MOVE THE WORLD FORWARD

MITSUBISHI HEAVY INDUSTRIES GROUP

DATA CENTER ONE-STOP SOLUTIONS

MITSUBISHI HEAVY INDUSTRIES

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MITSUBISHI HEAVY INDUSTRIES

The Importance of Data Centers for Better Tomorrows and Social Issues

The impacts of digital transformation continue to accelerate throughout society. Data centers have become integral to the social infrastructure. They accordingly have to become larger and deliver better processing capacity.

At the same time, there are growing concerns about the environmental impacts of data centers, as cooling data centers consumes a considerable amount of energy resulting in an increase in CO_2 emissions.

Mitsubishi Heavy Industries (MHI) Group Profile

We are one of the world's top conglomerates. Our operations extend from energy, logistics, and infrastructure to industrial machinery, aerospace, and defense. We have underpinned social infrastructure on land, across the oceans, in the air, and up in space for more than 130 years. We are spearheading global efforts to tackle climate change by bringing our technologies together in the drive toward realizing carbon neutrality.

Key Businesses and Products

ENERGY

AIRCRAFT

SPACE

SHIP & OCEAN

MATERIAL HANDLING

ENVIRONMENT

INDUSTRIAL MACHINERY

DEFENSE

Revenue	Number of employees	Global network
¥4,200 billion	77,283	254 subsidiaries and affiliates
(On a consolidated basis in fiscal 2022)	(On a consolidated basis as of March 31, 2022)	(As of March 31, 2022)

Our History: Creating a Better World

More than 130 years

1880–

Develops Japan's infrastructure

1884

Establishment: Leases a government-owned shipyard and starts constructing ships

1950–

Contributes to Japan's rapid economic growth

1968

Builds the *Hakone Maru*, Japan's first container ship

1970–

Provides global solutions for fuel diversity and energy efficiency

1985

Tohoku Electric's 545-MW Higashi-Niigata Thermal Power Station–one of the world's largest combined cycle power plants–begins operation

2010–

Leading the world with technology that drives carbon neutrality

2011

Achieves world's highest turbine inlet temperature of 1,600°C in test operations of advanced J Series gas turbine

2016

Completes one of the world's biggest flue gas carbon dioxide capture units for an American oil recovery facility

1868–
Japan's Industrial Revolution

1950–
Rapid economic growth (GDP growth exceeded 15% annually during this period)

1973/1979
Oil Crisis

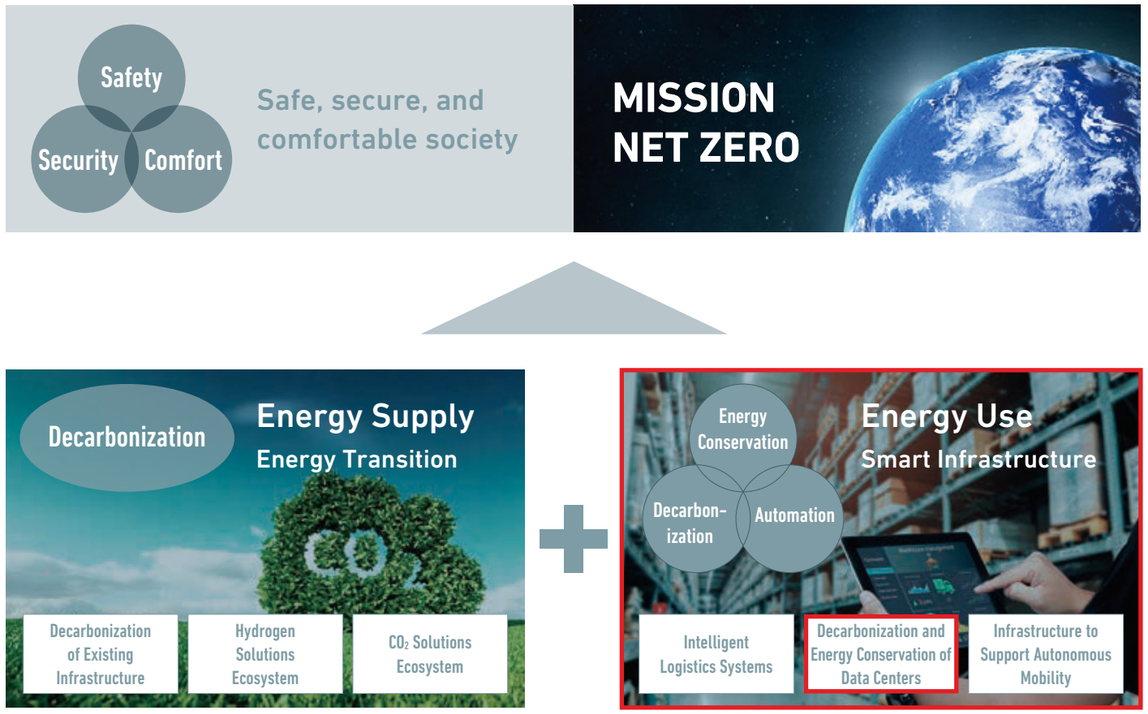
2015
Paris Agreement on climate change

Our Vision

We have supported social infrastructure for more than 130 years, contributing to global economic progress.

In keeping with our enduring commitment to human development and harmony with the environment, we will keep pursuing carbon neutrality from both energy supply and demand perspectives and help materialize a better world.

MHI's Initiatives for a Sustainable Society



Our One-Stop Solutions

Mitsubishi Heavy Industries is a single point of contact to help realize your sustainable data center.

The power supply, cooling, and digital infrastructure that helps data centers to operate stably demands reliable and innovative cooling capabilities that can manage advanced processing capacity and ensure outstanding energy efficiency. Mitsubishi Heavy Industries draws on its advanced technology and ample experience to offer comprehensive data center infrastructure solutions, tailoring data center concepts to the specific requirements of customers.

The One-Stop Solutions Value Proposition

Improved power and water usage effectiveness to reduce CO_2 emissions and water consumption for environmentally friendly and sustainable data centers

Enhanced cash flow for customers by increasing data center density and boosting power usage effectiveness

Higher cash inflows

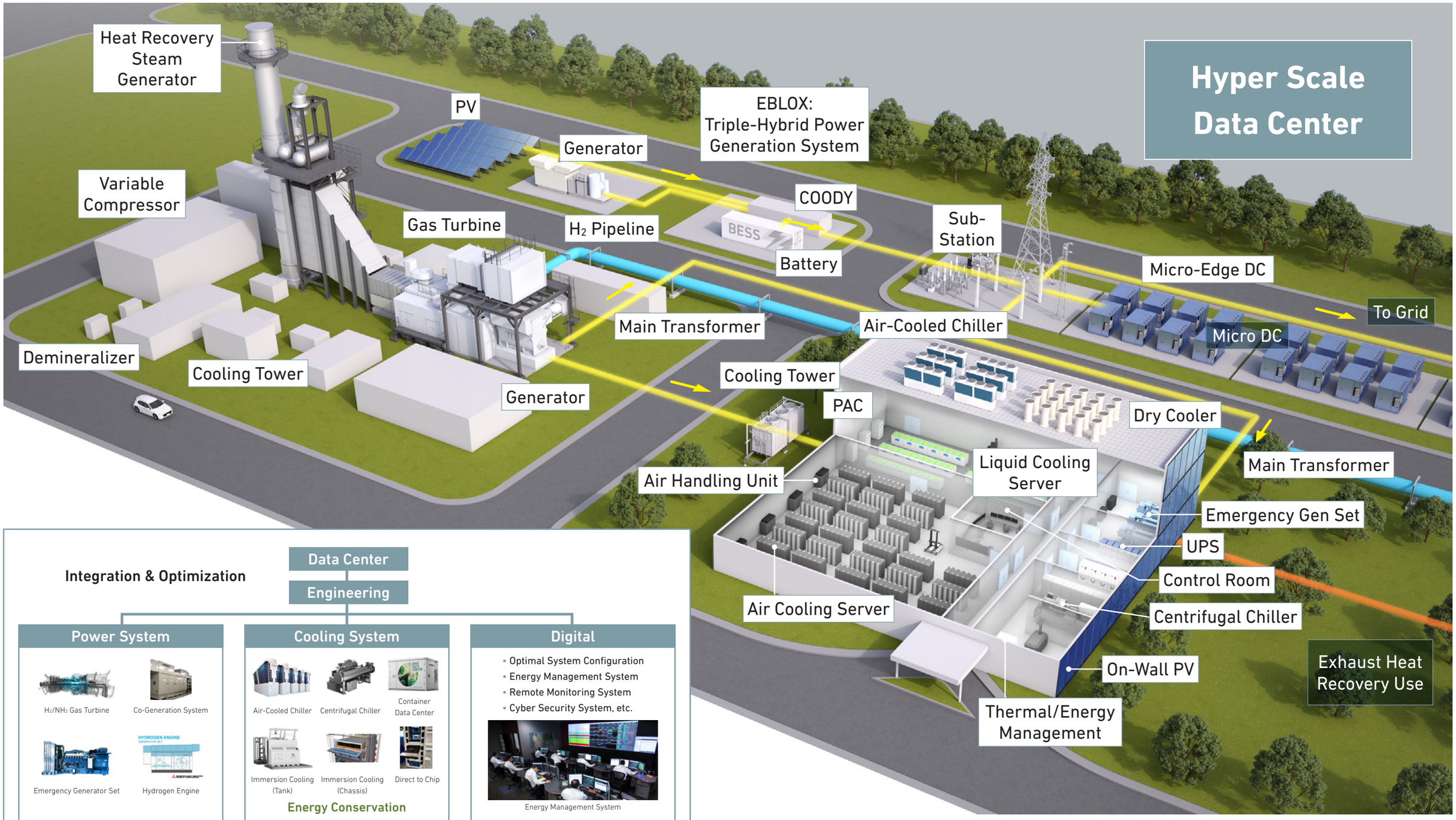
- Maximizing CPU and GPU performance
- AI-based services deployment
- More available power for IT

Lower cash outflows

- Cutting operating expenses by conserving energy
- Reducing impacts of water and electrical systems (lowering capital expenditures)
- Minimizing installed equipment (lowering capital and operating expenditures)
- Space savings (lowering capital expenditures)

Sustainable Data Centers

We make data centers green and sustainable by providing one-stop solutions that integrate power, cooling, and digital technology to decarbonize data centers in terms of power supply and conserving energy.



Integration & Optimization

Data Center

Engineering

Power System

H_2/NH_3 Gas Turbine

Co-Generation System

Emergency Generator Set

Hydrogen Engine

Green Power, Decentralization

Cooling System

Air-Cooled Chiller

Centrifugal Chiller

Container Data Center

Immersion Cooling (Tank)

Immersion Cooling (Chassis)

Direct to Chip

Energy Conservation (Electricity, Water)

Digital

- Optimal System Configuration
- Energy Management System
- Remote Monitoring System
- Cyber Security System, etc.

Energy Management System

Smartly and Securely

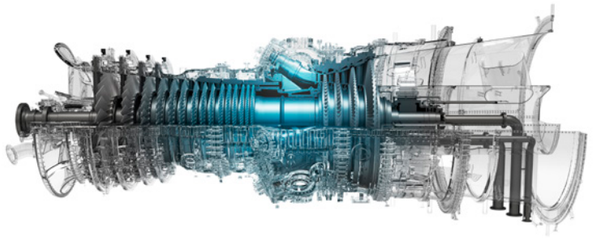
Power Supply Systems

Providing Highly Reliable, CO_2-Free Power Supply Systems

Our power generation and engine businesses have proven track records, offering reliable power sources for data centers. We will realize carbon-free energy supplies through fuel conversion using hydrogen gas turbines that are under development and scheduled to switch fully to hydrogen-only combustion by 2025, and hydrogen engines.

Gas Turbine

- **H25/100: 30 MW, 40 MW, 100 MW**
- **J/F/G/D: 114 MW – 574 MW**
- **GTCC: 60 MW – 1,332 MW**
- **Top market share on megawatt basis in 2022**
- **Hydrogen-only combustion by 2025**
- **Rock-solid customer support system**



USE CASES

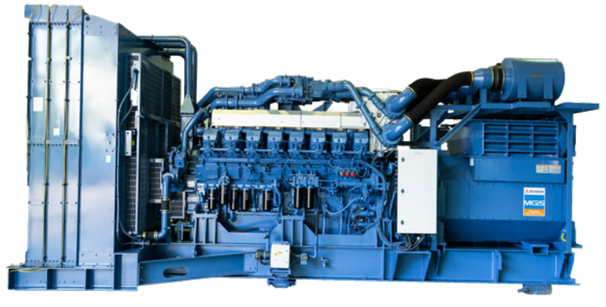
1. Mitsubishi Power delivers Hydrogen-Ready Gas Turbines to "IPP Renewed" Project in Utah to meet Decarbonization Goals in the Western US
- Mitsubishi Power recently delivered two M501JAC advanced-class gas turbines to the IPP Renewed project in Utah -- the cornerstone of the project's utilization of hydrogen for power generation
- The 694,000 lb. turbines journeyed from Japan to the IPP Renewed site via ship, train and truck traveling over 5,800 miles in 30 days
- Hydrogen will be provided to IPP Renewed from the nearby ACES Delta Hydrogen Hub
  https://power.mhi.com/regions/amer/news/20230727

2. Keppel, together with Mitsubishi Power and Jurong Engineering consortium, breaks ground for Singapore's first hydrogen ready cogeneration plant
- The KSC Plant is designed to be able co-fire with 30% hydrogen content and has the capability of shifting to run entirely on hydrogen in line with the decarbonisation of Singapore's power sector.
  https://power.mhi.com/regions/apac/news/gro20230719

3. Mitsubishi Power to Establish Hydrogen Power Demonstration Facility "Takasago Hydrogen Park" at Takasago Machinery Works
- Hydrogen production and storage equipment to be added to existing validation facility to support commercialization of hydrogen gas turbines by 2025.
  https://power.mhi.com/regions/amer/news/20220222

Engines

- **480 kVA – 3,025 kVA (0.4 MW – 2.4 MW)**
- **More than 12,000 units delivered**
- **Short lead times (as fast as 6 to 8 months)**
- **Comprehensive customer support structure**
- **10-second startup time**
- **Dual start**



USE CASES

1. MHIET to Install 100% Hydrogen Engine Generator Set for In-house Evaluation
- MHIET will conduct a technical evaluation of 500kW, 6-cyl 100% hydrogen engine
- Installing a 100% hydrogen engine generator set and hydrogen supply facility within Sagamihara Plant for evaluation, MHIET aims to help carbon neutrality through marketing its products
  https://www.mhi.com/news/230706.html

2. MHIET Launches MGS3100R, A New 3,000 kVA Class Generator Set for Commercial and Mission Critical Facilities
- Releases the highest output model in the series to meet needs of various industries including factories, commercial buildings, hospitals and data centers as a means to supply power at time of power crunches, power failures, and disasters or for Business Continuity Plan
- Features space-saving, easy installation, and performance and quality approvals
  https://www.mhi.com/group/mhiet/news/20230822.html

Next-Generation Cooling System

Cooling Technology Combines Innovation and Proven Performance

Our innovative liquid cooling system technology makes data center operations environmentally sustainable by greatly reducing power and water consumption. Our high density and excellent power usage effectiveness (PUE) cut operating and capital expenditures, improving cash flow for customers.

Energy conservation (electricity and water)
- Operating expense reduction (PUE 1.1 or less)
- Green and sustainable brand image
- ESG investments and data center differentiation

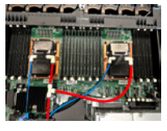
Higher density and improved PUE
- Lower capital expenditure (reduction of footprint)
- Maximum power available for IT usage
- Maximized IT services delivery

Cooled chips that air cooling could not accommodate
- High-density, high-performance CPUs and GPUs
- Delivering high-value-added IT services

Container Data Center

Immersion Cooling (Tank)

Immersion Cooling (Chassis)



Direct to Chip Cooling (Two Phase)

Dry Cooler

USE CASES

1. MHI and ZutaCore Join Forces in a Strategic Alliance, Paving the Way for a Zero-emission Data Industry
- MHI Enters White-label Agreement and Invests in ZutaCore, Accelerating the Growth of Sustainable Dielectric Direct-Liquid-Cooling Solutions
  https://www.mhi.com/news/23092602.html

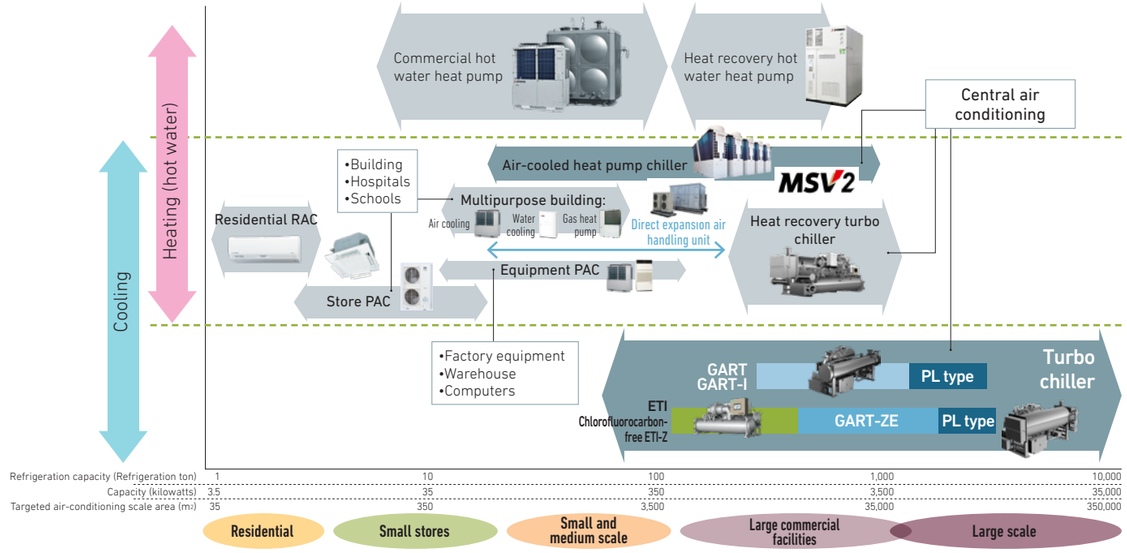
2. Demonstration Testing of Liquid Cooling System Achieves 94% Reduction in Energy Consumption to Cool Servers in Data Centers
- System Provision to Commence in FY2023, Enabling Sustainable Immersion Cooling Data Centers Contributing to Decarbonization
  https://www.mhi.com/news/230306.html

3. Liquid Cooling of Servers Cuts Containerized Data Center Power Consumption by 43%
- In a Proof-of-Concept Experiment, We Used Liquid Immersion Cooling Equipment to House and Run a Data Center in a Small Container.
- Compared with a Conventional Data Center, This Containerized Setup Delivered 43% Lower Power Consumption and Attained a PUE of 1.07.
  https://youtu.be/bzQCL-MgIKc

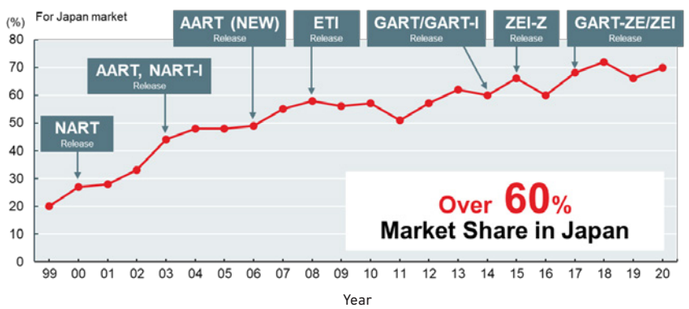
Cooling Systems

Cooling Equipment Lineup for Diverse Needs

We offer an array of products to meet diverse needs, from central air conditioning through individually distributed systems. We lead the domestic market with our highly reliable and high-performance centrifugal chillers, and we also offer air-cooled chillers. Our Ene-Conductor heat source control system conserves energy. We also provide a remote monitoring system.



- High coefficient of performance rating of 6.4 (GART ZE250, cold water 12 7)
- 300 – 5,000 USRt (1 MW – 17.6 MW)
- Global warming potential less than 1



USE CASES

1. MHI Group Delivers Two Large-Capacity Centrifugal Chillers for Singapore's Marina Bay District Cooling System
- The high-efficiency chillers with low environmental impact will help expand Marina Bay's district cooling system, which will service 28 buildings by 2026
- High confidence in MHI Group's technologies and after-sales servicing, chillers' environmental and economic performance, and excellent delivery record led to the order
  https://www.mhi.com/news/221004.html

2. MHI Thermal Systems to Launch New Series of Large-Capacity Centrifugal Chillers Adopting Low-GWP Refrigerant

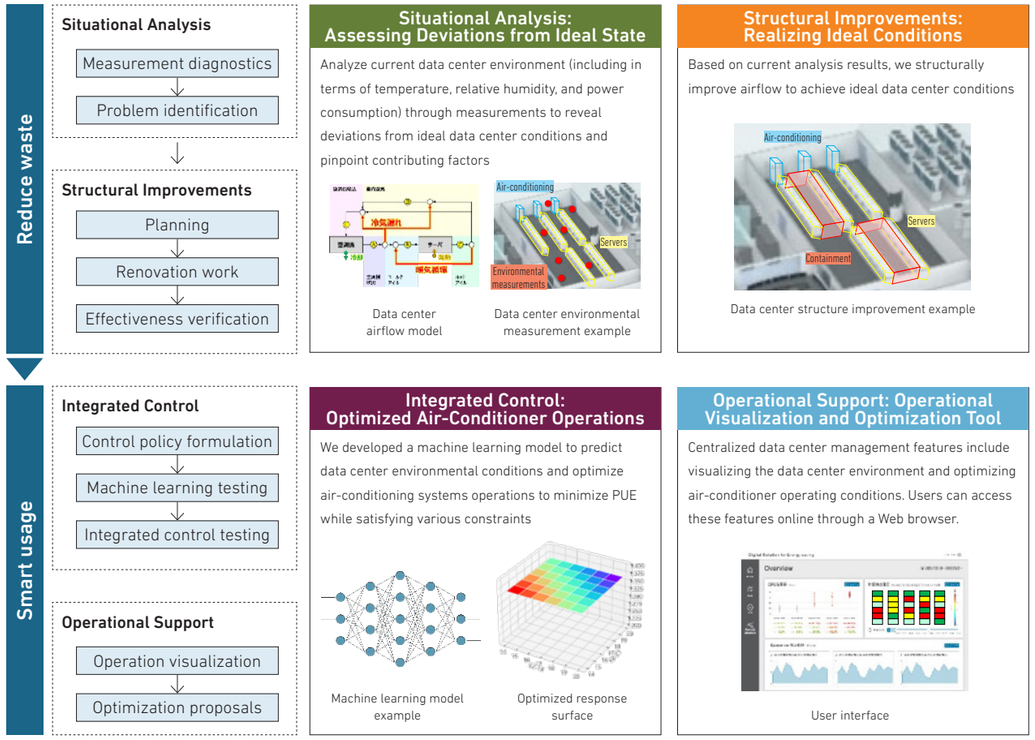
—Constant-Speed JHT-Y and Inverter-Equipped JHT-YI Will Reach Market in June—
- Both models adopt HFO-1234yf refrigerant, available in capacities ranging from 300 to 5,400 RT
- Adoption of new type compressor enables optimal selection to match chiller output, achieving high performance throughout the capacity range
  https://www.mhi.com/news/220405.html

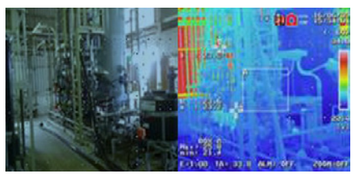
Digital Solutions

Cutting-Edge Analytical Technology Optimizes Operating Conditions

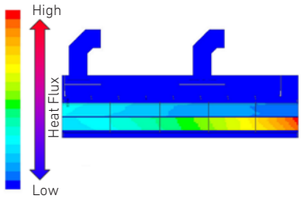
We have a technology for analyzing heat flows and heat transfers within spaces and mechanisms that we have cultivated across diverse business domains.

We also employ this technology at data centers, tracking operating conditions and optimizing them with AI. This stabilizes operations and reduces costs for customer data centers.





Thermal flow and temperature analysis techniques for predicting heat flows within spaces



Numerical analysis techniques for gas-liquid two-phase flow

USE CASES

MHI Concludes MOU with FNT of Germany to Provide Integrated Management Software for Data Centers
- MHI's technologies in analysis and energy management will be integrated with FNT's DCIM software solution for data centers
- The collaboration targets development of new solutions for achieving operation of IT and infrastructure facilities and optimization of power consumption
  https://www.mhi.com/news/23071302.html