MITSUBISHI ELECTRIC
Changes for the Better

Net Zero Energy Building Test Facility "SUSTIE" and Technology for Building Management System

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三菱電機株式会社

SUSTIE - Mitsubishi Electric's ZEB test facility

The name SUSTIE combines the words "Sustainability" and "Energy" to express the idea of an office for researching and demonstrating energy saving and workers' health and comfort.

Location	Kamakura City, Japan (Information Technology R&D Center)
Floor number	4 floors above ground
Total floor area	About 6,460㎡ (Approx.)
Building area	About 1,950㎡ (Approx.)
Construction	Four-story steel-frame
Completion	October 2020
Start of operation	January 2021
Design	Mitsubishi Jisho Design Inc.
Construction	Takenaka Corporation
Supervision	Prof. Shinichi Tanabe, Waseda University
Investment	Approx. 4 billion JPY (including approx. 1.6 billion JPY for equipment regarding development and testing)

Official web site: https://www.mitsubishielectric.com/en/about/rd/sustie/index.html

Certifications – ZEB and WELLNESS

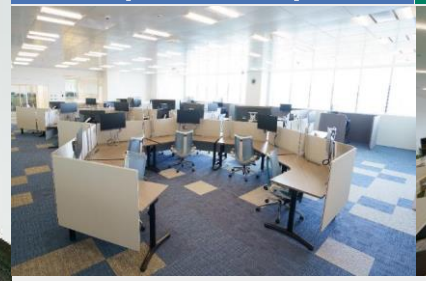
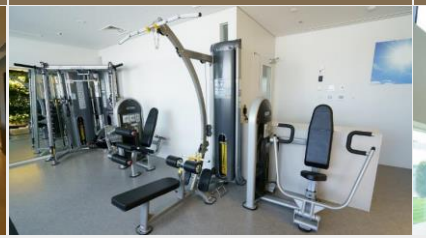
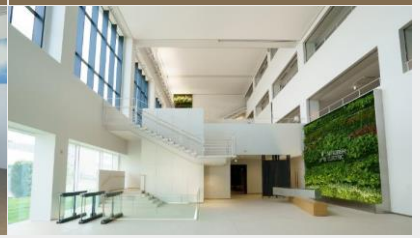
SUSTIE is the first in Japan to achieve the highest rank in all of BELS, CASBEE Wellness Office, and WELL Building Standard.

- **BELS *1**
  - Energy performance labeling in Japan
  - Five-stars (the highest rating)
- **CASBEE Wellness Office**
  - Wellness building labeling in Japan
  - Five-stars (the highest rating)
- **WELL Building Standard**
  - US wellness building certification
  - Platinum (the highest rating)

*1 BELS: Building-Housing Energy-efficiency Labeling System

Workplace – Activity based working

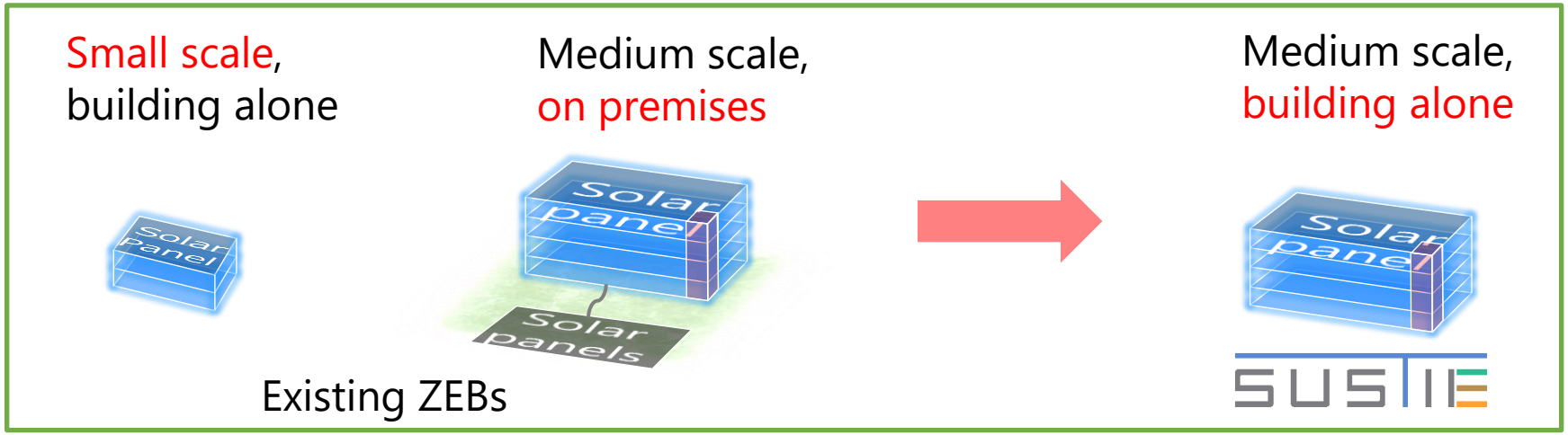
SUSTIE makes an office that offers both energy savings and comfort.

4th Floor (Focus)	3rd Floor (Relax)	2nd Floor (Dialogue)
		
Cafeteria	**Exercise Room**	**Biophilic Walls**
		

Aims

1. Less footprint and larger volume

Realizing medium scale 〖ZEB〗, which is a premium segment of the domestic building market.



2. Live laboratory for ZEB-compliant technologies

Accelerating development and testing of ZEB-compliant energy saving technologies.

3. Balancing energy saving and comfort

Achieving both of energy savings and high-quality indoor spaces.

Energy performance – design and operation phase

SUSTIE achieved over 115% reduction (compared to the standard value) in annual energy consumption.

Technology - High-Efficiency Equipment

Saving energy consumption by installing Mitsubishi Electric's various highly efficient equipment.

Gran Multi®
(High-COP*1 type)
VRF*2 multi-unit
air conditioner system

Commercial Lossnay®
Heat Recovery Ventilation

MILIE®
LED lighting

Mitsubishi EcoCute*3
industrial EcoCute
heat pump water heating

D-SMiree®
DC distribution system

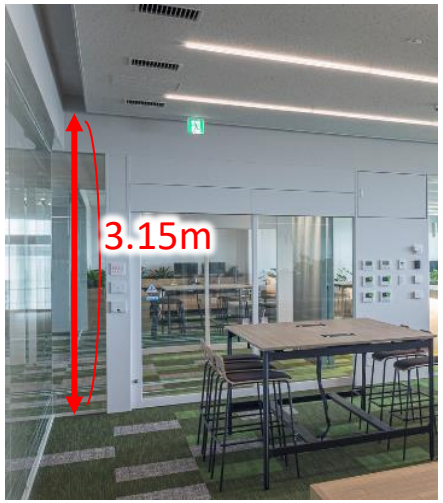
SUSTIE

AXIES®
Lift (Elevator)

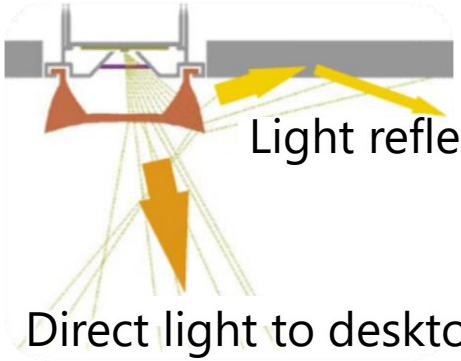
*1: COP: Coefficient Of Performance
*2: VRF: Variable Refrigerant Flow
*3: "EcoCute" is a nickname of natural refrigerant (CO_2) heat pump water heaters.

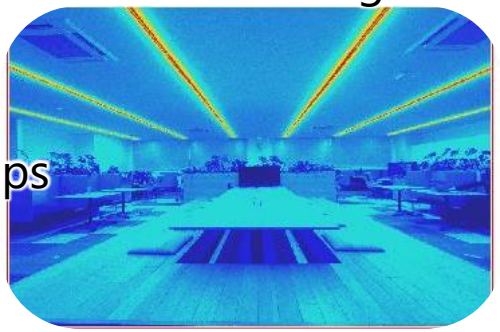
Technology - Balancing energy savings and comfort

a. Mitsubishi Electric's best performance model air-conditioner to enable higher ceilings



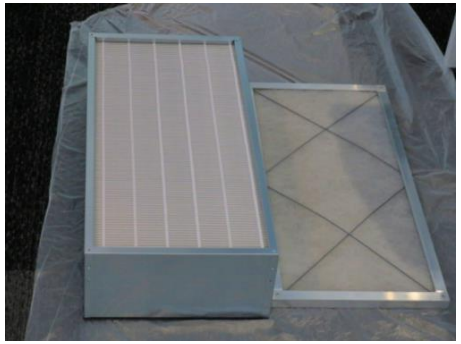
b. Ambient lighting to reduce contrast





Perceptible brightness

c. High performance ventilators and air filters for cleaner air



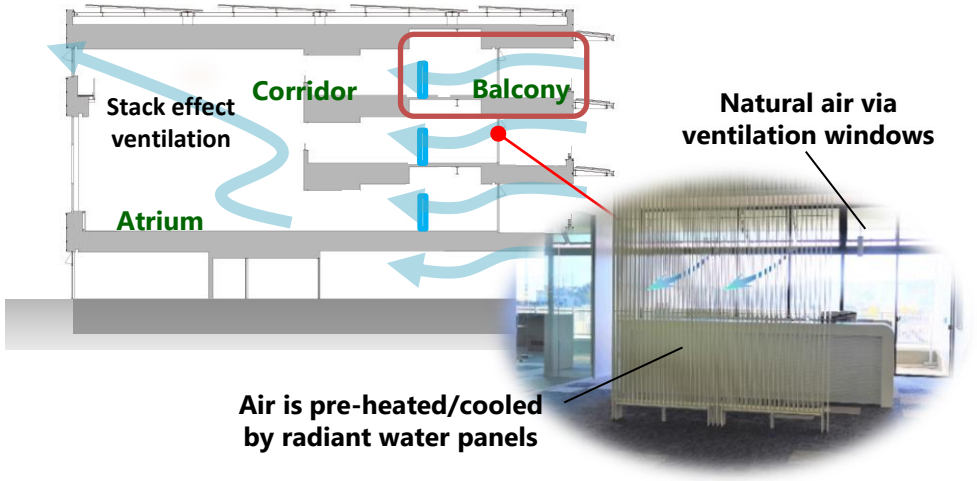
MERV 10 class air filter

Technology - Utilization of natural energy

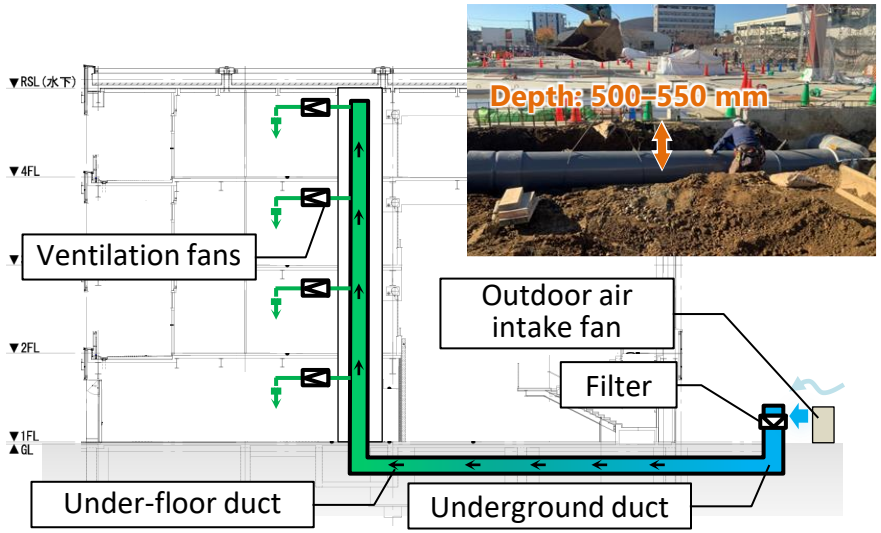
a. Introducing/shading sunlight

Automatic blind system
(Controlled based on sun position)

b. Natural ventilation and free cooling



c. Cool/Heat tubes



d. Photovoltaic system

PV Panels are on the entire roof and on eaves

Technology - Air conditioning strategy

Common areas (Lobby, atrium, etc.)
- Using water-type systems with heat pumps.
- Conditioning air around occupants.

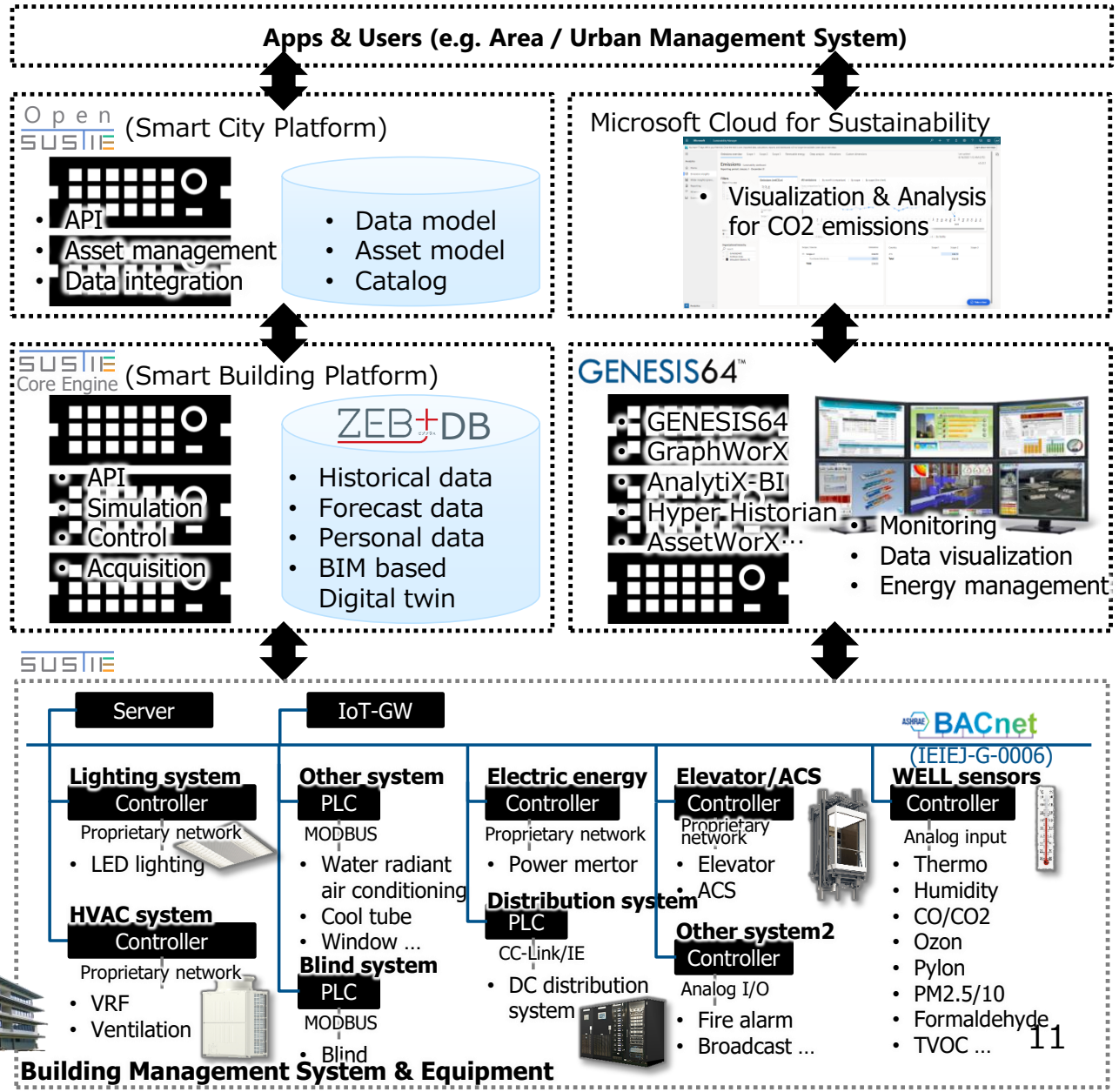
Occupied areas (office rooms)
- Using performance model of air-conditioners.
- Creating well-conditioned air in entire rooms.

R&D works – Smart building platform for simulation and AI

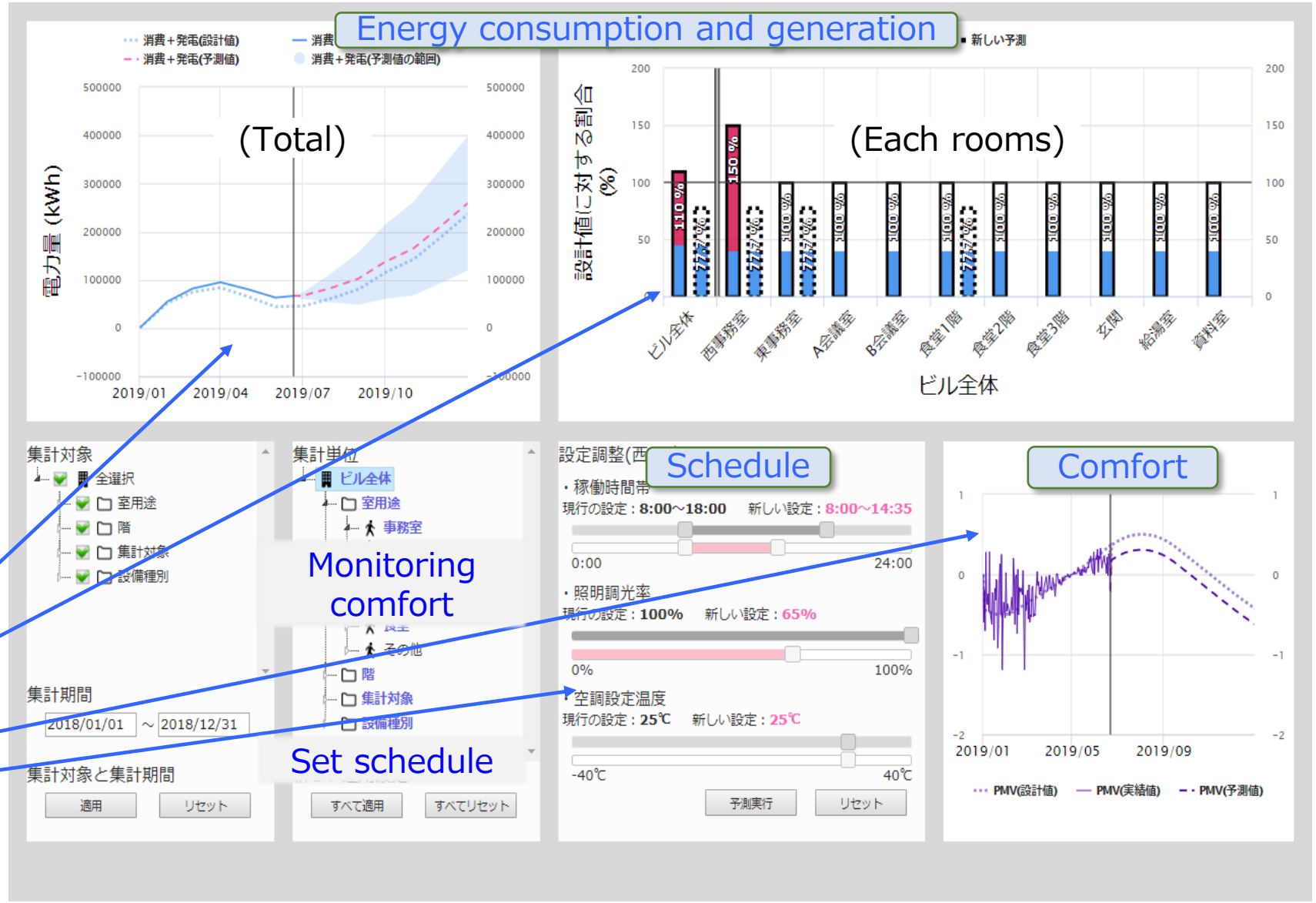
Open SUSTIE
- A smart city platform.
- Providing FIWARE based APIs and models.
- Ready to connect smart city and smart buildings.

SUSTIE Core Engine
- A smart building platform.
- Implementing our R&D technologies.
- Monitoring and control energy and environment.

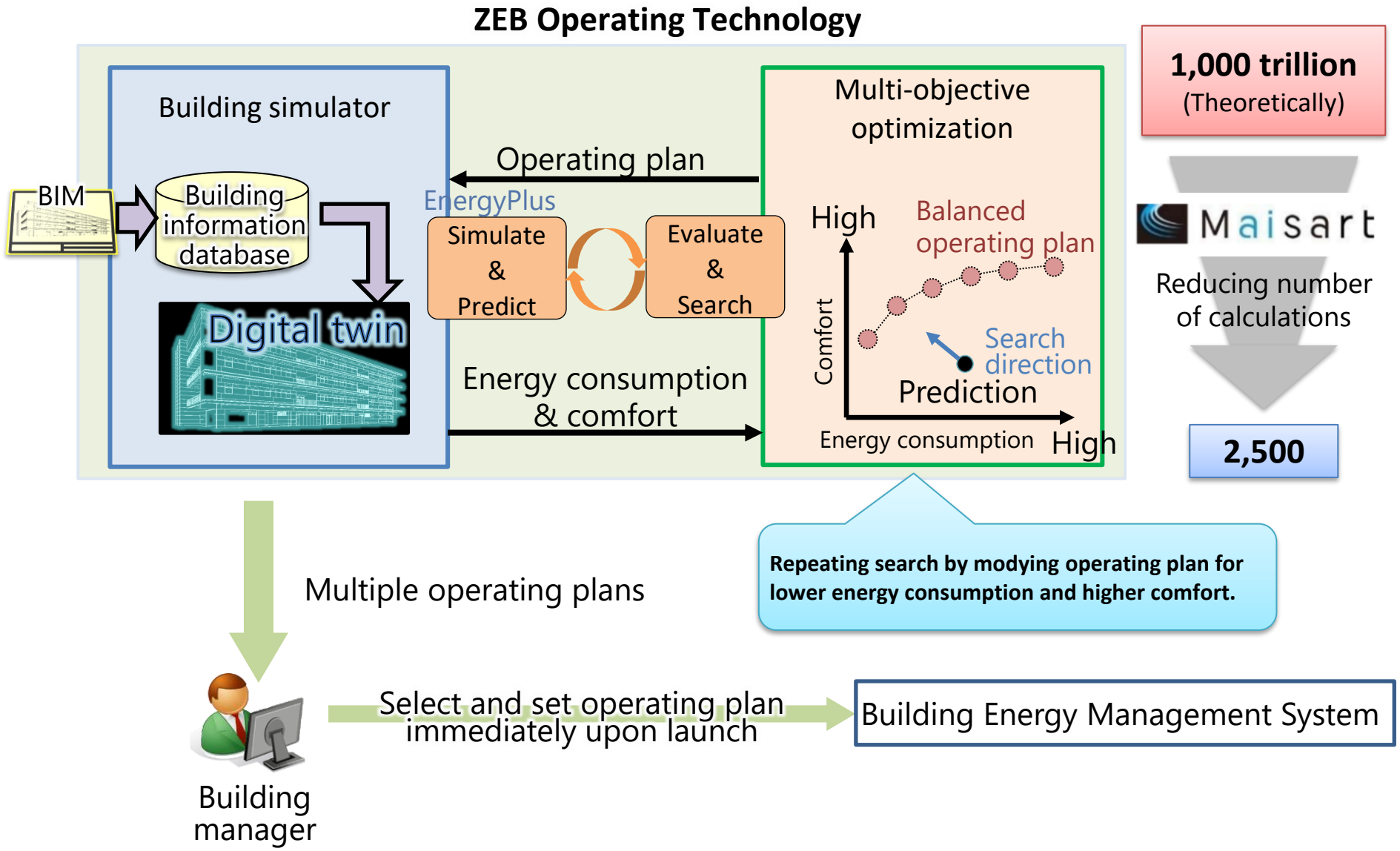
SUSTIE
- Various highly efficient equipment and systems.



R&D works – ZEB operation application with simulation and AI

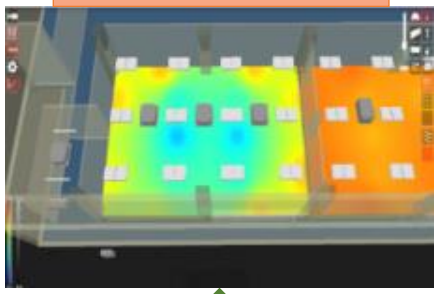


R&D works – Simulation and AI for ZEB operation



R&D works – Digital twin for simulation and AI

Physical



Analysis

Planning

BMS

Control

History data

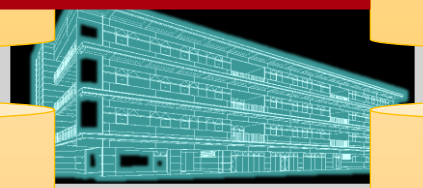
Predictive data / Control schedule

Simulator

AI

Engineering tools

System data (Engineering)

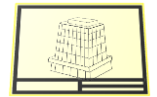


Digital Twin

Design data (Structure/ equipment)

Design support tools

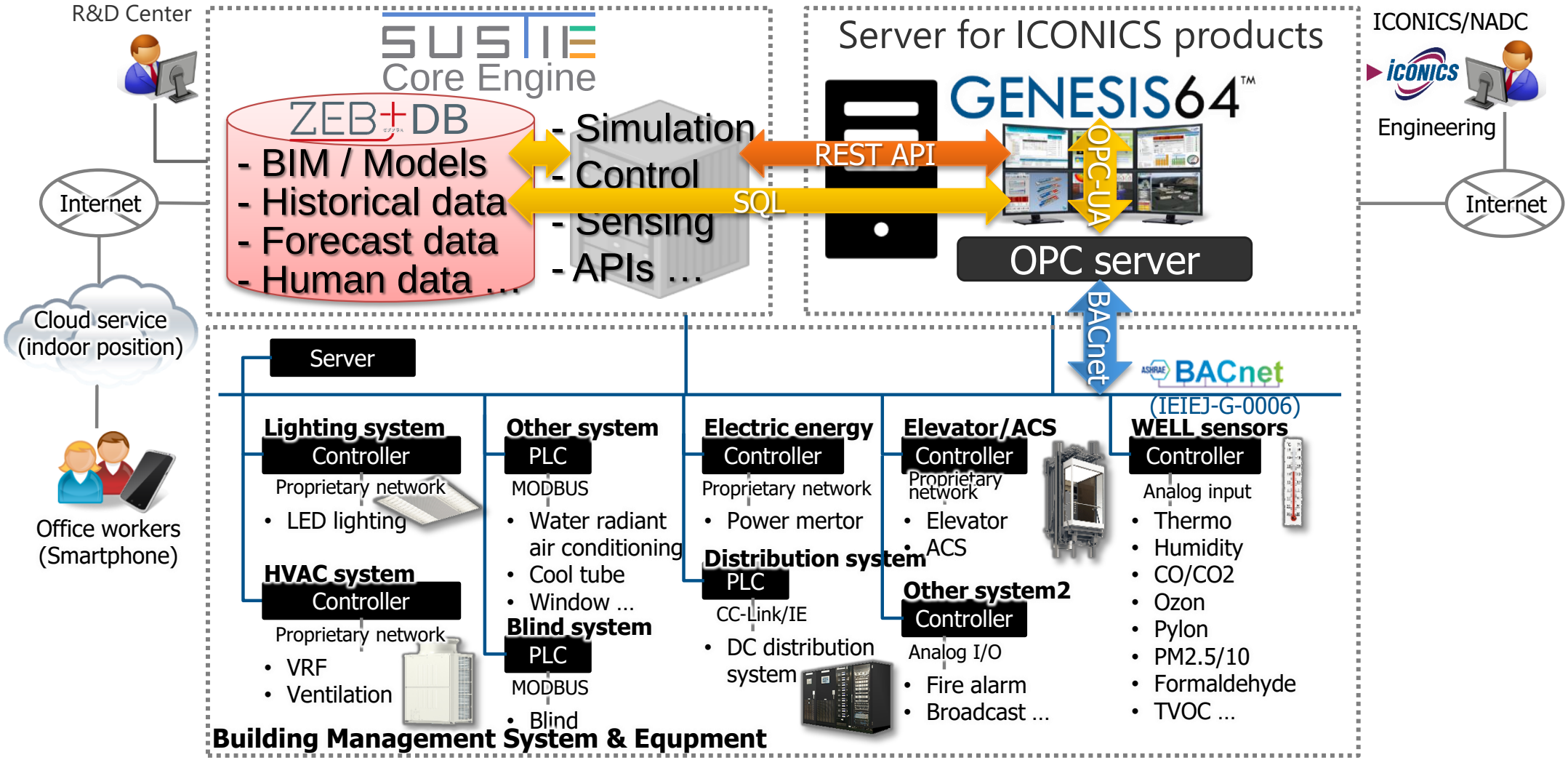
BIM parser



ZEB+DB (spatiotemporal database)

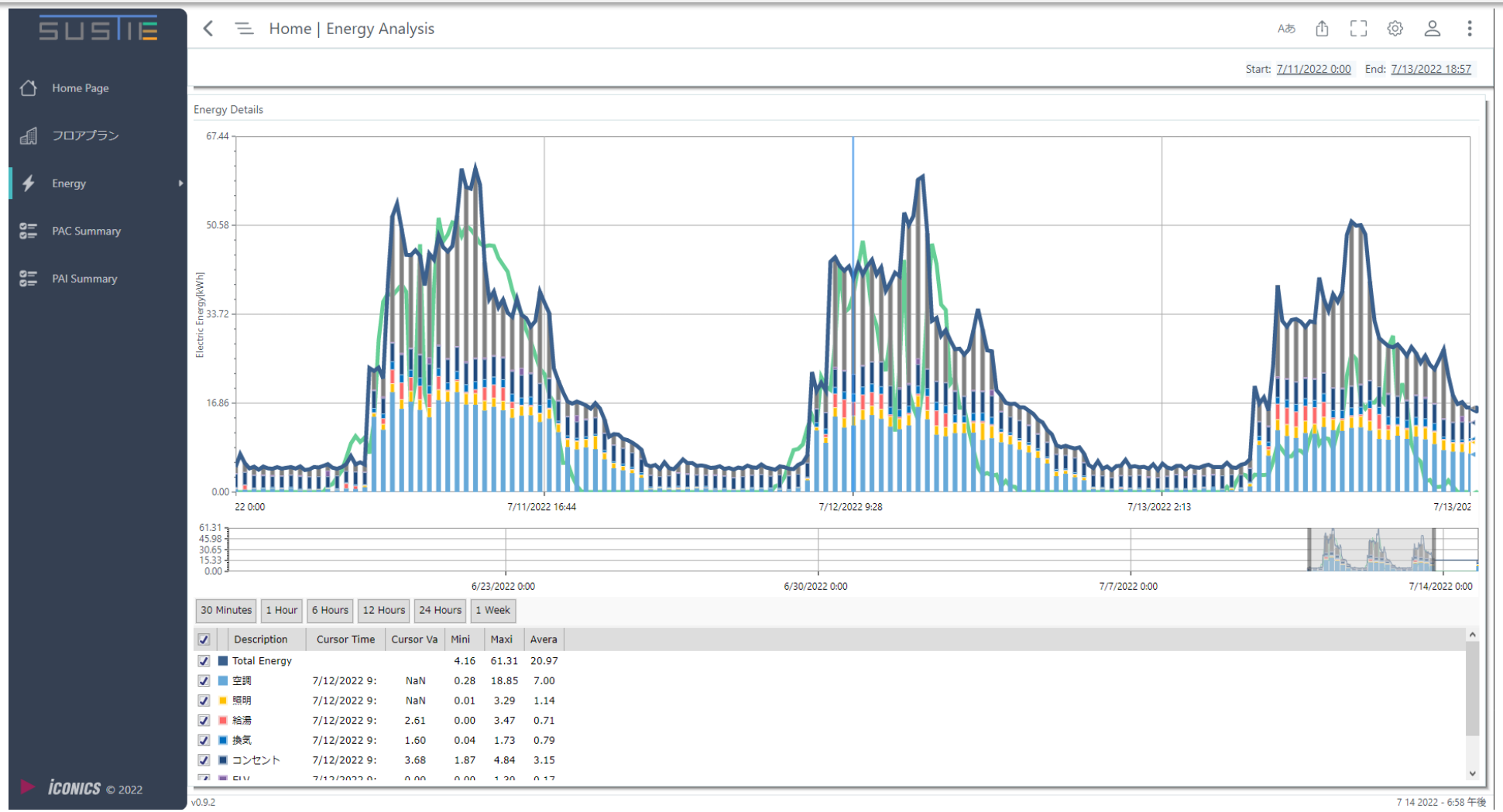
BMS visualization and analysis – Overview of system

SUSTIE integrated R&D system (SUSTIE Core Engine) and SCADA (GENESIS64) to demonstrate solutions.



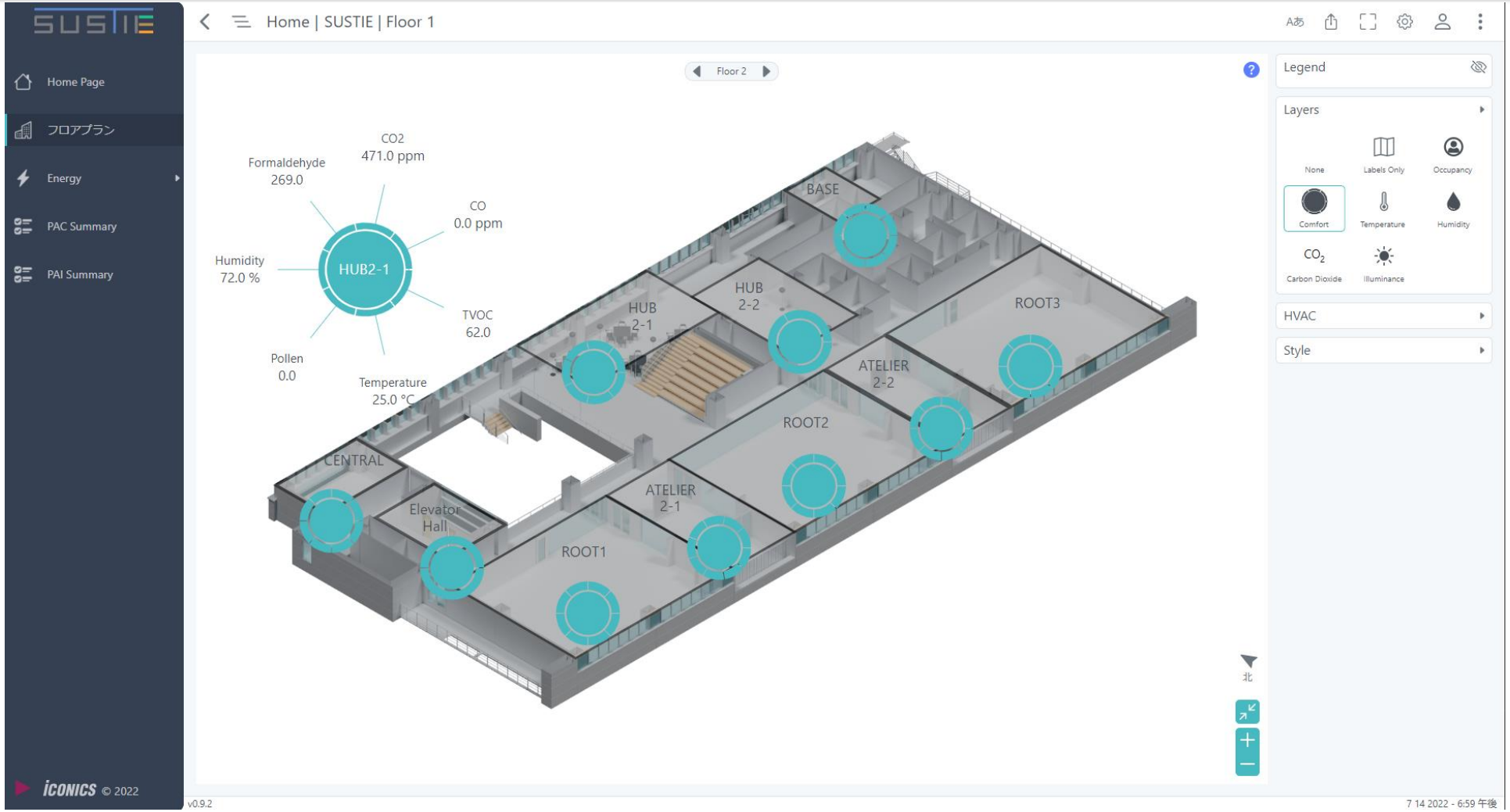
BMS visualization and analysis - Energy management

SUSTIE manage total electric consumption and generation to show ZEB operation results.



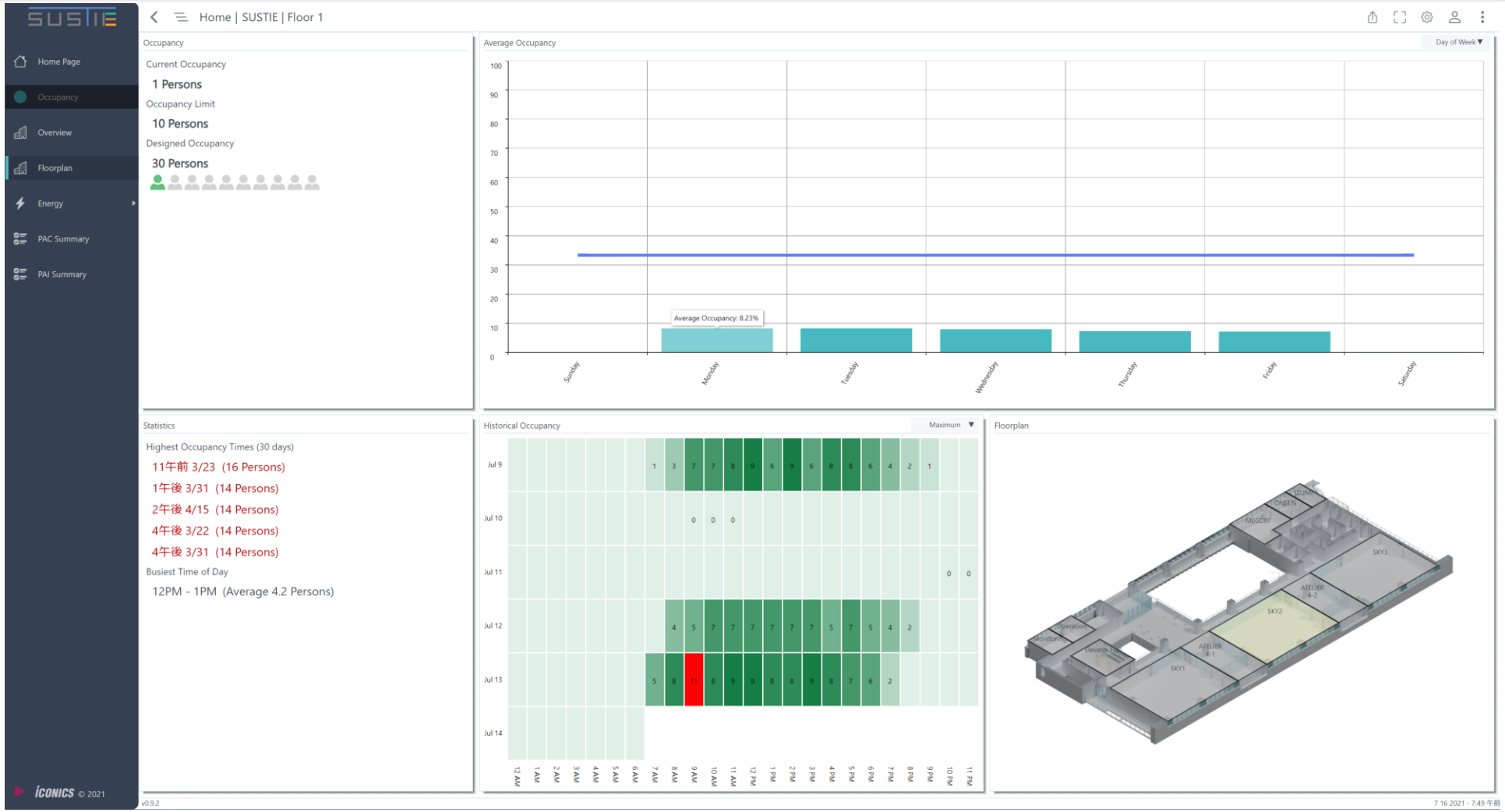
BMS visualization and analysis - Comfort monitoring

SUSTIE supports understanding office comfort and air quality on floorplan easily.



BMS visualization and analysis - Occupancy and Space Utilization

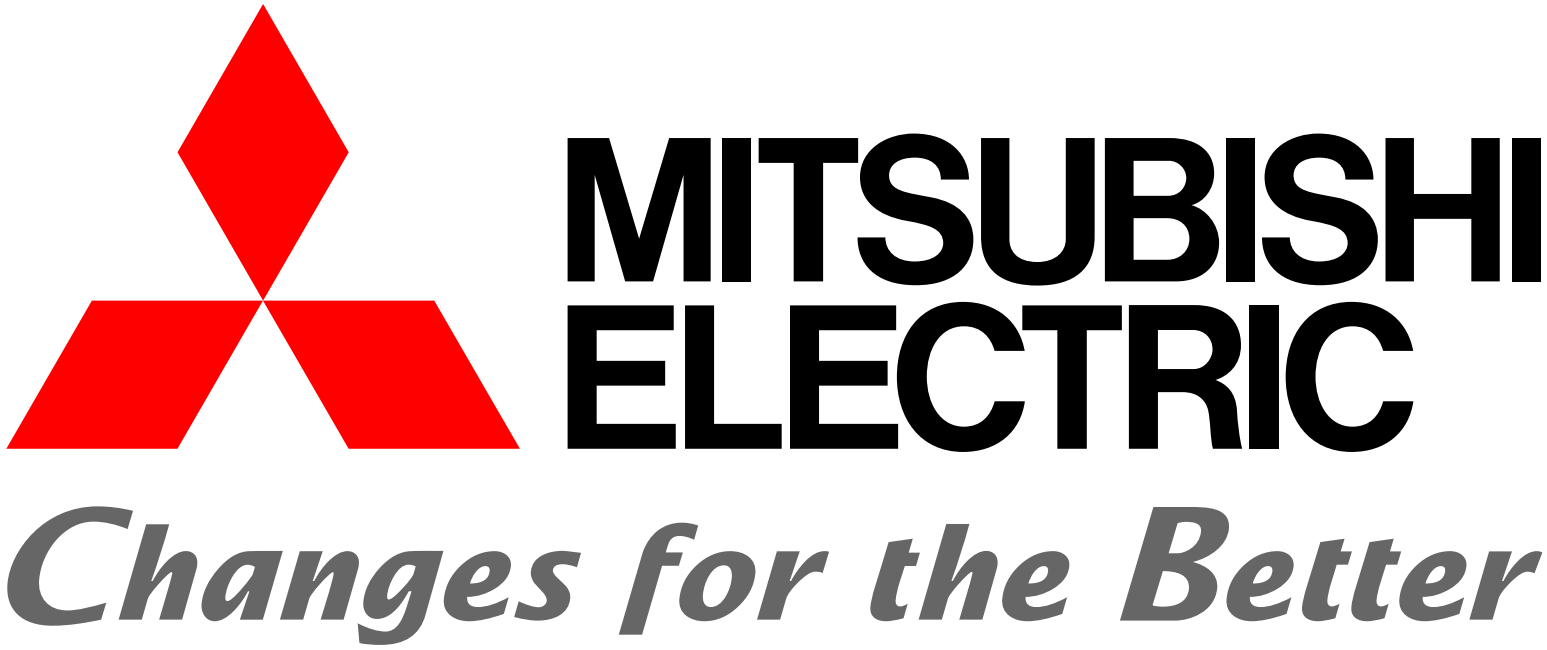
SUSTIE visualizes and analyses occupancy and space utilization data on all office rooms.



Summary

- is the Mitsubishi Electric's net-zero energy building test facility built for development and testing of ZEB related technologies.
- has been certified 106% energy reduction against its referenced building.
- has been the biggest 『ZEB』 office certified at design.
- has acquired 3 certifications (BELS, CASBEE Wellness Office, WELL Building Standard) with the highest grade.

- Simulation and AI technology is contributing these results.
- Smart building platform technology is supporting to achieve simulation and AI in SUSTIE.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