

# COMPANY PROFILE



## Mitsubishi Power, Ltd.

3-1, Minatomirai 3-chome, Nishi-ku, Yokohama,  
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[power.mhi.com](http://power.mhi.com)



# Top Message

## Creating a future that works for people and the planet by developing innovative power generation technology and solutions

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The global energy sector is rapidly changing. Around the world, there are initiatives to ramp up decarbonization of power systems, develop new digital technologies and significantly transform the energy mix. Through it all, Mitsubishi Power has brought to market solutions that are reliable, efficient and economical, while also achieving high environmental performance.

As a company, we are committed to addressing the various needs of our customers, by designing equipment to handle various types of fuel, maintaining output flexibility as more renewables enter the market, and optimizing operations and maintenance through deep technologies such as AI and IoT. At the same time, we continue to accelerate our global efforts to help provide reliable, accessible and affordable electricity for all.

Mitsubishi Power is creating a future that works for people and the planet by developing innovative power generation technology and solutions to enable the decarbonization of energy and deliver reliable power everywhere.



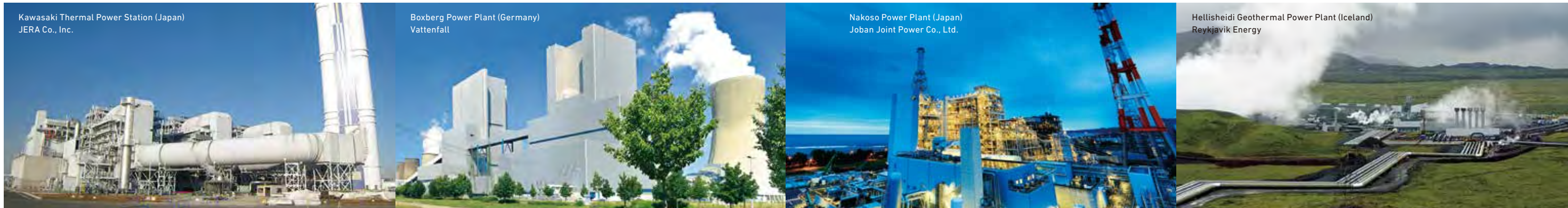
President and CEO  
Ken Kawai





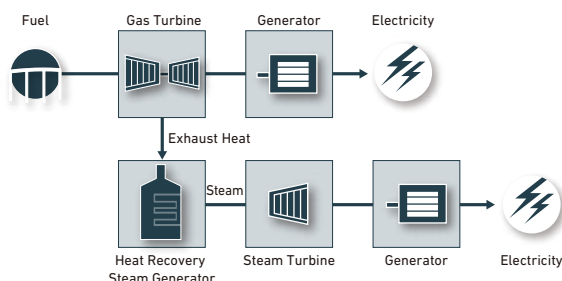
# State-of-the-Art Power Plants that Help Supply Electricity to the World

Mitsubishi Power supplies a variety of power plants in accordance with application and scale. These plants have been rated highly for their outstanding reliability, operability, and ease of maintenance in particular, which has resulted in an extensive proven record around the world.



## GTCC Highly Efficient Energy via Combined Cycle Power Generation

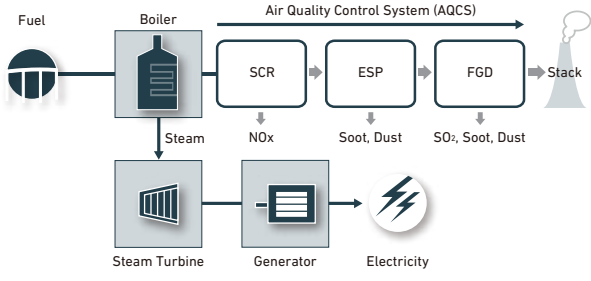
Gas Turbine Combined Cycle (GTCC) power plants utilize fossil fuels to deliver the cleanest and most efficient power generation possible. In addition to the power generated by a gas turbine, the system also incorporates a steam turbine to utilize exhaust heat in achieving optimal power-generation efficiency. Plants employing Mitsubishi Power's state-of-the-art J-series gas turbines have about 30% higher power generation efficiency than conventional coal-fired thermal power generation systems, and have the potential of achieving the world's highest level of efficiency at 64% or more. In addition, GTCC power plants enable CO<sub>2</sub> emissions to be reduced by around 50%.



Gas Turbine Combined Cycle Power Plants (GTCC)

## Steam Power Several Types of Fuel Are Applicable to High Efficiency Power Generation Plant

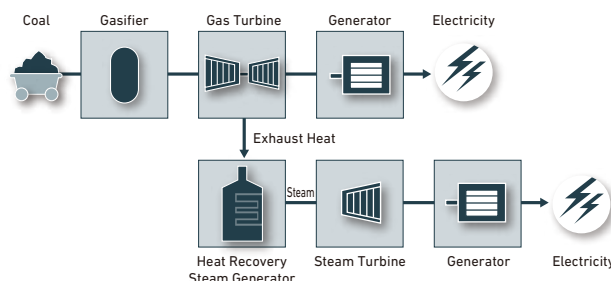
Steam power plants generate electricity utilizing not only fossil fuels but also a variety of other types including biomass, by-product gas, and oil pitch to generate electricity. Mitsubishi Power has an extensive record in terms of high-efficiency ultra-supercritical pressure boilers and steam turbines with an output of over 1,000 MW. Mitsubishi Power also have developed unique technologies that enable the efficient burning of lignite (low-grade coal), which is generally difficult to use due to its high water content, and leads the world in technologies for clean emissions in steam power plants.



Steam Power Plants

## IGCC Highly Efficient, Clean Power Utilization Based on Coal Gasification

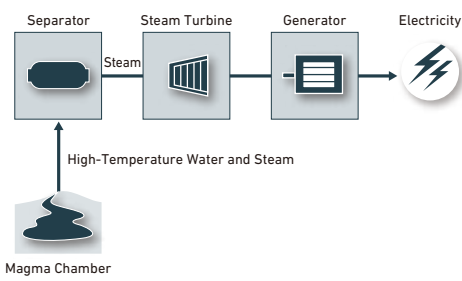
The Integrated coal Gasification Combined Cycle (IGCC) system is a next-generation power generation system with significantly enhanced power generation efficiency and environmental performance due to its combination of coal gasification via a gasifier with a Gas Turbine Combined Cycle (GTCC) system. Large IGCC systems can improve power generation efficiency by approximately 10-15% and reduce CO<sub>2</sub> compared to conventional coal-fired thermal power systems. Mitsubishi Power has two types of coal gasification technologies—namely, air-blown and oxygen-blown—and leads the world in terms of technological capability.



Integrated coal Gasification Combined Cycle Power Plants (IGCC)

## Geothermal Utilizing Natural Energy with Cutting-Edge Power Generation Technologies

Geothermal power generation refers to a system of generating high-efficiency, clean power by extracting heat energy from the ground in its natural state. Mitsubishi Power was the first in the world to apply a combined system that consists of a two-phase flow transportation system and a double-flash cycle, which has now been applied to geothermal power generation worldwide. Our geothermal power generation systems have achieved the world's top delivery record.



Geothermal Power Plants

## Products

### Gas Turbines



We have a wide range of gas turbines to respond to diverse needs, including everything from turbines in the 30-MW class to turbines in the 560-MW class. Up until now, we have delivered more than 1,500 units in over 50 countries, including aero-derivative gas turbines, gas turbines for power-generation, and gas turbines for industrial use.

### Steam Turbines



We manufacture and deliver a wide variety of steam turbines, including everything from small single-cylinder turbines for industrial use to large turbines for nuclear power. Of these, the large turbines can handle any combination of power (thermal power / nuclear power) and frequency (50 Hz / 60 Hz), and have the capability of handling over 1,000 MW.

### Boilers



We have unique combustion technologies for handling diverse types of fuel, including coal, heavy oil, biomass, natural gas, and other fuel gas. In addition, we have boiler technologies that can handle high steam temperatures of over 600°C, which makes it possible to achieve high efficiency.

### Environmental Equipment



Our environmental equipment helps to clean up air pollutants emitted by thermal power plants, thereby reducing the environmental burden. Our extensive results in this field include over 1,400 SCR systems for removing NO<sub>x</sub> (nitrogen oxides), 300 FGD systems for removing SO<sub>2</sub> (sulfur dioxide), and over 3,200 ESP (electrostatic precipitators) for removing soot and dust.

### Generators



We provide highly efficient turbine generators that employ a range of cooling systems, such as air cooling, hydrogen cooling, and water cooling generators. In addition, we provide special generators that include synchronous condensers intended to achieve power-system stabilization as well as short-circuit generators for laboratories and institutes.

### Control Systems



We deliver control systems that offer optimal reliability and operational rates, and that are designed to bring out the full potential of machinery. In conjunction, we provide responsive service solutions related to long-term maintenance support, linkage with AI and the cloud, functional safety, and cyber security.



# Mitsubishi Power's Technological Development: Toward a Future of Brighter and Safer Energy

## Reducing CO<sub>2</sub> with the World's Leading Level of Efficiency Large Gas Turbines

Mitsubishi Power develops cutting-edge gas turbines by incorporating the latest advances in aerodynamics, cooling design, and material technologies. Our state-of-the-art JAC gas turbine have achieved a turbine-inlet temperature of 1,650°C and a power generation efficiency of 64% or more. We have a power plant for verification tests at Takasago Works (in Takasago City, Hyogo Prefecture), and we completed new facility (T-Point 2) for long-term validation of JAC gas turbine in 2020. We provide highly efficient, highly reliable products that are backed by many years of operational experience.

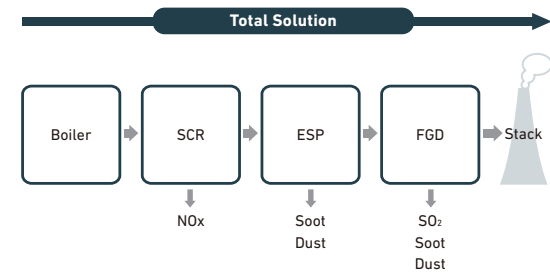


## The World's No.1 Share of the Flue Gas Desulfurization (FGD) Market Air Quality Control Systems (AQCS)

An Air Quality Control System (AQCS) is a system for cleaning up gas emitted by thermal power plants through the combination of a selective catalyst reduction (SCR) system for removing NO<sub>x</sub>, an electrostatic precipitator (ESP) for removing soot and dust, and a flue gas desulfurization (FGD) system for removing SO<sub>2</sub>. Mitsubishi Power has the world's No.1 share of the FGD market, and we have utilized our technologies to jointly develop an FGD system for ships with Mitsubishi Shipbuilding.

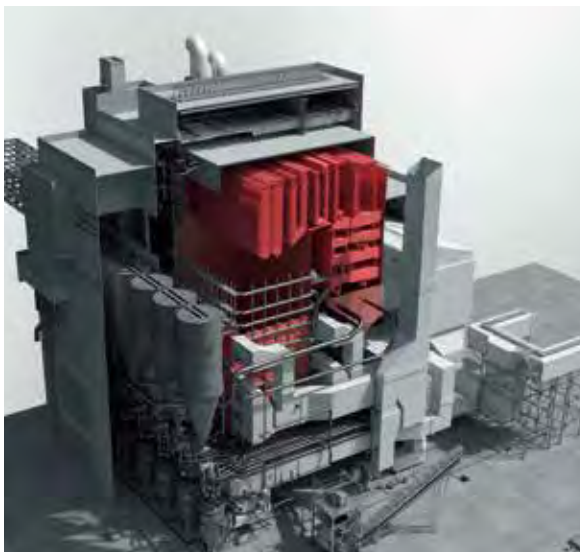


Hirano Thermal Power Station (Japan), JERA Co., Inc.



## Backing Up Renewable Energy Aero-Derivative Gas Turbines

PW Power Systems, Mitsubishi Power group company, is developing and selling aero-derivative gas turbines to which aircraft jet-engine technologies have been applied to enable a rapid startup time of five minutes or less. These turbines boast outstanding energy-saving performance and load-following capability, are environmentally friendly, and are regarded as an important auxiliary power source for renewable energy, for which the power-generation amount is easily affected by the weather. In addition, due to the durability and refined modular design of our aero-derivative gas turbines, they make it possible to shorten the construction period and achieve mobile power generation (container-type systems and barge power generation), for which they are attracting attention as a maintenance-free power source suitable for emergency situations, natural disasters, etc.

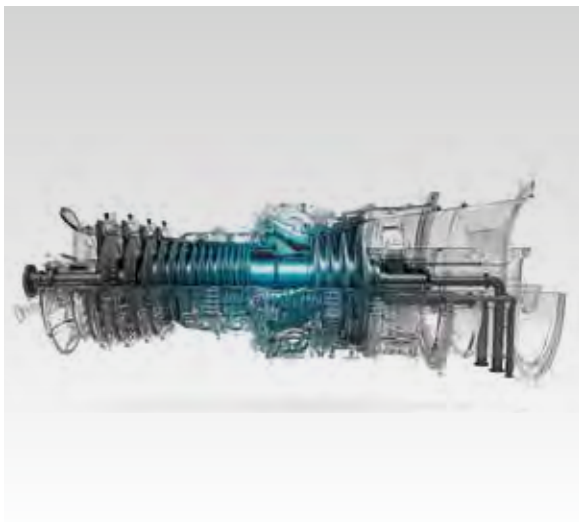


## Reducing Coal-Derived CO<sub>2</sub> Emissions Biomass-Fired / Multi-Fuel Boilers

Mitsubishi Power has developed combustion technologies that allow the use of biomass fuels in coal fired boilers, and now have numbers of operating references. We enable the utilization of biomass fuel as a carbon-neutral solution to reduce coal-derived CO<sub>2</sub> emissions from coal-fired steam power plants. By applying our combustion technologies to newly developed plants, or by retrofitting existing coal-fired boilers, we enable our clients to use biomass fuel as either a primary or complementary, or blended source.

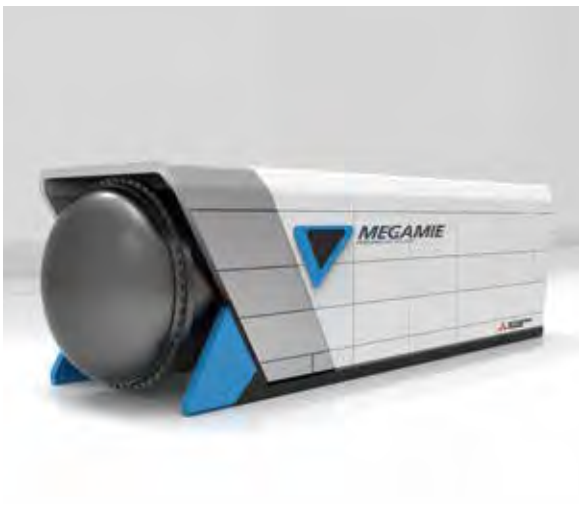
## Next-Generation Power Generation that Does Not Emit CO<sub>2</sub> Hydrogen Gas Turbines

Mitsubishi Power is working on the development of power-generation technologies for handling new types of fuels that reduce CO<sub>2</sub> emissions. Hydrogen has gained popularity as a fuel that does not emit CO<sub>2</sub> when burned. Mitsubishi Power has successfully tested a large-scale turbine that uses a 30% hydrogen fuel mix. The test results confirmed that by using Mitsubishi Power's proprietary burner, which was newly developed to burn hydrogen, stable combustion can be attained even when hydrogen is mixed with natural gas. We will accelerate the development of hydrogen-fueled gas turbines to achieve 100% hydrogen power generation.



## Clean, Distributed Power Generation Fuel Cells (SOFC)

In 2017, Mitsubishi Power launched a new pressurized hybrid power generation system that integrates solid oxide fuel cells (SOFC) with micro gas turbines (MGT) as an effective distributed power generation / cogeneration system option. The system boasts a total efficiency of over 70%, reduces CO<sub>2</sub> emissions compared to conventional cogeneration systems by approximately half, and is expected to be used for a wide range of applications, including private power generation for buildings, hospitals, and plants.





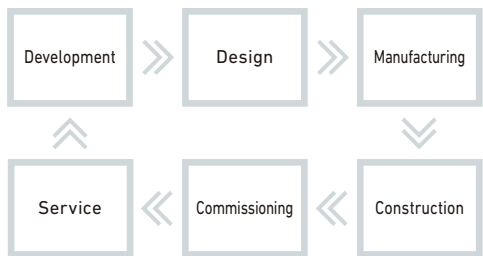
# Total Solutions that Include Product / Technology Development, Design, Construction, and Service



## Mitsubishi Power provides Engineering, Procurement, and Construction (EPC) as “turn-key” solutions for customers.

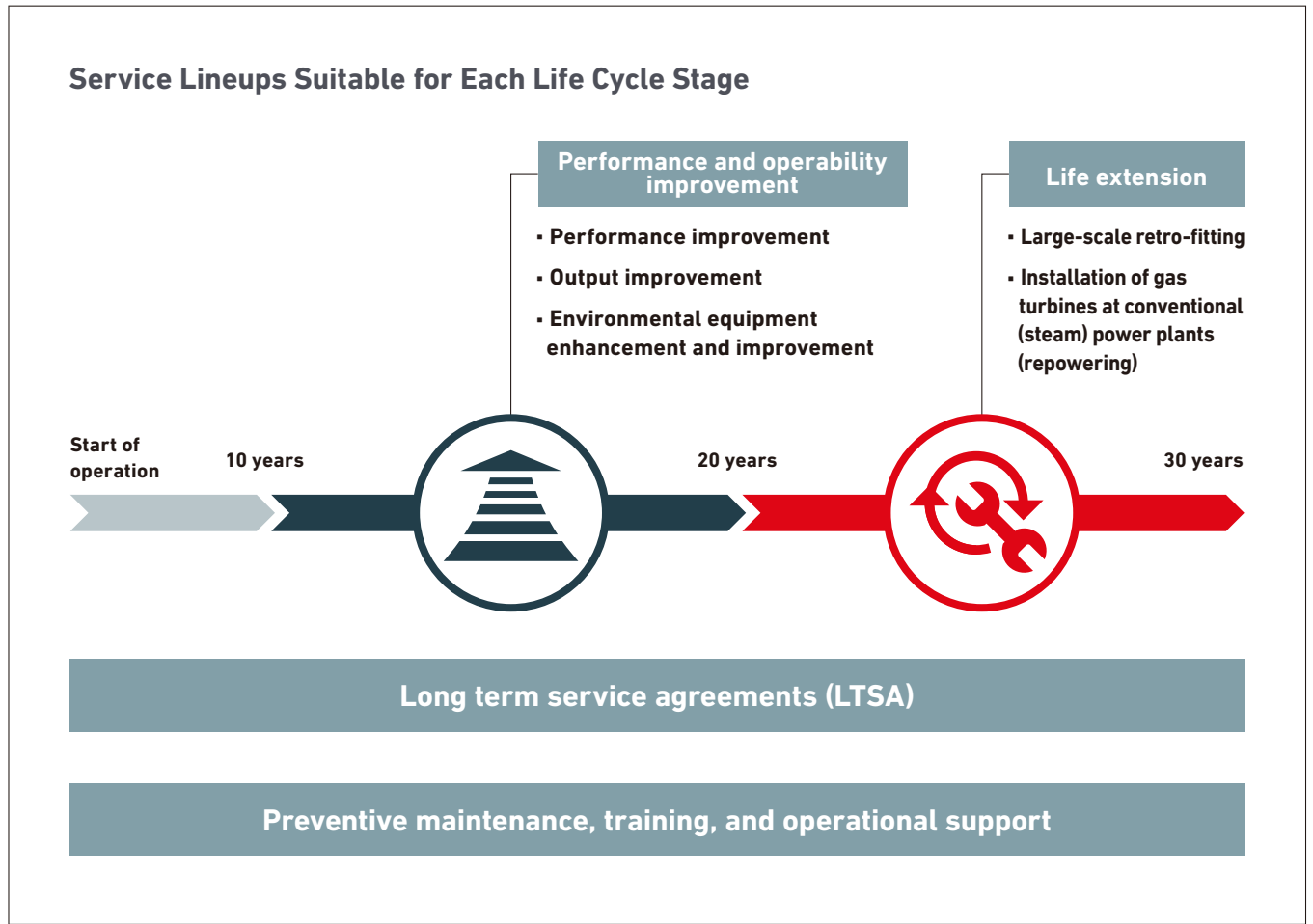
Mitsubishi Power is one of the few contractors capable of delivering self-developed products, accompanied with fully integrated EPC\* solutions. Mitsubishi Power is able to manage complex, large-scale projects within a vastly integrated organization, in which all activities are conducted in a consistent and harmonized manner with a continuous flow of information and a standardized quality control and project management system. Mitsubishi Power continues to be dedicated in contributing to the stable supply of electric power and the reduction of environmental impact all around the world.

\* EPC: Engineering, Procurement, Construction



## Providing Optimal Service According to the Plant Life Cycle

To ensure a stable power supply in line with constantly changing market needs and environmental requirements, we provide a wide range of services, optimized to accommodate customer needs, at every stage of the plant life cycle. In addition, throughout the entire life cycle, we provide operational support and a full range of maintenance and repair services, ensuring full utilization of cutting-edge ICT (information and communications technology), preventive equipment maintenance, human resource development, rapid recovery support, and long term service agreements (LTSA), to meet the diverse needs of our global customer base.



## Digital Solutions, Applying the Latest AI and IoT Technologies

Mitsubishi Power provides digital solutions for a wide range of plants, including those used for grid-level power generation and industrial applications. Mitsubishi Power's digital solutions can be customized to work with customers' existing platforms, thus contributing to O&M optimization as well as improvements in plant performance and operability.



# Delivery Results

## Gas Turbine Combined Cycle (GTCC) / Gas Turbine Power Plants



- 1** a. Tohoku Electric Power Co., Inc.  
b. Shin-Sendai Thermal Power Station Unit 3 (Japan)  
c. 980 MW  
d. 2015 / 2016

- 2** a. Tohoku Electric Power Co., Inc.  
b. Niigata Thermal Power Station Group 5 (Japan)  
c. 109 MW  
d. 2011



- 3** a. JERA Co., Inc.  
b. Kawasaki Thermal Power Station Group 1, 2 (Japan)  
c. 3,420 MW  
d. 2009 / 2016

- 4** a. The Kansai Electric Power Company, Incorporated  
b. Sakaiko Thermal Power Station Units 1-5 (Japan)  
c. 2,000 MW  
d. 2009 / 2010

- 5** a. Gulf JP NS Company, Limited  
b. Nong Saeng Power Plant (Thailand)  
c. 1,600 MW  
d. 2014



- 6** a. Sonelgaz  
b. Algeria  
c. 1,350 MW (FT8MP x 54)  
d. 2011 / 2014 / 2015 / 2017

- a. Client                      b. Plant (country)  
c. Generating power        d. Start Up

## Environmental Plants



- Selective Catalyst Reduction (SCR)**  
**7** a. JERA Co., Inc.  
b. Joetsu Thermal Power Station Units 1-1 / 1-2 (Japan)  
c. 1,190 MW  
d. 2012 / 2013

- 8** a. Xcel Energy  
b. Allen S. King Generating Station (U.S.A.)  
c. 598 MW  
d. 2007



- Flue Gas Desulfurization (FGD)**  
**9** a. JERA Co., Inc.  
b. Hitachinaka Thermal Power Station Unit 2 (Japan)  
c. 1,000 MW  
d. 2013

- 10** a. Electric Power Development Co., Ltd.  
b. Tachibanawan Power Station Unit 1 (Japan)  
c. 1,050 MW  
d. 2000

- a. Client                      b. Plant (country)  
c. Generating power        d. Start Up

Mitsubishi Power's products have been rated highly, particularly on account of their reliability, ease of maintenance, and economical attributes, and have received a great deal of support from users in various countries and regions of the world. Some of our product delivery results over the years are outlined here.

## Steam Power Plants



- 11** a. JERA Co., Inc.  
b. Hitachinaka Thermal Power Station Units 1, 2 (Japan)  
c. 2,000 MW  
d. Bituminous coal / Subbituminous coal  
e. 2003 / 2013

- 12** a. ENEA Wytwarzanie S.A.  
b. Kozenice Thermal Power Plant Unit 11 (Poland)  
c. 1,075 MW  
d. Bituminous coal / Subbituminous coal  
e. 2017



- 13** a. Vattenfall  
b. Boxberg Power Plant (Germany)  
c. 670 MW  
d. Lignite  
e. 2012

- 14** a. Capital Power Corporation / TransAlta Corporation  
b. Genesee Power Generating Station Phase 3 (Canada)  
c. 495 MW  
d. Bituminous coal  
e. 2005



- 15** a. PT Paiton Energy  
b. Paiton III Thermal Power Plant (Indonesia)  
c. 866 MW  
d. Subbituminous coal  
e. 2012

- 16** a. NIPPON STEEL CORPORATION  
b. Oita Works (Japan)  
c. 330 MW  
d. Coal, by-product gas  
e. 2002

- a. Client                      b. Plant (country)  
c. Generating power        d. Fuel  
e. Start Up

## Geothermal Power Plants



- 17** a. Reykjavik Energy  
b. Hellisheidi Geothermal Power Plant (Iceland)  
c. 250 MW  
d. 2006-2011

- 18** a. Kyushu Electric Power Co., Inc.  
b. Hatchobaru Power Plant Units 1, 2 (Japan)  
c. 110 MW  
d. 1977 / 1990



- 19** a. Kenya Electricity Generating Company Limited  
b. Olkaria II Power Station (Kenya)  
c. 105 MW  
d. 2003 / 2010

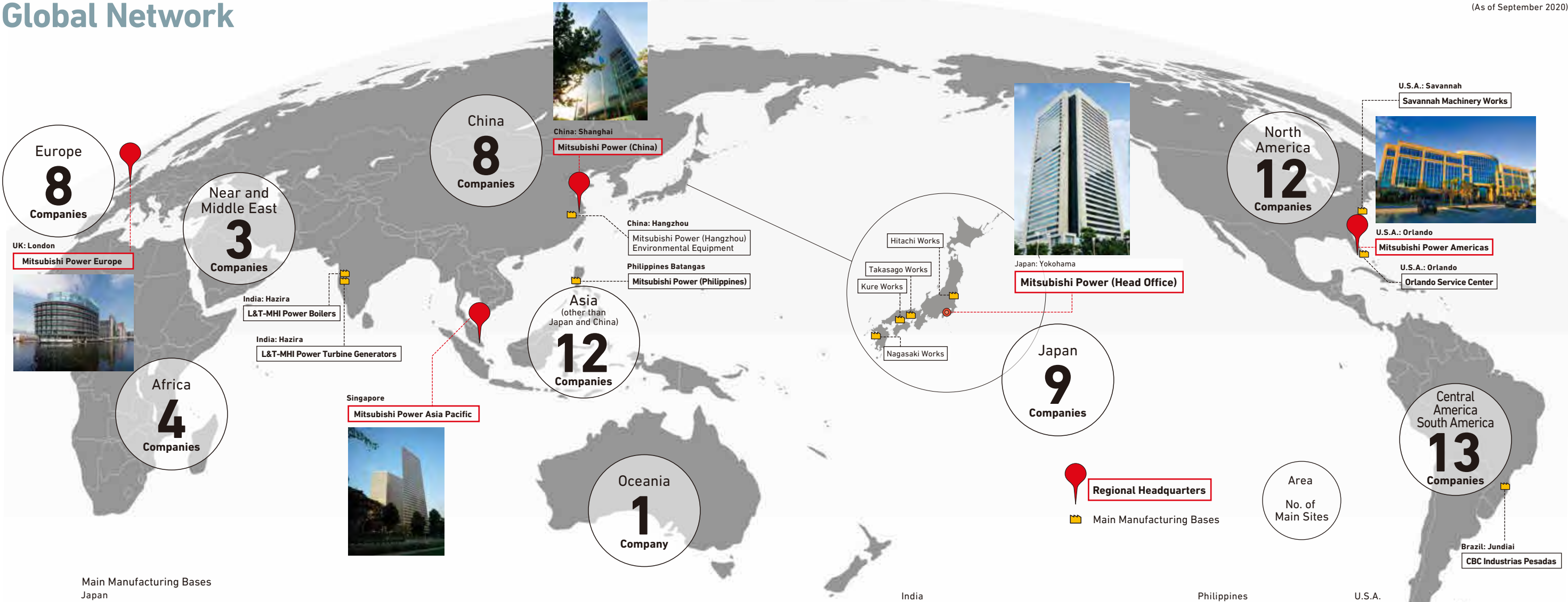
- 20** a. Instituto Costarricense de Electricidad  
b. Miravalles III Power Station (Costa Rica)  
c. 27 MW  
d. 2000

- a. Client                      b. Plant (country)  
c. Generating power        d. Start Up



Global Network

(As of September 2020)



Main Manufacturing Bases Japan



Mitsubishi Power, Ltd.		Group Companies						
Works	Overseas Offices							
	Hitachi Works	Moscow Representative Office (Russia)						
	Takasago Works	Basra Branch (Iraq)						
	Kure Works	Middle East and North Africa (MENA) Branch (U.A.E.)						
	Nagasaki Works	Kuwait Branch	Doha Branch (Qatar)	Taipei Branch (Taiwan)				
Group Companies								
Japan								
Mitsubishi Power Precision Casting Co., Ltd.								
Mitsubishi Power Environmental Solutions, Ltd.								
Mitsubishi Power Industries Co., Ltd.								
MHI Power Engineering Co., Ltd.								
Mitsubishi Power Inspection Technologies, Ltd.								
MHI Power Control Systems Co., Ltd.								
Mitsubishi Power Maintenance Service, Co., Ltd.								
CECYLLS Co., Ltd.								
		Europe, Near and Middle East, Africa						
		UK	Mitsubishi Power Europe, Ltd.					
		Belgium	PW Power Systems Europe SPRL					
		Germany	Mitsubishi Power Europe GmbH	Meeraner Dampfkesselbau GmbH	Babcock Fertigungszentrum GmbH			
		Italy	ATLA S.r.l.					
		Romania	MHI Power Romania SRL					
		Russia	PW Power Systems CIS LLC					
		Algeria	PWPS Algeria LLC					
		Egypt	MHI Power Egypt, LLC.					
		Saudi Arabia	Mitsubishi Power Saudi Arabia, Co.					
			U.A.E.	MHI Power Middle East, L.L.C.	MHI Power Middle East for Manufacturing Parts and Machinery, LLC			
			South Africa	MHI Power ZAF (Pty) Ltd.	Mitsubishi Power Africa (Pty) Ltd.			
			Asia, Oceania					
			India	Mitsubishi Power India Private Limited	L&T-MHI Power Boilers Private Ltd.	L&T-MHI Power Turbine Generators Private Ltd.		
			Singapore	Mitsubishi Power Asia Pacific Pte. Ltd.				
			Thailand	Mitsubishi Power (Thailand) Ltd.	EGAT Diamond Service Co., Ltd.			
			Indonesia	PT. Mitsubishi Power Indonesia			P.T. Power Systems Service Indonesia	
			Philippines	Mitsubishi Power (Philippines) Inc.	MHI Power (Philippines) Plant Services Corporation		MHI Power Technical Services Corporation	
			China	Mitsubishi Power (China) Co., Ltd.				
				Mitsubishi Heavy Industries Dongfang Gas Turbine (Guangzhou) Co., Ltd.	MHI Power Jieneng (Qingdao) Steam Turbine Co., Limited		Mitsubishi Power Gas Turbine Engineering Technology (Nanjing) Co., Ltd.	
				MHI Power Dalian Electricity Equipment Co., Ltd.	Mitsubishi Power (Hangzhou) Environmental Equipment Co., Ltd.		MHI Power Dongfang Boiler Co., Ltd.	
				PW Power Systems (Beijing) Management and Consulting Ltd.				
			Korea	MH Power Systems Korea, Ltd.				
			Australia	Mitsubishi Power Australia Pty. Ltd.				
			North America, Central America, South America					
			U.S.A.	Mitsubishi Power Americas, Inc.				
				MHI Power Florida LLC	Mechanical Dynamics & Analysis LLC			
				Power Generation Services, Inc.				
				Mohawk Labor Services, LLC				
				PW Power Systems LLC				
				PW Power Systems International LLC				
				Energy Services LLC				
				Wood Group Pratt & Whitney Industrial Turbine Services, LLC				
				Oriden LLC				
				Advatech, LLC				
			Canada	Mitsubishi Power Canada, Ltd.				
			Mexico	Mitsubishi Power de Mexico, S.A. de C.V.				MHI Power de Mexico, S.A. de C.V.
				Mechanical Dynamics & Analysis de Mexico, S.A. de C.V.				
			Puerto Rico	MHI Power Puerto Rico, LLC.				
			Barbados	MD&A International Incorporated				
			Venezuela	MHI Power de Venezuela, C.A.				
			Colombia	MHI Power Colombia S.A.S.				
			Ecuador	MHI Power Ecuador CIA. LTDA.				
			Brazil	MHI Power America Latina EIRELI				CBC Industrias Pesadas S.A.
			Chile	MHI Power Chile SpA				
			Argentina	MHI Power Argentina S.R.L.				PW Power Systems Argentina S.R.L.

# History and Development

1850

Mitsubishi Heavy Industries, Ltd.

1884

Mitsubishi Heavy Industries established  
(Lease of Government-Owned Nagasaki Shipyard)

1900

Yataro Iwasaki (Photo by The Mitsubishi Archives)

1908

Completed first steam turbine [0.5 MW]

1950

1963

Completed first gas turbine  
(Chiba Plant, Asahi Glass Co., Ltd. [12 MW])

1980

Completed conventional power plant  
(Hartha Thermal Power Station, Iraq [200 MW x 4 units])

1984

Completed world's highest efficiency and largest Gas Turbine Combined Cycle (GTCC) power plant  
(Higashi Niigata Thermal Power Station Group 3, Tohoku Electric Power Co., Inc. [1,090 MW])

1988

Completed first H-25 series gas turbine  
Tokuyama Refinery, Idemitsu Kosan Co., Ltd. [25 MW class])

1990

Completed world's first double flash cycle geothermal power plant  
(Hatchobaru Power Plant Unit 2, Kyushu Electric Power Co., Inc. [55 MW])

1997

Developed world's highest efficiency 1,500°C class G-series gas turbine [330 MW]

2000

Completed ultra-supercritical pressure coal-fired conventional power plant  
(Tachibanawan Power Station Unit 2, Electric Power Development Co., Ltd. [1,050 MW 600 / 610°C])

2010

Started commercial operation of first H-100 series gas turbine  
(Shin Oita Power Station Group 1, Kyushu Electric Power Co., Inc. [115 MW x 6 units])

2011

Developed world's highest efficiency 1,600°C class J-series gas turbine  
Started commercial operation at demonstration unit at power plant [389 MW]

2013

Started commercial operation of an Integrated coal Gasification Combined Cycle (IGCC) power plant  
(Nakoso Power Plant Unit 10, Joban Joint Power Co., Ltd. [250 MW])

2014

February: Established Mitsubishi Hitachi Power Systems, Ltd. following integration of thermal-power generation systems businesses of Mitsubishi Heavy Industries, Ltd. and Hitachi, Ltd.  
October: Merged with Babcock-Hitachi K.K.

2016

December: Launched JAC-series Gas Turbines  
  
Received an order for a global state-of-the-art Integrated coal Gasification Combined Cycle (IGCC) power plant  
(Nakoso IGCC Power GK [540 MW])  
(Hirono IGCC Power GK [540 MW])







2017

August: Launched solid oxide fuel cells (SOFC) and Micro Gas Turbines Hybrid Power Generation System

2020

July: Commissioned and started commercial operations of T-Point 2 combined cycle power plant validation facility

September: Established Mitsubishi Power, Ltd.



# Corporate Overview

Company Name

Mitsubishi Power, Ltd.

Establishment

September 1, 2020

Head Office Address

3-1 Minatomirai 3-chome, Nishi-ku, Yokohama, Kanagawa, 220-8401, Japan

Representative

President and CEO Ken Kawai

Capital

100 billion yen

Stockholders

Mitsubishi Heavy Industries, Ltd. (100%)

Number of Employees

Consolidated: 18,356 / Non-consolidated: 9,589 (As of April 2020)

Works in Japan

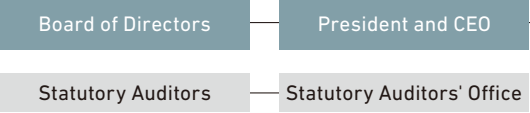
Hitachi / Takasago / Kure / Nagasaki

Offices in Japan

Hokkaido / Tohoku / Hokuriku / Chubu / Kansai / Chugoku / Shikoku / Kyushu

Number of Main Group Companies

69 companies (including 8 companies in Japan)



CSO : Chief Strategy Officer  
CFO : Chief Financial Officer  
CAO : Chief Administrative Officer  
CTO : Chief Technology Officer

