Power for a Brighter Future

MHPS

Integrated coal Gasification
Combined Cycle
Power Plants
HOW TO POWER THE WORLD

Our planet is calling for affordable, sustainable, highly reliable and clean power. Together we can achieve it.

Power grows when we all work together.

Today, one in six people around the world lives without reliable access to electricity, while global demand for power continues to grow. The mission of Mitsubishi Hitachi Power Systems, Ltd. (MHPS) is to address those needs by providing more affordable, highly reliable and cleaner energy solutions.

MHPS was born through the merger of the thermal power generation divisions of Mitsubishi Heavy Industries, Ltd. and Hitachi, Ltd. in 2014. Based on our parent companies' long histories of product development and supply for more than a century, we have been dedicated to designing, manufacturing, supplying, engineering, installing and providing support services for a wide range of proprietary power generation systems.

One of our products is the gas turbine, the engine of gas turbine combined cycle (GTCC) power plants, which provides incredibly efficient electric power while reducing greenhouse gas emissions. We also provide multi-generation thermal power systems, such as integrated coal gasification combined cycle (IGCC) power plants, thermal power plants, geothermal power plants, air quality control systems (AQCIS) and digital solutions MHPS-TOMONI®. We will continue our mission to address power needs by developing technologies that enhance the global environment and provide affordable, sustainable, reliable power for the planet.

Power for a Brighter Future
High efficiency
A power generation system with high efficiency is essential for overall environmental performance. IGCC power plants offer superior environmental performance compared to older plants with solid fuel-fired technology and capture CO2 emissions.

Coal Flexibility
Flexible design allows for the use of a wide variety of coals, which are abundant in the world. This allows IGCC to remain competitive as a power generation source even as coal supplies fluctuate.

Superior Performance
IGCC power plants can achieve more than 48% efficiency, which is higher than that of most other power plants. This efficiency is achieved through advanced gasification and combustion technologies.

Environmental
IGCC plants capture CO2 emissions, making them a leading technology for reducing greenhouse gas emissions. This technology offers a low-carbon solution for power generation.

IGCC Power Plants

IGCC (Integrated Gasification Combined Cycle) is a power generation technology that is widely accepted for its high efficiency, flexibility, and environmental benefits.
Answering the call for lower-emission coal-fired power plants

Today, 40% of global electricity depends on coal for fuel and it will continue to be the primary source of energy in many countries for the foreseeable future, largely due to its high energy density per unit mass. It is the major source of carbon dioxide emissions, which contribute to global warming. Therefore, efforts to reduce the emissions from coal-fired power plants are critical to mitigate climate change.

This is where the latest technology comes in. New coal-fired power plants designed with advanced technologies can significantly reduce emissions while maintaining efficiency. These new plants are characterized by high thermal efficiency and low emission levels, making them a key solution in the fight against climate change.

Two Types of Coal Gasification Technology

MORFs offers two coal gasification technologies: Air-blown gasifier and Oxygen-blown gasifier. Each effectively utilizes coal resources and protects the environment, making MORFs poised to lead the industry.

Air-blown gasifier

This technology utilizes a reactor between coal and oxygen as a gasification agent, producing chemically pure syngas, which is primarily composed of carbon monoxide (CO) and hydrogen (H2). The gasifier is based on a single-chamber, downwind design with preheating of the air and oxygen in the air preheater, ensuring efficient operation. The syngas generated is highly pure and can be used for various applications, such as power generation, synthesis gas production, and chemical feedstock.

Oxygen-blown gasifier

This technology involves a reactor between coal and oxygen, with oxygen as the gasification agent, utilizing the oxygen-instead-of-air effect. This results in a more efficient and cleaner process, reducing emissions and improving energy efficiency. The high-purity syngas produced can be used for power generation, synthesis gas production, and chemical feedstock applications.

Specifications for a single 10 MW coal gasification plant

<table>
<thead>
<tr>
<th>Component</th>
<th>Input/Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>100 kg/h</td>
</tr>
<tr>
<td>Water</td>
<td>10 kg/h</td>
</tr>
<tr>
<td>Gas</td>
<td>500 m³/h</td>
</tr>
<tr>
<td>Power</td>
<td>10 MW</td>
</tr>
<tr>
<td>Efficiency</td>
<td>75%</td>
</tr>
</tbody>
</table>

In summary, the advancement in coal gasification technology offers a promising solution to the challenge of reducing emissions from coal-fired power plants. By adopting these advanced technologies, we can achieve a balance between energy production and environmental sustainability, contributing to a cleaner and more sustainable future.
Gas Turbines
For more than 40 years, MHI has led the development of gas turbines, integrating the latest advances in aerodynamics, cooling design and material technologies to achieve high efficiency and reliability.

Evolution of the F-series
The M701F was released in 1992 to serve the US market, and over the years, MHI has continued to develop and improve the performance of its gas turbines. In each development phase, MHI has introduced improved components and materials from its F and G series gas turbine technologies. The F-series gas turbines are a proven reliable design that is likely to keep power generation needs for many years to come.

A more efficient compressor
Variable guide vanes operate to regulate the gas turbine airflow in order to maintain stable high exhaust temperatures and high part load for improved bottoming cycle efficiency.

A giant step in gas turbine development
When MHI incorporated its latest aeroderivative combustor technology into the advanced cooled combustion, the M501G was born. Basic compressor discharge air and gas path do not require any external cooling sources. The advanced GAC, with an cooled combustion, improves operational flexibility by eliminating any need for the cooling from the bottoming cycle.

A high-pressure multi-stage compressor
The GAC uses the existing proven sleeve compressor, a common multi-stage design. This is followed by a high efficiency and high-pressure ratio variable guide vanes are operable to modulate the gas turbine and to maintain relatively high exhaust temperature at part load for improved bottoming cycle efficiency.

A four-stage axial-flow turbine
The turbine employs a 3D aerodynamic design in a four-stage axial-flow turbine, braided/coolant-fed (B/C) material with thermal barrier coating (TBC) are applied to the first two stages and the first three stages are cooled. The blades for the turbine are 1 to 3 mm thick. The remaining vanes are cooled by compressor intermediate stage bleed air. The third and fourth stages on the turbine enter the freewheeling area. The first and fourth stages are integral slugs, each row of vanes is supported in a separate blade ring, which is brazed and supported to permit radial and axial thermal stress characteristic of axial turbines.

M701F
M501GAC
Bottling Cycle

Steam Turbines

Contributing to global power generation for more than 100 Years.

MPS’s steam turbines are built with more than a century of SLM & manufacturing experience, and each unit undergoes rigid factory testing. We have a successful track record of delivering highly reliable and efficient steam turbines to customers around the world.

We offer a comprehensive range of steam turbines including small and medium-sized turbines for industrial applications, large turbines for thermal power plants, turbines for nuclear power plants and turbines for geothermal power plants. Our line-up covers a range of different applications and operating requirements, and offering high efficient turbines that meet the needs of our customers, we are working to reduce CO₂ emissions and preserve the environment.

Heat Recovery Steam Generators

MPS’s heat recovery steam generators (HRSGs) apply cutting-edge technologies to provide world-leading quality, performance, and reliability.

An HRSG is a type of heat exchange that recovers heat from the exhaust gases of a gas turbine to an extreme degree, the heat is replaced with high pressure and high temperature steam, which serves as the power source of a power-generating steam turbine.

Utilizing advanced materials and designs, the HRSG system is compact, and a compact design reduces the installation footprint of the equipment.

In addition, Sulzer’s Catalytic Reduction (CDR) equipment is included in the HRSG, reducing the content of nitrogen oxide in the exhaust gases released into the atmosphere.

Heat recovery steam from gas turbine is superheated in HRSG, therefore it also serves as the power source of steam Turbine.

Generators

MPS develops a wide range of highly reliable and efficient generators backed by decades of applied experience.

More than 5,000 generators delivered.

To date, MPS has delivered more than 5,000 turbine generators around the world, with a strong and big operational track record. MPS has earned an exceptional reputation for product reliability.

Supporting a wide range of power systems

MPS provides turbine generations that employ a range of cooling systems, including air-cooling, hydrogen-cooling, and water/steam-cooling systems. MPS also offers solutions that span the entire product lifecycle, including sales and maintenance.

Control Systems

Today, a wide range of devices and applications are interconnected, and MPS’s control systems are processing enormous volumes of data and device information to strike a balance between openness and high reliability.

Offering highly reliable control systems

For several decades, MPS has developed and supplied control systems that maintain high reliability and efficiency, while meeting maintenance support and safety requirements throughout the lifespan of machinery and equipment at power plants around the world.

Our proprietary DCS/PCS Series

MPS’s Digital Control System, or DCS/PCS, maintains high reliability and an impressive service life, while incorporating the latest techniques and control technologies of a latest manufacturing. MPS’s features a distributed control system (DCS) providing ease of use for the plants, from operation to plant equipment and maintenance personnel.

Services

Proposing services tailored to meet diverse customer needs.

Extended Services & Solutions

Providing a vast array of power system services to address specific and wide-ranging customer needs. MPS contributes to improving power plant availability and maintaining customers’ asset values by providing proven system assessment covering a full spectrum of maintenance for specified periods, reducing the risks associated with plant operation and maintenance and streamlining the time required for regular inspections and performance upgrades.

Using modern digital technologies, MPS provides a unique solution for power generation equipment and all quality control systems.