PRESS RELEASE

September 26, 2023

Takasago Thermal Engineering Co., Ltd.
Mitsubishi Jisho Design Inc.

Realizing Carbon Neutral Building by Utilizing Renewable Energy

“Takasago Thermal Engineering Innovation Center”

Awarded Asian Regional Competition of the World’s Largest Environmental Building Technology Award

Left： ”Takasago Thermal Engineering Innovation Center” Office Annex
Right： Award ceremony on Aug 19th, 2023, in Taichung, Taiwan

Takasago Thermal Engineering Co., Ltd. and Mitsubishi Jisho Design Inc. are pleased to announce that together with Professor Shinichi Tanabe (Waseda University) and Professor Yasuyoshi Akashi (University of Tokyo), have been awarded the top Asian regional award at ASHRAE Region XIII 26th Chapters Regional Conference of “ASHRAE Technology awards 2024” hosted by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) *, the world's largest international society on air conditioning and air-conditioning, at the Takasago Thermology Engineering Innovation Center (Tsukuba City, Ibaragi / The subject of application for this award is the Office Annex) on August 19, 2023. This facility actively utilizes renewable energy sources that take advantage of local characteristics. By combining groundwater heat, biomass CHP and photovoltaic power generation with a large-scale power storage system, this facility has achieved off-grid operation (a state in which this facility is self-sufficient in electricity). We believe that this achievement is a particularly useful system in Japan, where resilience against natural disasters is critical.

※ With more than 50,000 members from over 130+ nations, ASHRAE* is a diverse organization (founded in 1894, HQ Atlanta GA) dedicated to advancing the arts and sciences of heating, ventilation, air conditioning and refrigeration to serve humanity and promote a sustainable world. https://www.ashrae.org/

For further information and press enquiries, please contact:
Takasago Thermal Engineering Co., Ltd. Corporate Communication Office TEL 03 -6369-8215
Mitsubishi Jisho Design Inc. Corporate Communications Office TEL 03-3287-5001

■ ASHRAE Technology Awards
- World's Largest Environmental Building Technology Award -

The ASHRAE Technology Awards (since 1999) recognize outstanding achievements by members who have successfully applied innovative building design in the areas of comfort for the occupants, indoor air quality and energy conservation. Performance must be proven through one-year of verifiable operating data; therefore, the awards are highly trusted by architects and engineers. The award, which is presented to, and the Takasago Thermal Engineering Innovation Center won First Place in "Region XIII" (Asia), which includes Singapore, South Korea, Taiwan, and other countries. As a result, we have been selected as the regional representative for the global best technology awards which will be awarded to the projects among the winners of 15 regions around the world. We will represent Japan and Asia in the world's best environmental architecture competition.

Japan Chapter nominee	Asia Region nominee	Global nominee
ASHRAE Japan Chapter Technology awards Japan Chapter Award (1st)	ASHRAE Region XIII Technology awards Asia Region Award (1st)	ASHRAE Technology awards Global nominee from regional winners Global Best Technology Award
July 6, 2023	August 19, 2023	to be announced in Jan. 2024

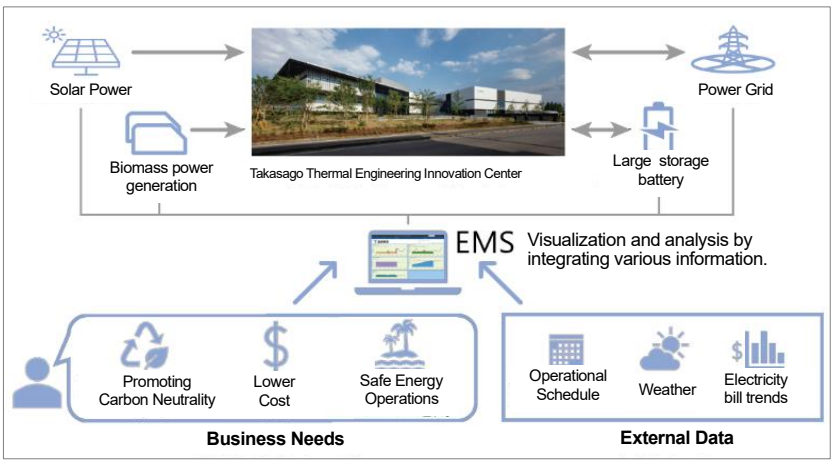
ASHRAE Technology Awards 2024 Nomination Process

■ Key Points for Award Evaluation: The Technological Innovativeness of Takasago Thermal Engineering Innovation Center

1. New Technology: Energy Management System for Large-Capacity Storage Battery

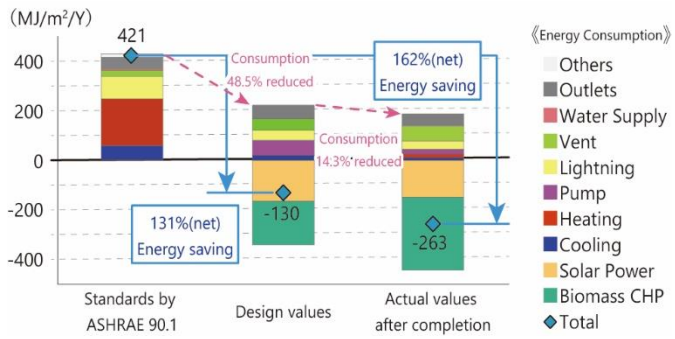
The new Energy Management System (EMS) to optimally control high-capacity batteries has developed for this Facility. This EMS predicts the on-site power load and solar radiation several days in advance, and optimally controls the storage/discharge of storage batteries based on the predicted power generation of solar power and biomass CHP, thereby enabling the Office Annex to go off-grid for electric power. Facilities can be operated without relying on an external power grid.

*Biomass CHP（Combined Heat and Power）: An energy-saving method that utilizes waste heat generated during power generation. In the series of power generation processes (heating and pyrolysis of wood chips to produce high-temperature combustible gas, which is fed into a gas engine for power generation), the biomass CHP at this facility supplies the waste heat obtained from cooling the cooler and engine to the facility as hot water via a heat exchanger.



Left：
An EMS that enables off-grid operation, visualizing and optimally controlling the operation of each generator + storage battery based on the facility's electricity demand and power generation forecasts.

Energy operation in this facility using EMS



Primary Energy Consumption

Left :
A simulation of energy consumption in the office building (ASHRAE 90.1) showed that the design value (-130 MJ/m2/year) would result in 131% energy savings compared to the ASHRAE standard value (421 MJ/m2/year) (When one biomass CHP unit is operated).
A post-completion survey (in FY2021) showed that continuous operational improvements resulted in a further 14.3% reduction in energy consumption from the design value. Adding the electricity generated by the solar panels and two biomass CHP units, the primary energy consumption (net amount: -263 MJ/m2/year) was reduced by -162% from the standard value. Carbon neutrality has been achieved.

2. New Technology: Two Air Conditioning Systems That Directly Utilize Groundwater Heat for Energy-Efficient Heating and Cooling

Two technologies have developed to realize air conditioning system utilizing groundwater heat and for the office space.

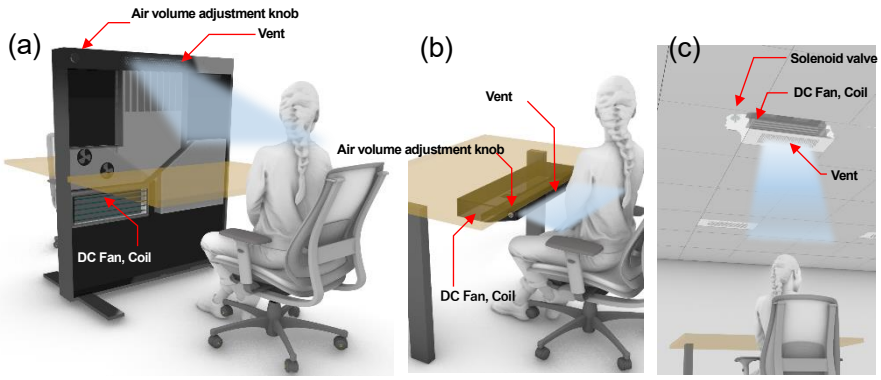
i. Radiant AC Panel for Grid Ceiling

Conventionally, ceiling radiant panel system could only provide uniform temperature control per room, but here we have developed the system that finely controls water supply according to load distribution, thereby reducing the power required to convey cold and hot water. The system consists of twelve 600 mm square panels as one unit, and water delivery is controlled according to the temperature of the panel surfaces.

ii. Three Types of Personal Air Conditioning System

We have developed a Personal Air Conditioning System that can heat and cool according to the temperature preferences of individuals. These systems received positive feedback in a thermal environment satisfaction survey of workers who use them in their workspaces.

Office Floor
Radiant AC Panel for Grid Ceiling is applied in the office space. The smooth panel surface also reflects light and contributes to improve sense of brightness of the office space.



Three Types of Personal Air Conditioning Systems
All systems can be controlled by a smartphone.
(a) "Partition Type Personal AC" is installed in the partitions between desks
(b) "Desk Type Personal AC" is installed under the table-top
(c) "Ceiling Type Personal AC" is installed between Radiant Air-Conditioning Panels.

3. Minimizing Environmental Impact by Realizing Highly Efficient Operation of Heat Sources Using Renewable Energy

By adopting a cloud-based central monitoring system, the facility can manage all equipment in an integrated manner without the need for a dedicated facilities manager on site, contributing to the efficient operation and rapid improvement of the following systems.

i. Utilization of Groundwater Heat

Groundwater heat is monitored throughout the year to set a stable average temperature (16.6°C). The utilization of groundwater heat has resulted in an average summer energy consumption efficiency COP of 7.8, a very high efficiency operation compared to air-cooled HP chillers COP of 4.1. This groundwater heat provides 63% of the facility's chiller demand.

ii. Biomass CHP

Through high-efficiency operation, 77% overall efficiency, the biomass CHPs successfully meet almost all, 91%, of the air conditioning thermal demand for the entire facility. Two biomass CHP units are installed to enable periodic maintenance in turn, contributing to stable operation.

Through the active use of renewable energy and improvements in system efficiency, Office Annex has achieved complete zero CO2 emissions, with an annual CO2 emissions volume of minus 159 tons during operation when power generation is factored in. In addition, the heat source system using groundwater heat and biomass CHP reduces not only CO2 emissions but also CFC gas consumption. Such technologies minimize environmental impact.

The entire facility is also carbon neutral through the purchase of green electricity derived from hydroelectric power generation.

■ Achievements of "Takasago Thermal Engineering Innovation Center" in Japan

This facility has received the following awards in Japan.

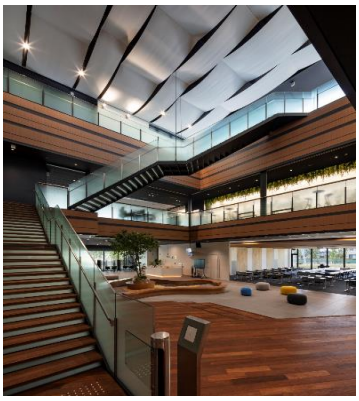
June 2022	33rd Institute of Electrical Installation Engineers Awards, Excellent Facility Award (Technology category) Institute of Electrical Installation Engineers of Japan **“Electrical Installations aiming at [ZEB] of Takasago Thermal Innovation Center”**
June 2022	“2022 Demand Side Management Awards” Integrated Systems Category Heat Pump & Thermal Storage Technology Center of Japan Promotion Award Heat Pump & Thermal Storage Technology Center of Japan **“Energy self-sufficient research facility that achieves both reduced environmental impact and intellectual productivity - Takasago Thermal Innovation Center”**
May 2023	61st SHASE Award for Distinguished Technologies Building equipment category The Society of Heating, Air-Conditioning and Sanitary Engineers of Japan **“Environmental Facility Planning and Execution at the Takasago Thermal Engineering Innovation Center”**
May 2023	Environmental and Equipment Design Award 2022 2nd Category: Integrated M&E Design distinguished design award Association of Building Engineering and Equipment **"Takasago Thermal Innovation Center"**
June 2023	11th carbon neutral Award Japanese Association of Building Mechanical and Electrical Engineers **"Takasago Thermal Innovation Center Energy self-sufficient research facility that achieves both reduced environmental impact and intellectual productivity"**

■ Project Outline

Project Name	Takasago Thermology Engineering Innovation Center	Location	2-19 Fujimigaoka, Tsukuba Mirai, Ibaragi
Building Use	R&D Center	Site Area	22,746.18 sqm
Building Area	7,129.74 sqm	G F A	11,763.97 sqm
Floor	2 above ground, 1 rooftop Maximum height: 15.455m	Structure	S above ground, Partially RC
Certifications	CASBEE Wellness Office（2020）：Rank S BELS：5 star, 91% reduction in design primary energy consumption, “Nearly ZEB” LEED V4 BD+C（NC）: GOLD		
Planning, Development, Verification and Evaluation	Takasago Thermal Engineering Co., Ltd.		
Design*1, Construction Administration, Verification and Evaluation	Mitsubishi Jisho Design Inc.		
Design*2 and Construction	Takenaka Corporation		
Construction	KANDENKO CO., LTD., YAMATO Inc., Takasago Thermal Engineering Co., Ltd. Kan-Shinetsu Branch		
Verification and Evaluation	Shinichi Tanabe (Waseda University), Yasuyoshi Akashi (University of Tokyo), Masanari Ukai (Lecturer, Waseda University), Shohei Miyata (Assistant Professor, University of Tokyo)		

∗1: Design Development and MEP Construction Document of HVAC

∗2: Architecture and Structure Construction Document



Left:
Overall view of the facility. The office building is on the left and the laboratory building on the right.

Right:
Central atrium of the office building.