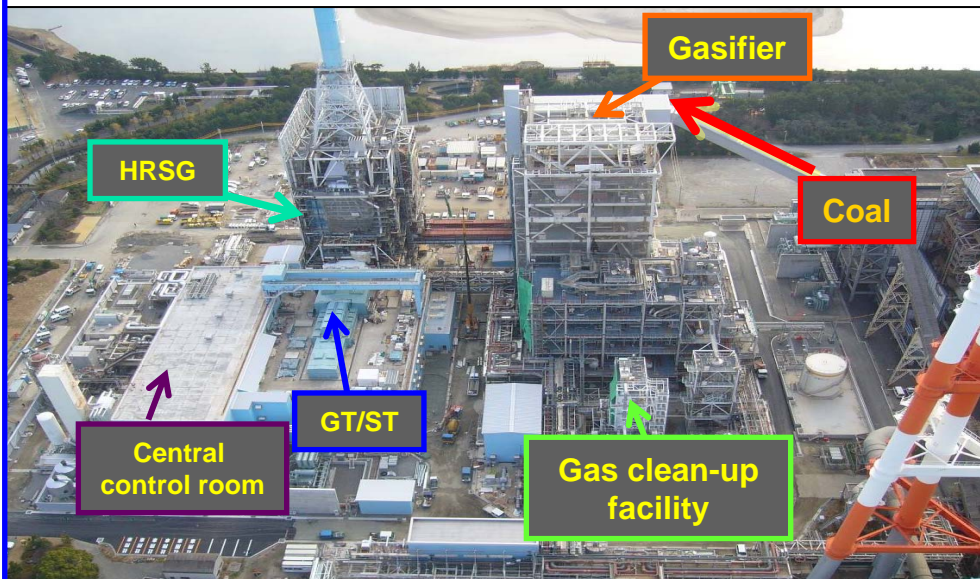
### Verification of higher reliability



### Higher efficiency



## Nakoso IGCC demonstration plant (250 MW)



HRSG: Heat Recovery Steam Generator

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

15%

# Clean Coal Technology

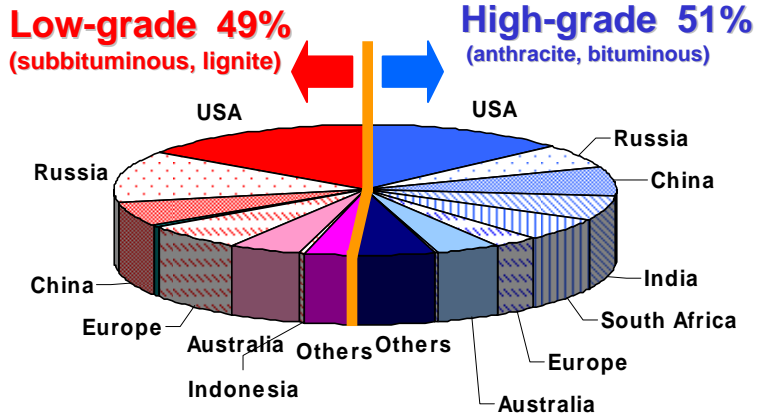
## « Superiority of IGCC with low-grade coal »

Known reserves of high- and low-grade coal are nearly equal. Today, high-grade coal holds a majority of coal production.

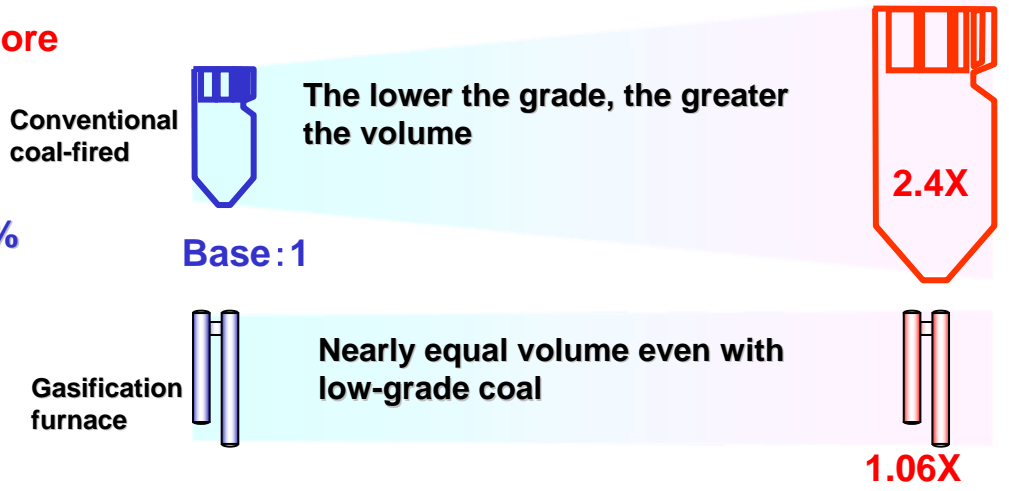
**Cheap low-grade coal to be utilized more from now on.**

IGCC offers cost advantage with low-grade coal over conventional coal-fired power

### Worldwide coal reserves 847.5 bn tons



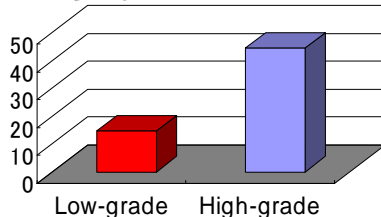
High-grade ← → Low-grade



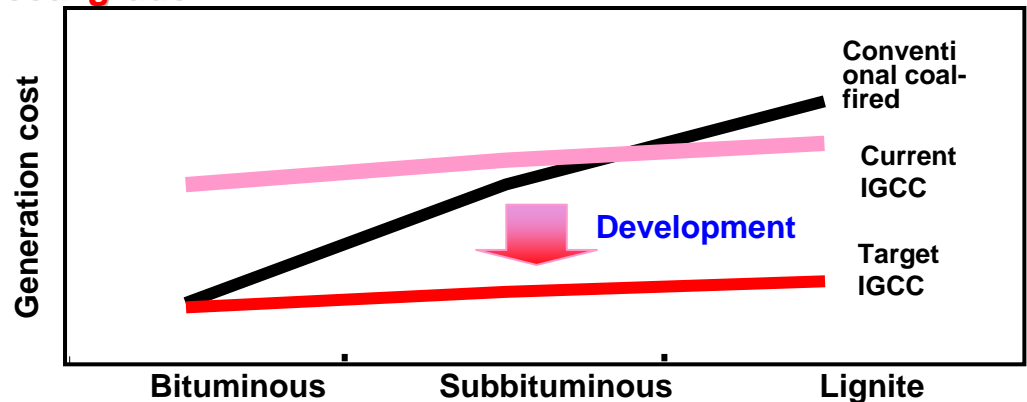
**In future, we will develop competitive IGCC independent of coal grade.**

### Worldwide coal production

(100 mil ton/year)

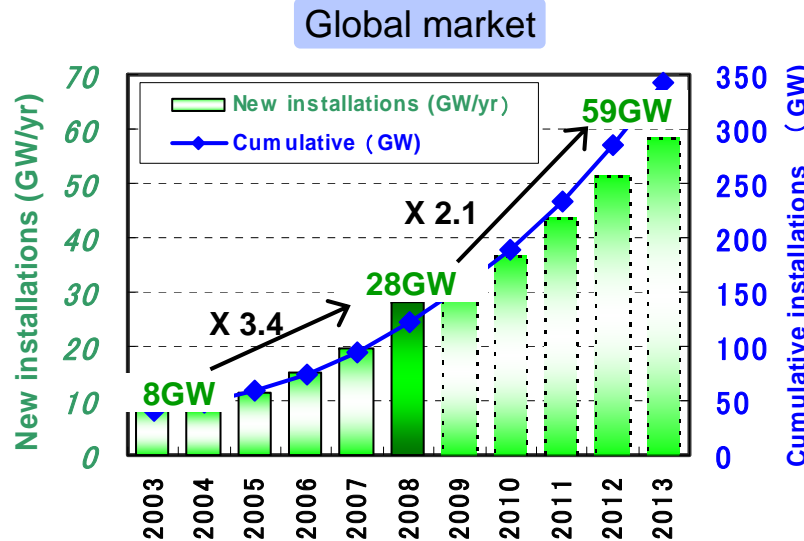


Low-grade accounts for about 1/4 of total production

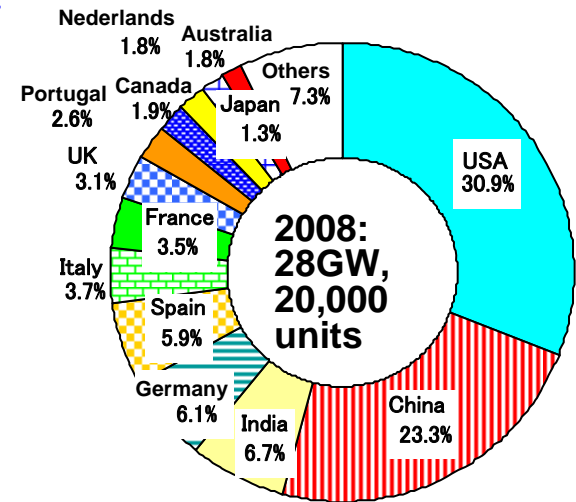


# Wind Turbine Business (Global)

- 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



## New wind turbine installations



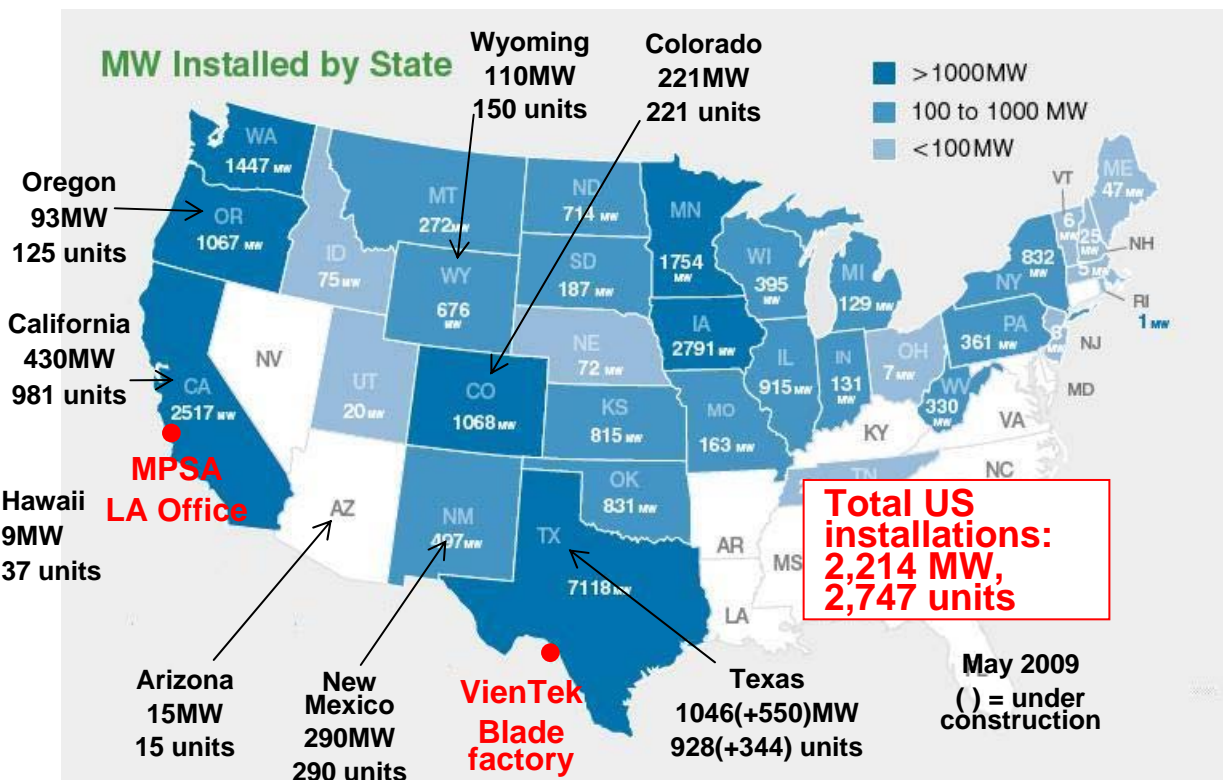
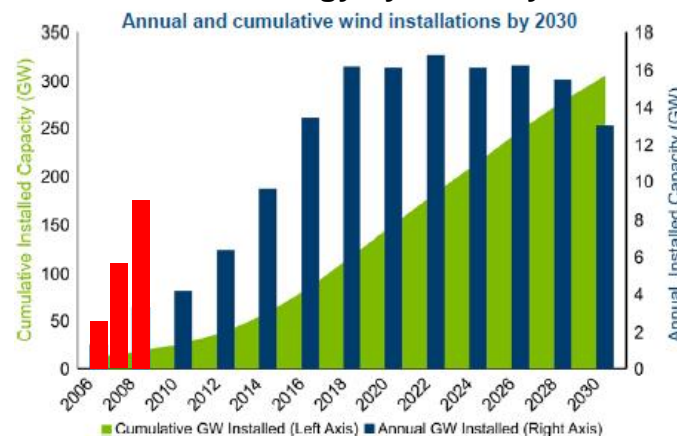
Penascal wind farm in Texas began operation in May 2009, MWT92/2.4 x 84 units: 201.6MW



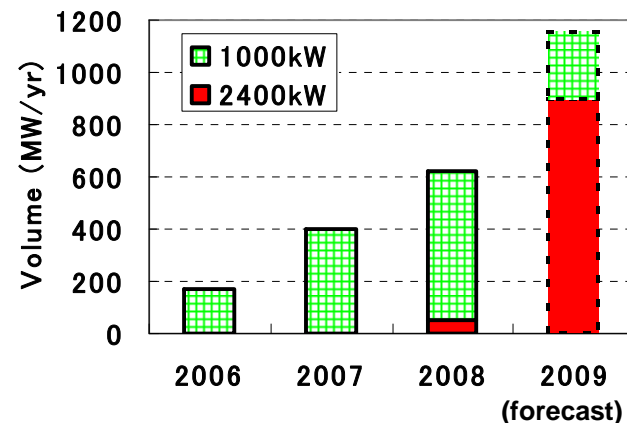
# Wind Turbine Business (USA)

- 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.

“20% Wind Energy by 2030” by DOE

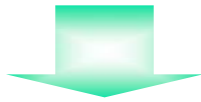


MHI wind turbine installations



# 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.

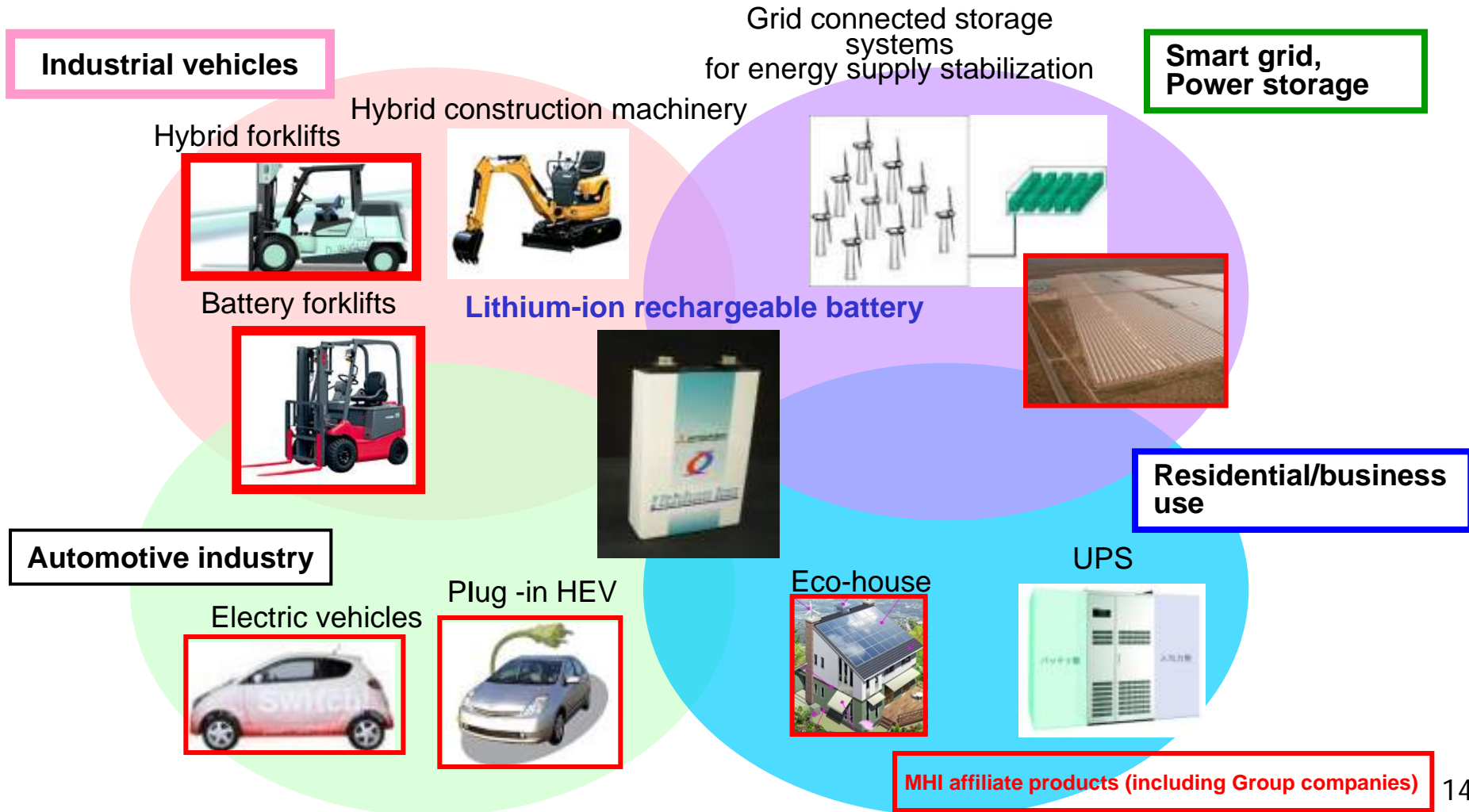


- MHI is sole manufacturer with **wind turbines and ships/marine equipment** capability.
- A design office has been set up in Europe for **developing 5MW class offshore wind turbines**.
- In Japan, participating in NEDO offshore wind turbine demonstration project.



# 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.

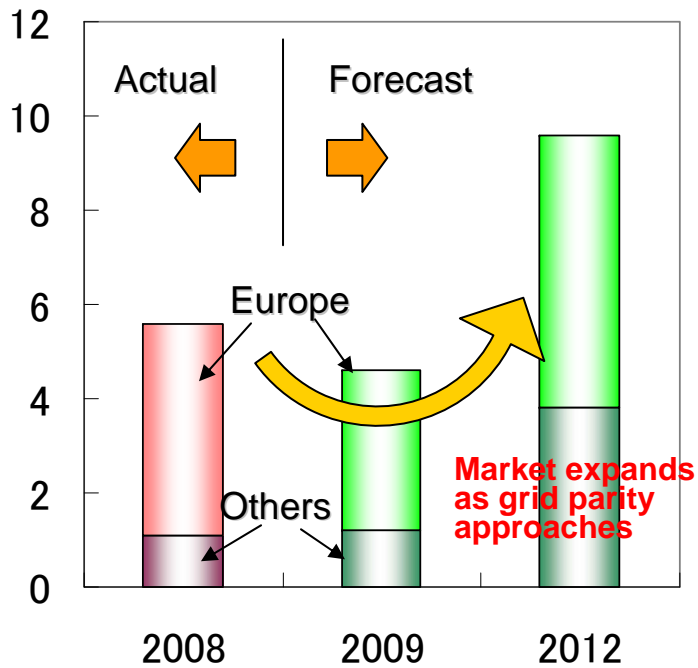


# Photovoltaic Business

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.

PV market forecasts

Installations  
(GW/yr)



EPIA global market outlook for photovoltaics through 2013

## 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



MHI microcrystalline tandem PV application (Huis Ten Bosch)

About 7,000 panels About 900kW

## MHI production capacity

FY2008 78MW

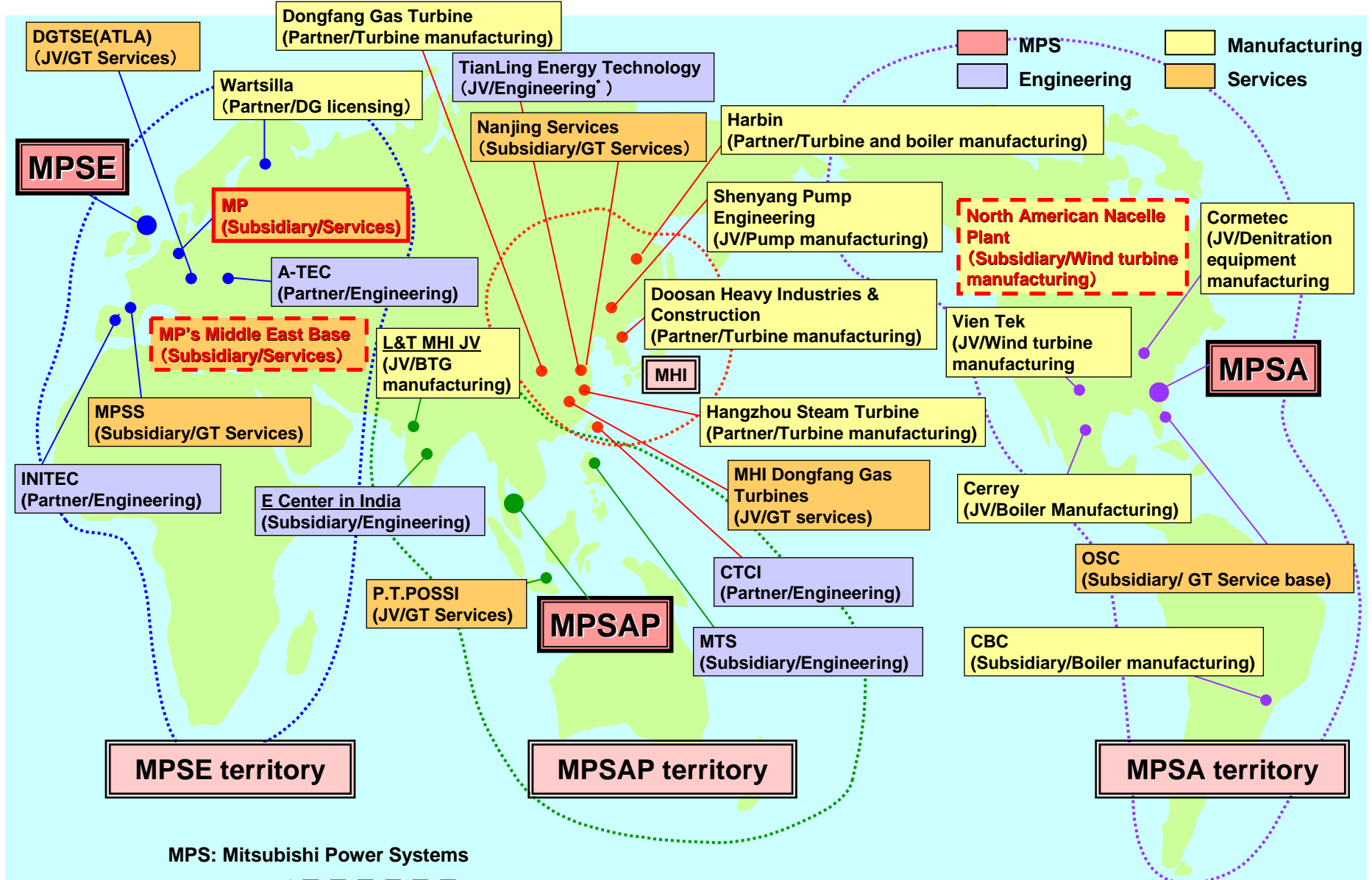


Investments into production expansion while monitoring market trends

\* 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: Mitsubishi Power Systems

Red: changes from 2008

Dotted Lines : Projects under consideration

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



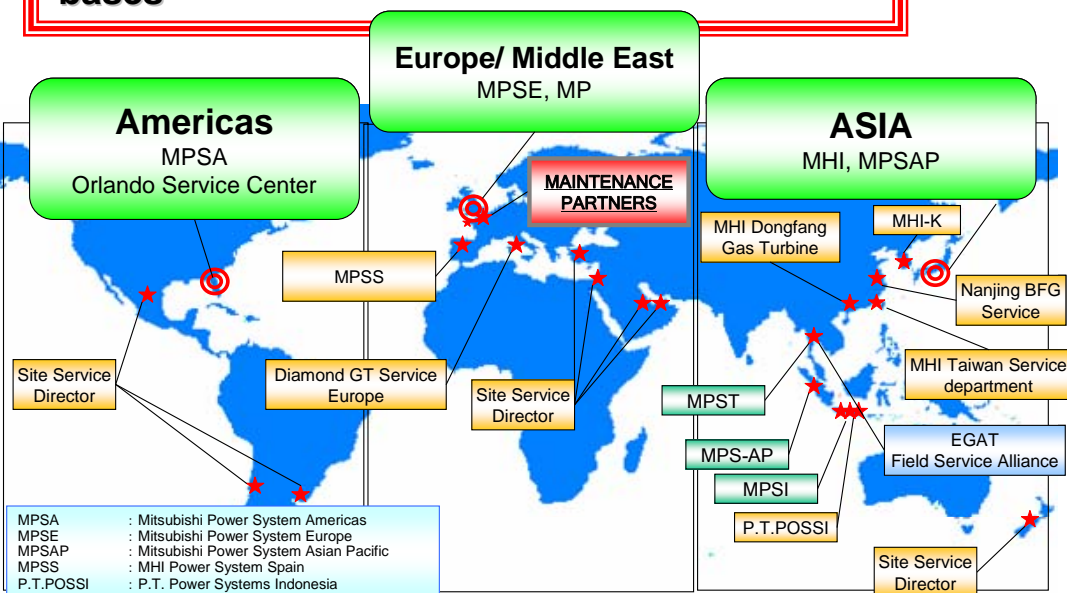
# Global Service Operations

**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**



Pursuing further segmentation from 3-pole network structure

## 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

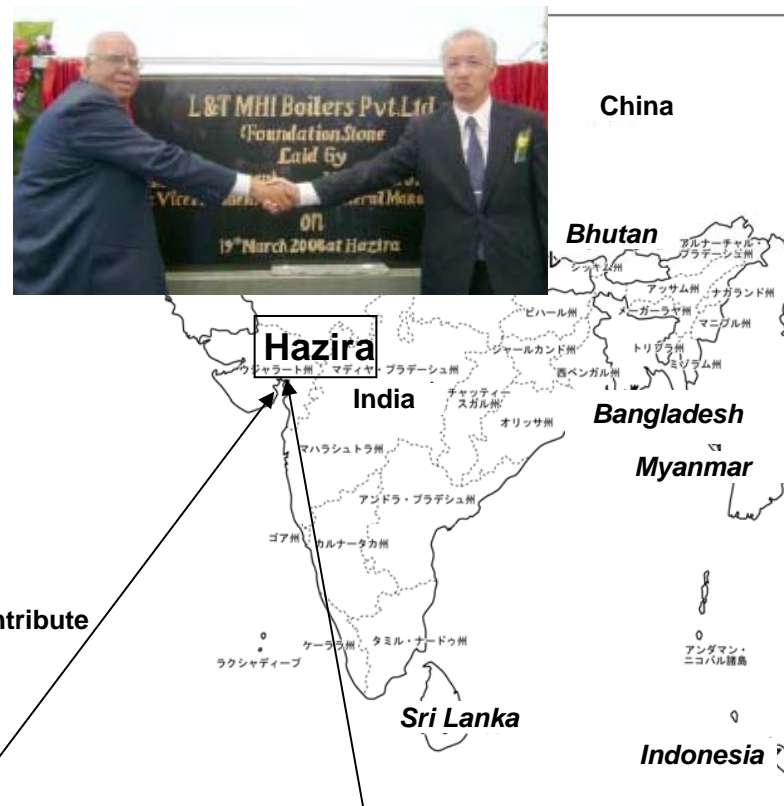
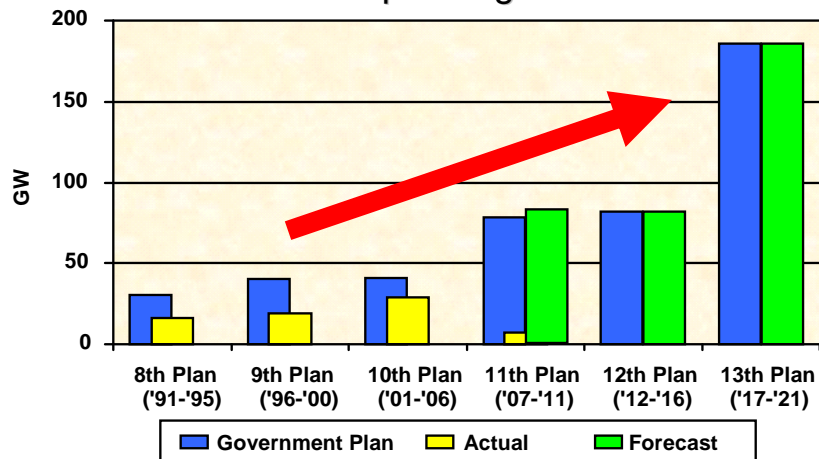
### M701F Users Conference



- Participating plants: 19
- Participating users: 37

# Business Development into Growing Markets (India)

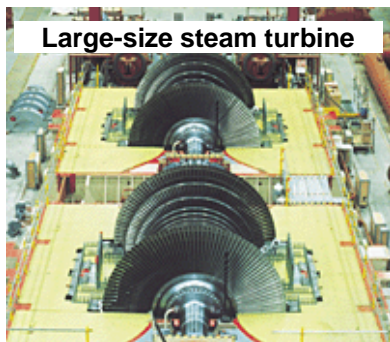
Growth of India thermal power generation market



## Establishment of India JVs & their activities

- In 2007, two JVs, as shown below, were established in India, that supply high-efficiency boiler and 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)



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



# 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)**

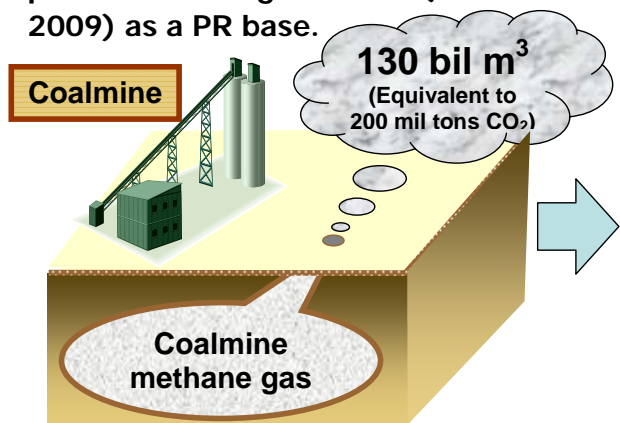
To prevent global warming higher efficiency is being achieved by combining the waste heat from gas co-generation and a heat pump.

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

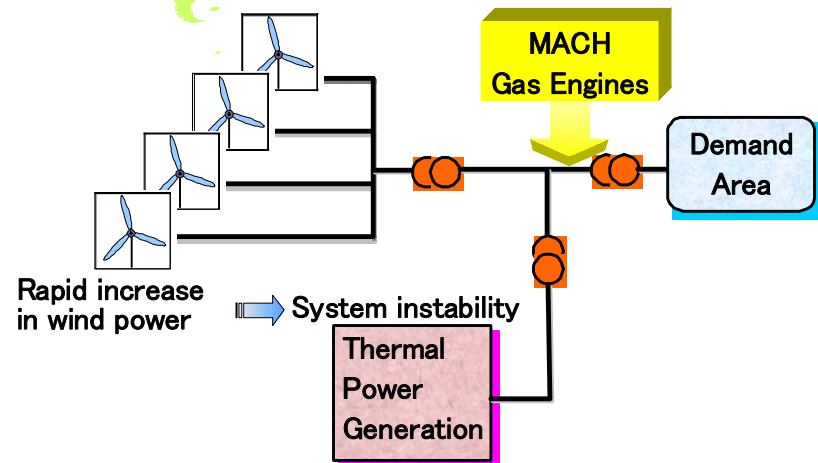
Sales of quick-start gas engines (100% load within 5 min) are to be expanded (400MW/yr) for around 50MW distributed allocation.

**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.



**MACH Gas Engines  
(Equivalent to 6.5GW)**



# 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





Our Technologies, Your Tomorrow

A red swoosh underline that starts under the text and extends to the right, ending in a pointed arrowhead.