Introduction of ZEB in Japan

-Energy Efficiency Building Design and performance evaluation-

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CONTENTS

COMPANY

- Multi-Disciplinary Design Consultancy Firm
- Founded in 1900
- Established in 1950, incorporated in Japan
- Over 25,000 projects in more than 50 countries
- 1,903 Staffs (Group Total: 2,685) as of April, 2018
- Annual Turnover: Over 355 Million US dollar

We contribute to society through work that offers true value. With this as our core objective, we grow as individuals and develop as a worthy company.

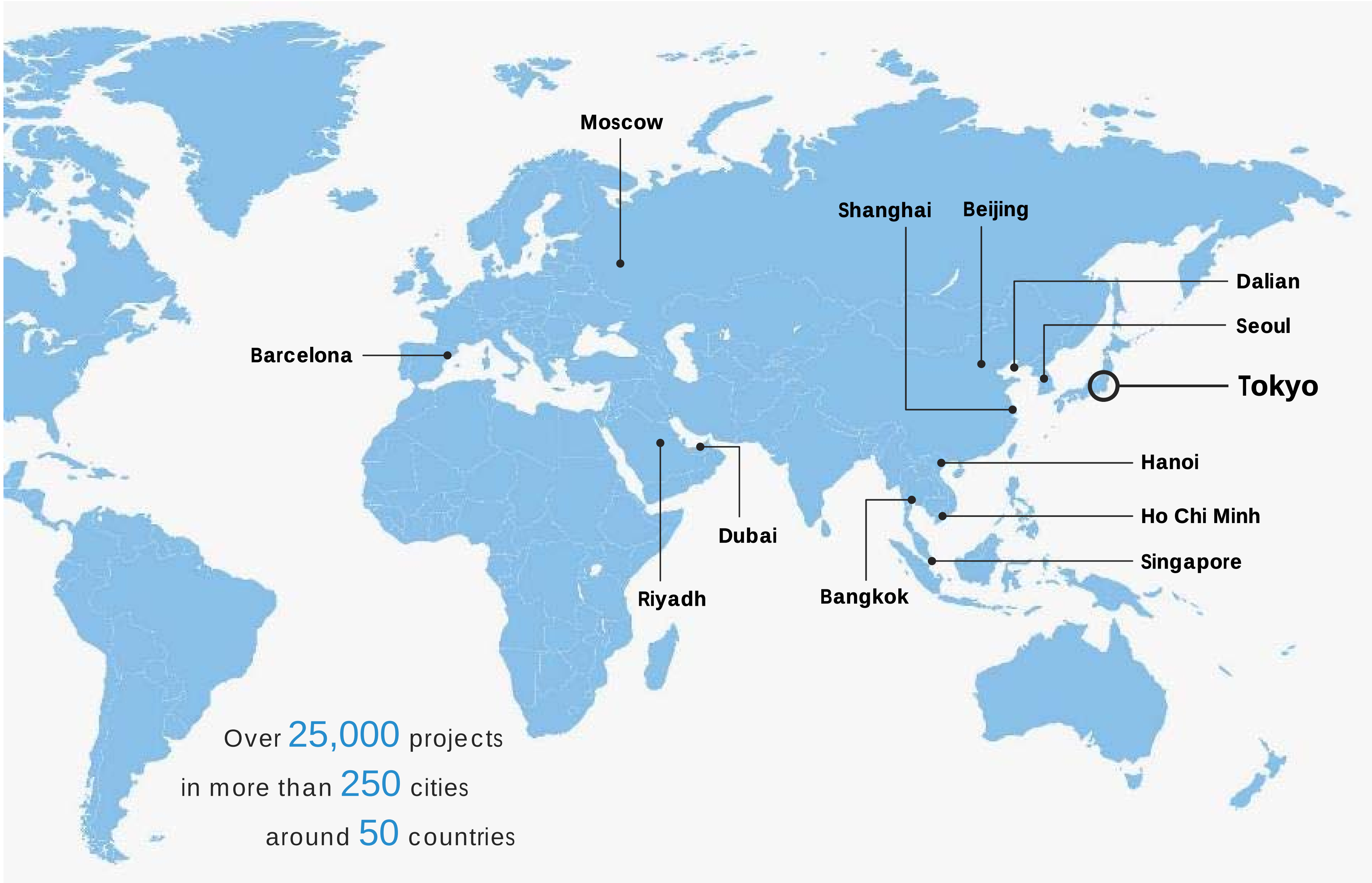
Nakanoshima Library(1904)

ORGANIZATION

PLANNERS	ARCHITECTS	ENGINEERS
- Urban Development - Urban Design & Planning - Landscape Design - Urban Infrastructure - Project Management	- Office, Government - Mixed Use, Residential - Retail, Hotel, Hospitality - Hospital, Wellness - Sports, Culture, Education - Airport, Station - Life Cycle Design - Industrial and Research	- Structural Engineering - MEP, Environment - Disaster Planning

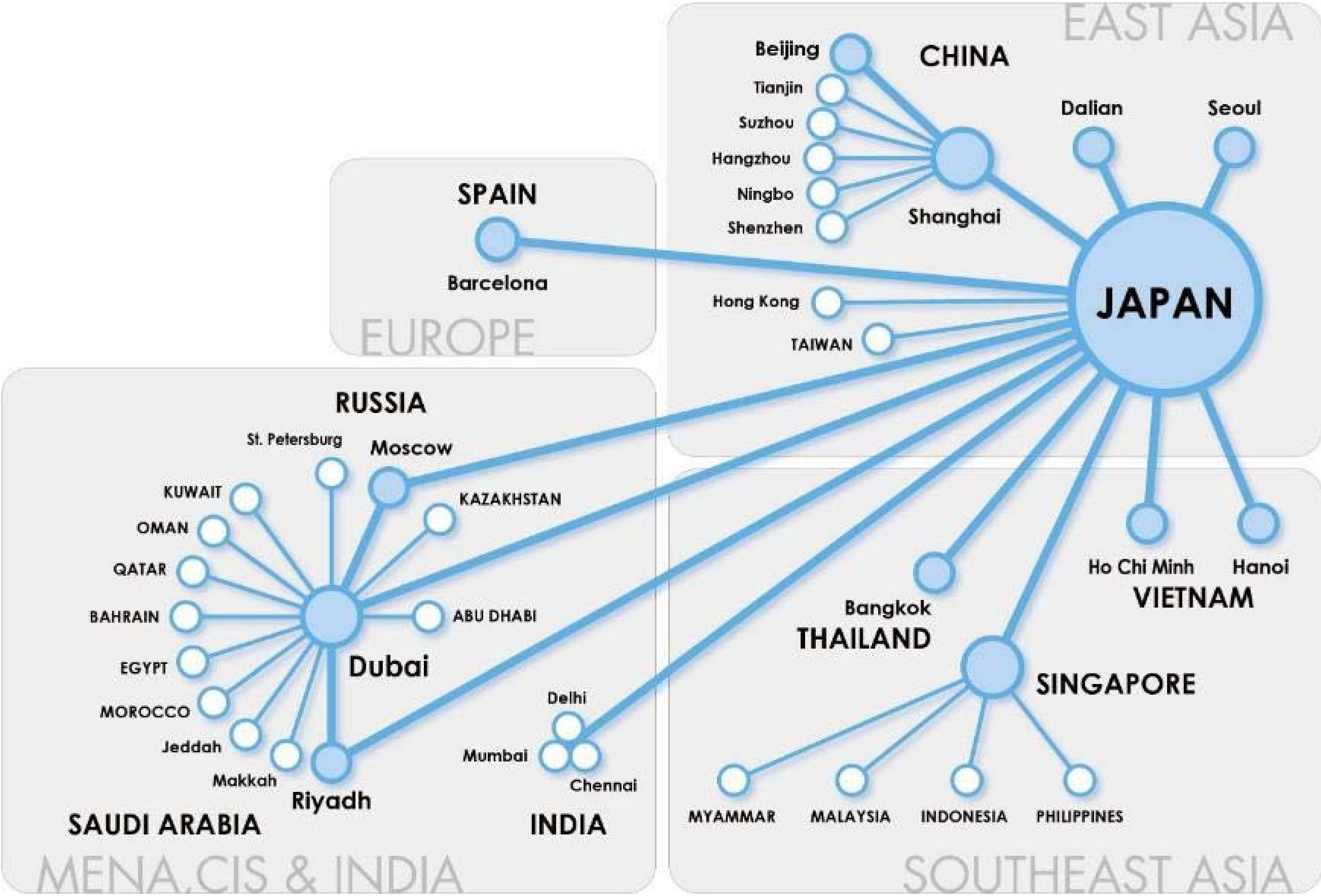
GLOBAL REACH

12 Oversea Offices



Over 25,000 projects
in more than 250 cities
around 50 countries

GLOBAL NETWORK



1. ZEB in Japan

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ZEB in Japan

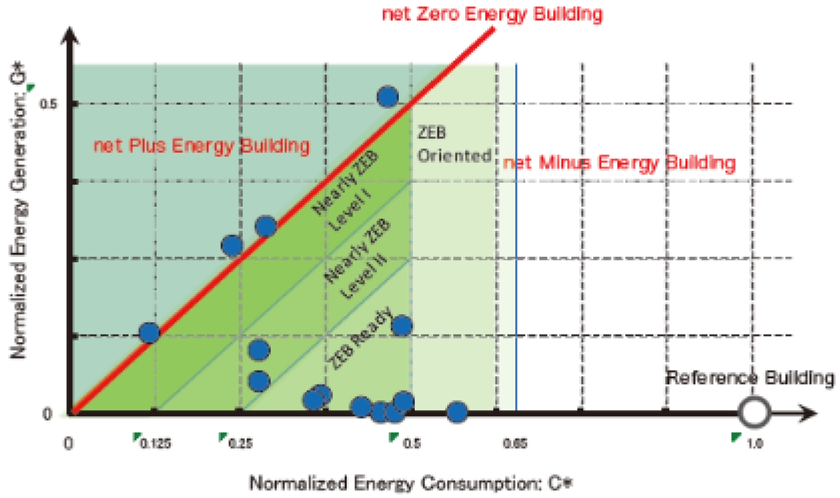
http://www.shasej.org/recommendation/ZEB%20in%20Japan_2017_SHASE100th.pdf

Technical introduction of 14 ZEB projects

国内のZEB先進事例の概要

Overview of Best Practices in Japan

Location of 14 Best practices



* ZEB chart for 14 Best Practices

No.	
1	Unnan City Hall
2	Shimizu Corporation Headquarters
3	ZEB Demonstration Building, TAISEI Corporation
4	KT Building
5	Takenaka Corporation Higashi Kanto Brunch Office
6	OBAYASHI Technical Research Institute Main Building, "Techno-Station"
7	21 KOMCEE, The University of Tokyo
8	DAIKIN Technology & Innovation Center
9	Minami-Osaka sales office of the Kasai electric power company
10	Tokyo Gas Tachikawa Builidng
11	Sanken Setsubi Kogyo Tsukubamirai Technology Center
12	DAI-DAN Kyushu Branch Office "Enefice Kyushu"
13	The SNK Engineering Center -"Demonstration Labo"
14	SHINRYO Headquarters Building





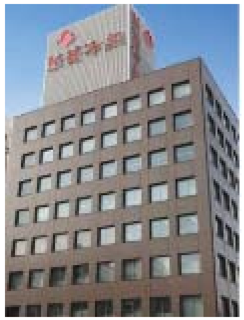


14 ZEB projects







2. ZEB Project Case Study 1

-Achievement of ZEB by state-of-the-art technology

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Daikin Industries, Ltd.
Technology and Innovation Center
DAIKIN

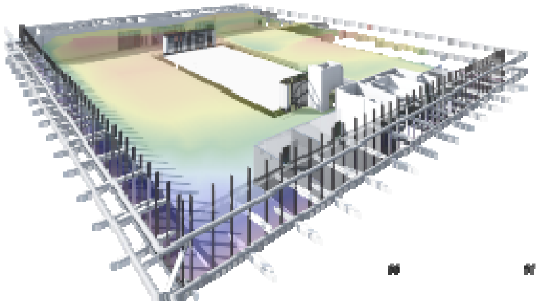
Daikin Yodogawa factory

Site plan

Daikin TIC (Technology and Innovation Center)

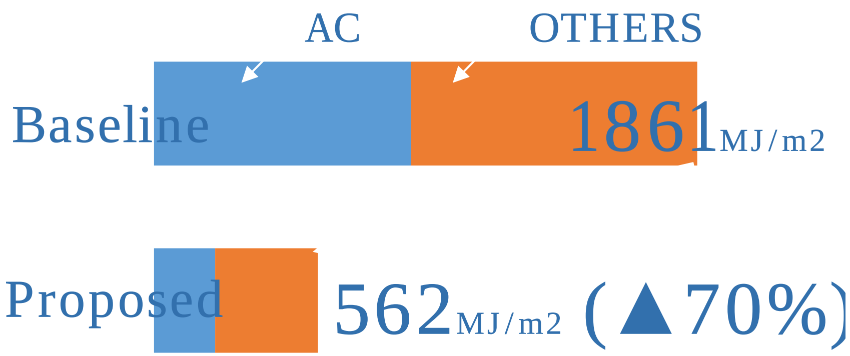
New Technology

Innovative Cx



Carbon Management

Top level Energy and Environment

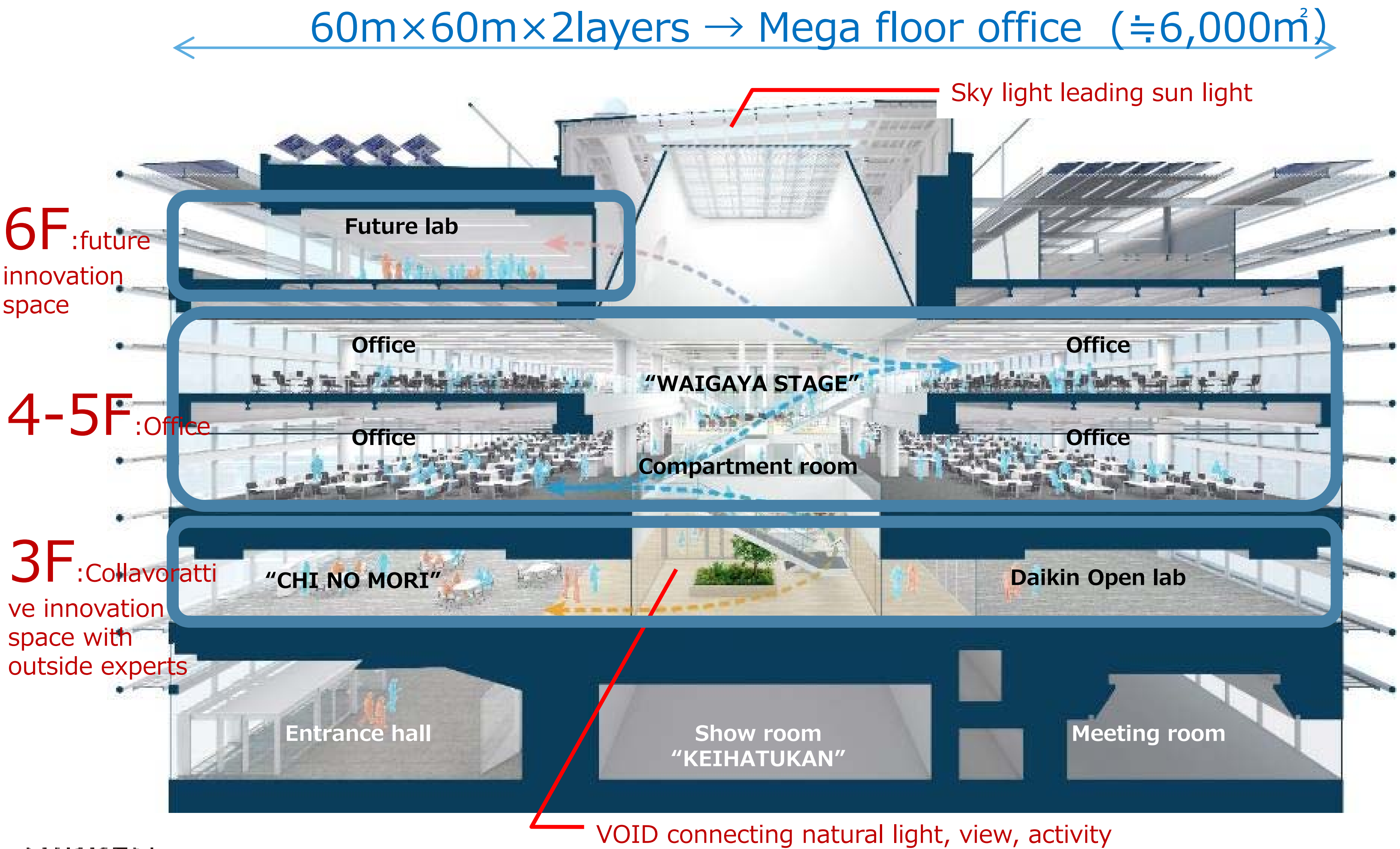


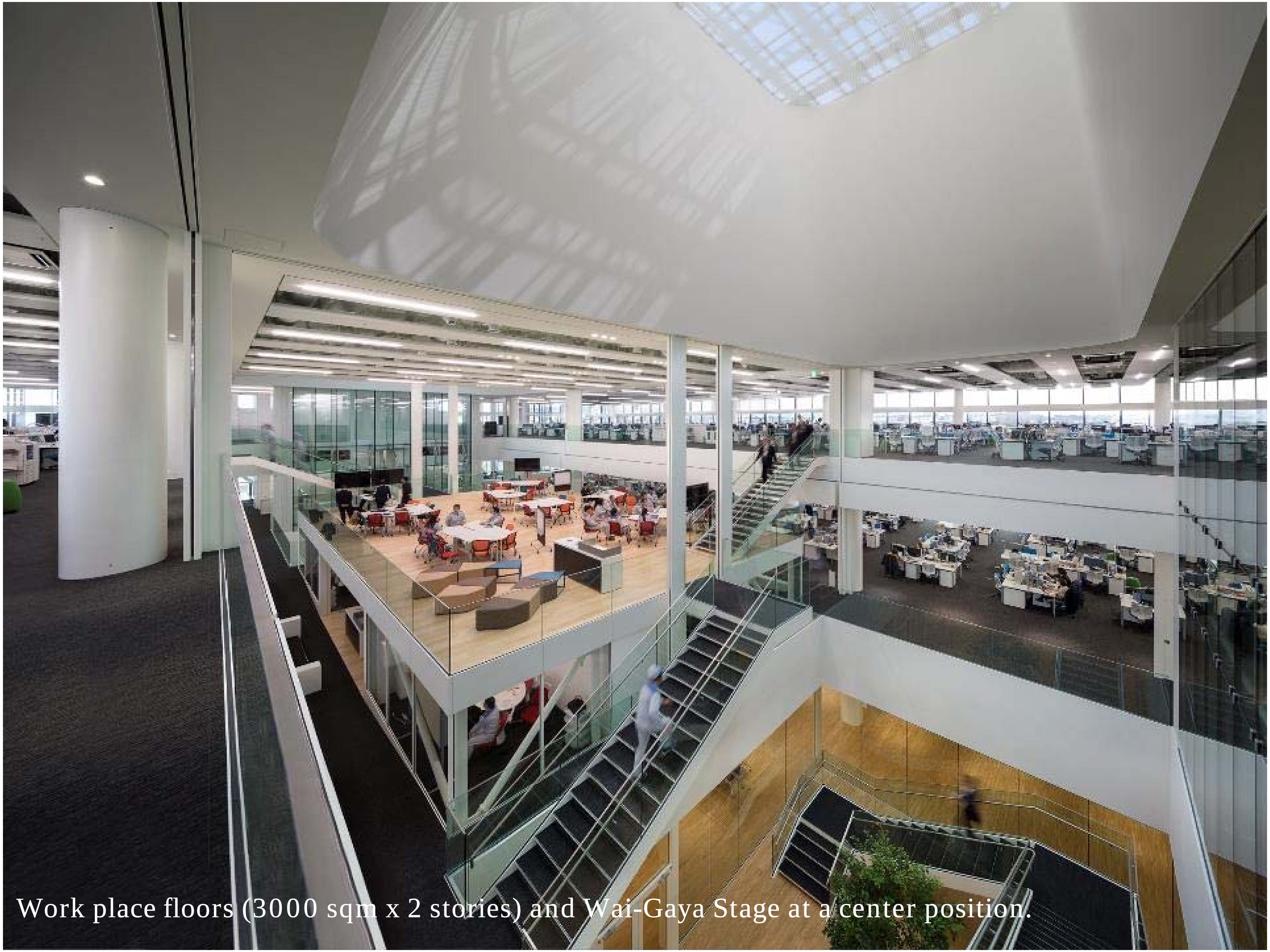
ZEB

LEED Platinum

TIC Forest

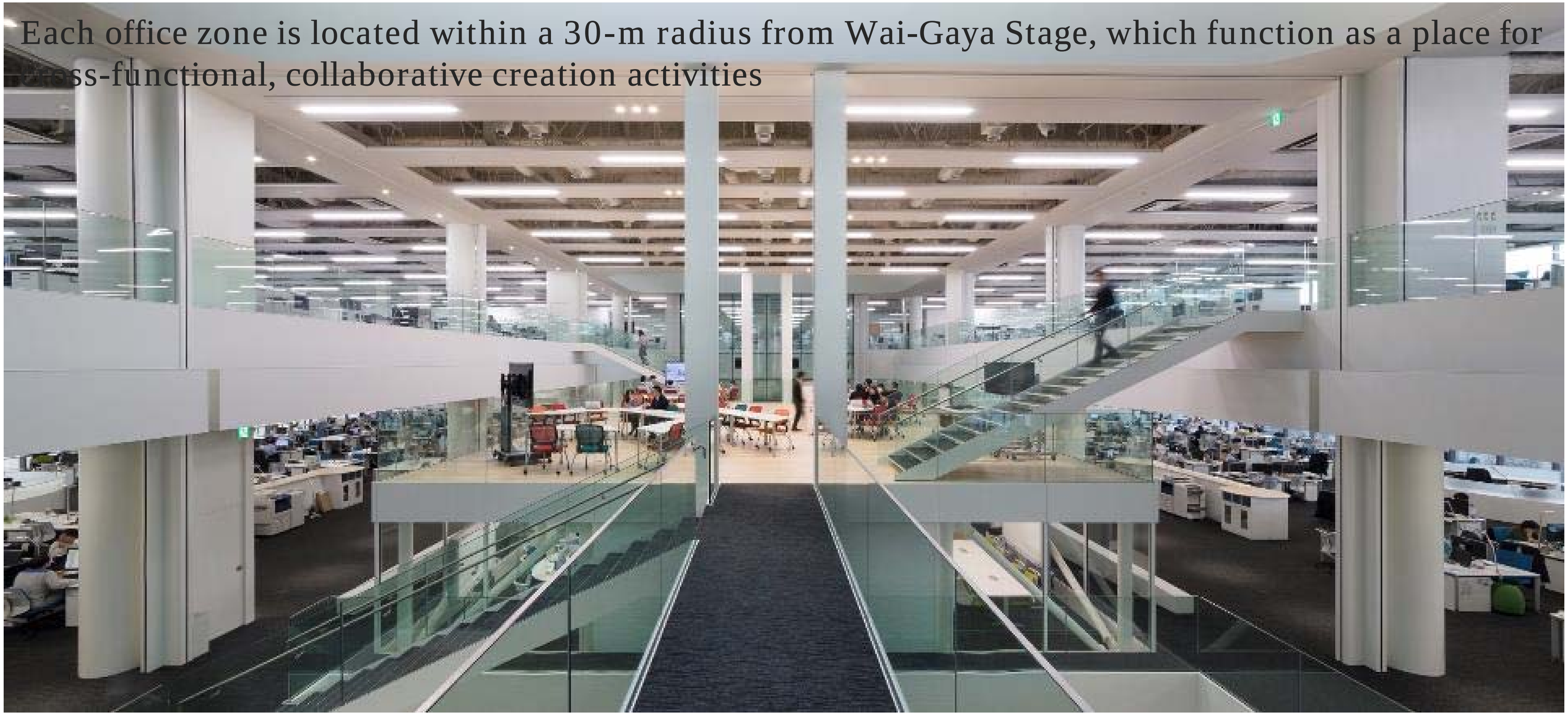
South-north cross section of Office zone





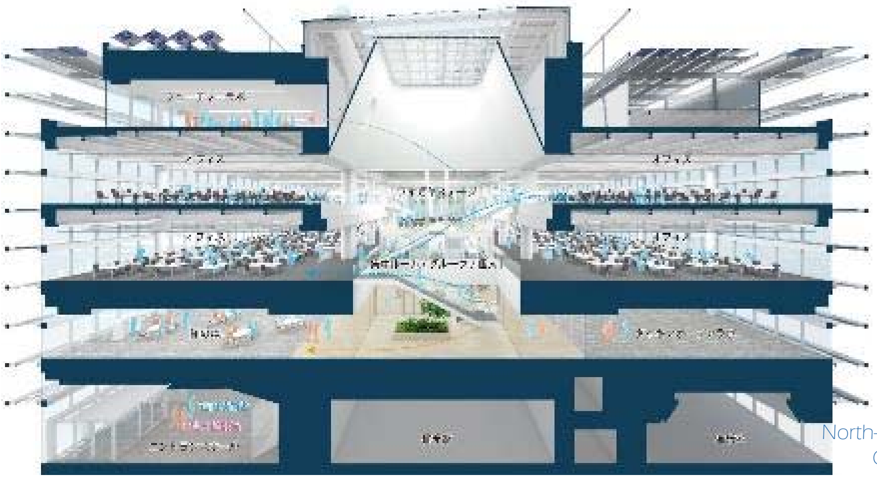
Work place floors (3000 sqm x 2 stories) and Wai-Gaya Stage at a center position.

Each office zone is located within a 30-m radius from Wai-Gaya Stage, which function as a place for cross-functional, collaborative creation activities

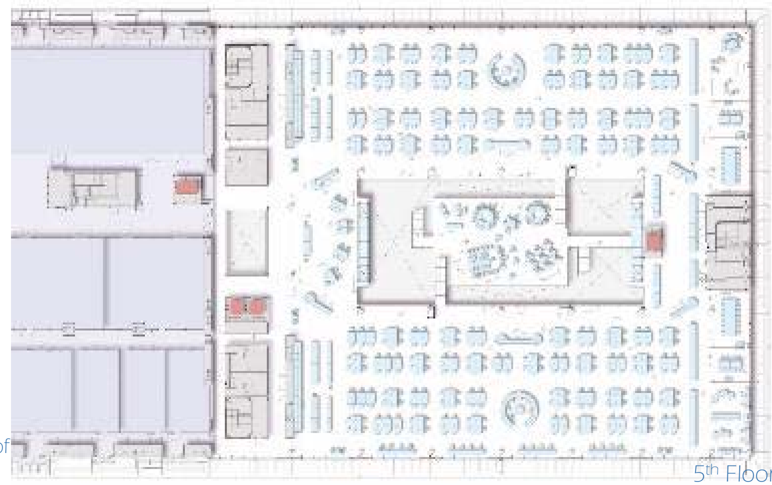


Knowledge Flow Structure in which people, knowledge and information circulates through east and west atriums.

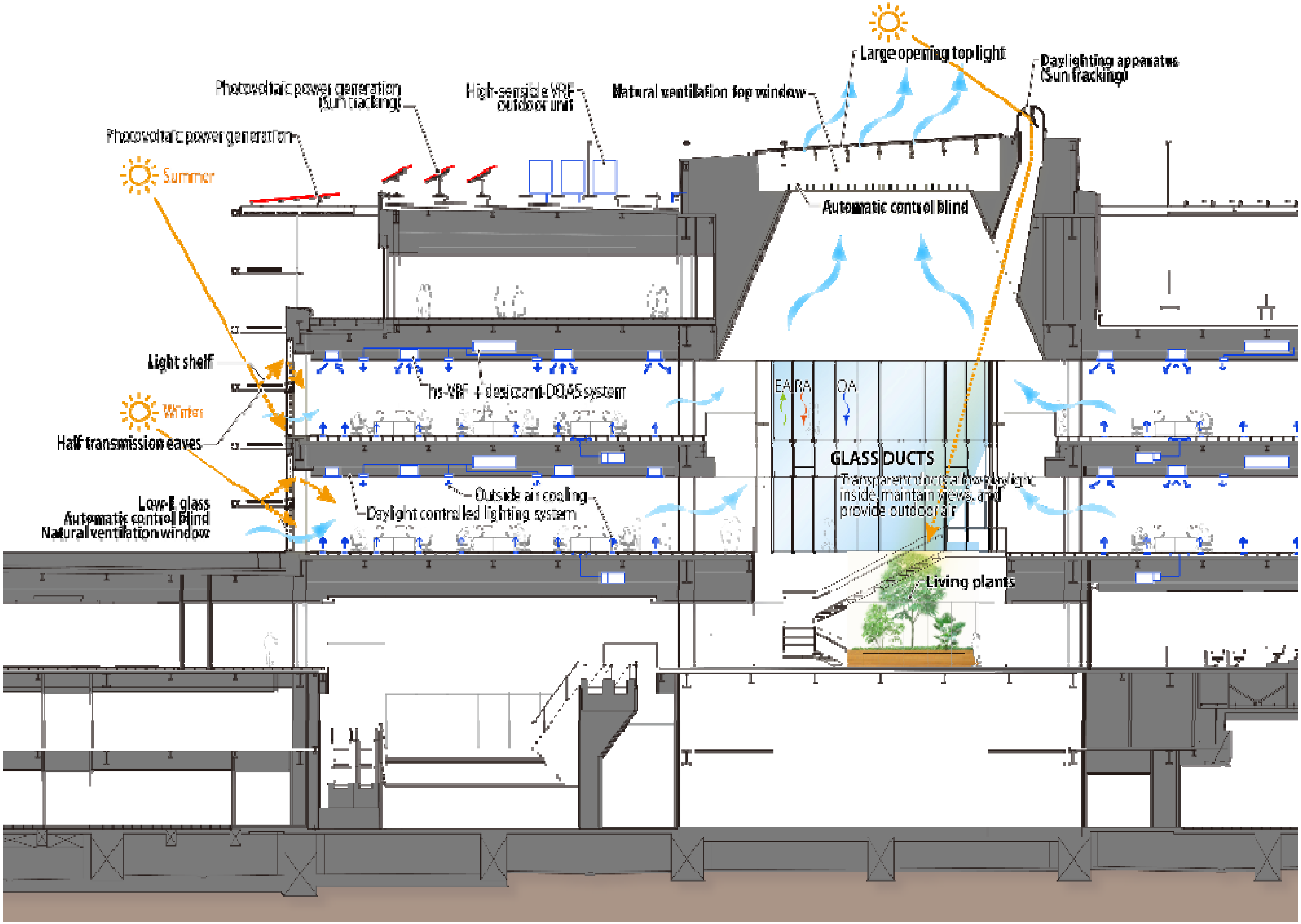
2-storey office with Wai-Gaya Stage in the center accommodates 700 researchers.



North-South Section of Office Area

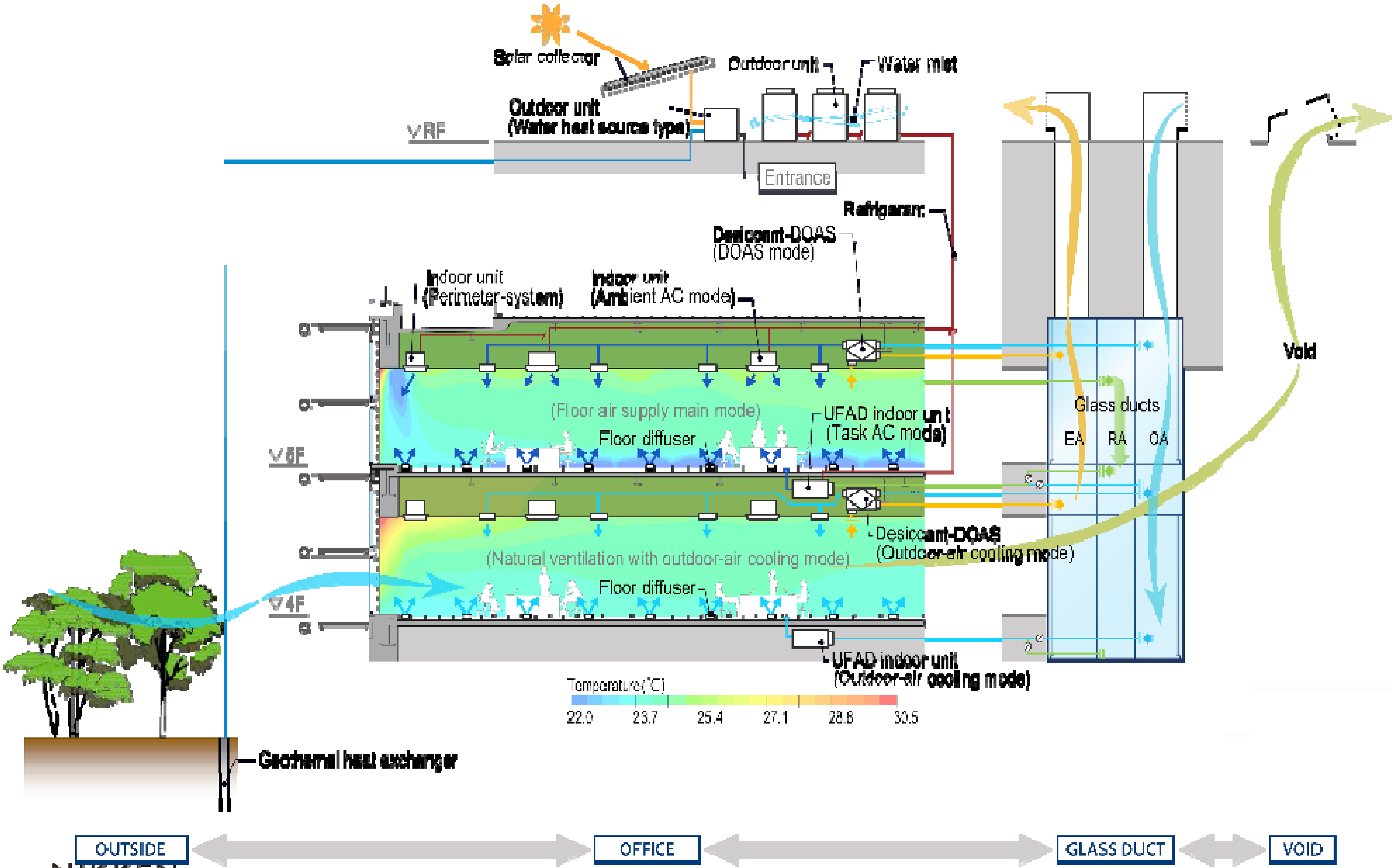


5th Floor Plan



Photovoltaic power generation (Sun tracking)
High-sensible VRF outdoor unit
Natural ventilation top window
Large opening top light
Daylighting apparatus (Sun tracking)
Photovoltaic power generation
Summer
Automatic control blind
Light shelf
hs-VRF + desiccant DOAS system
Winter
Half transmission eaves
EA
RA
OA
GLASS DUCTS
Transparent ducts allow daylight inside, maintain views, and provide outdoor air
Outside air cooling
Low-E glass
Automatic control blind
Natural ventilation window
Daylight controlled lighting system
Living plants

HVAC system -Passive and active method



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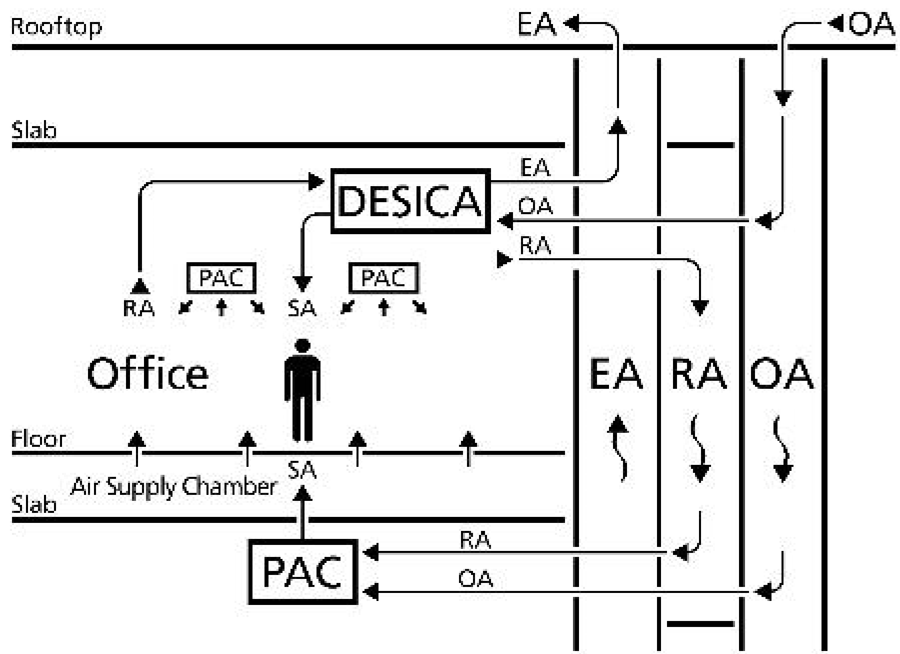
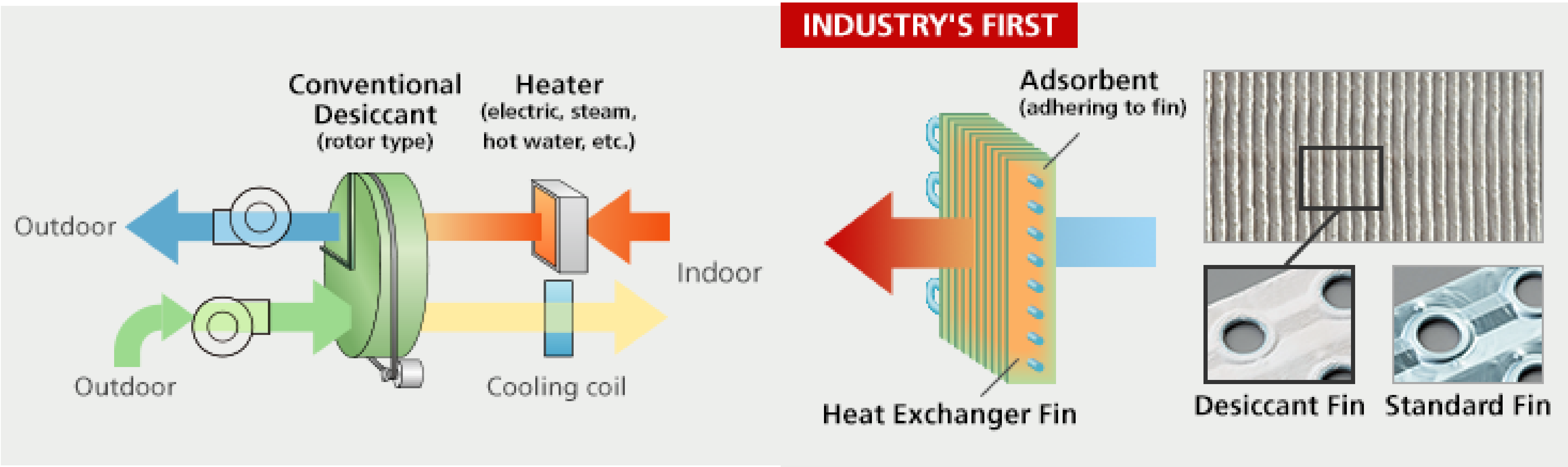
Glazing duct



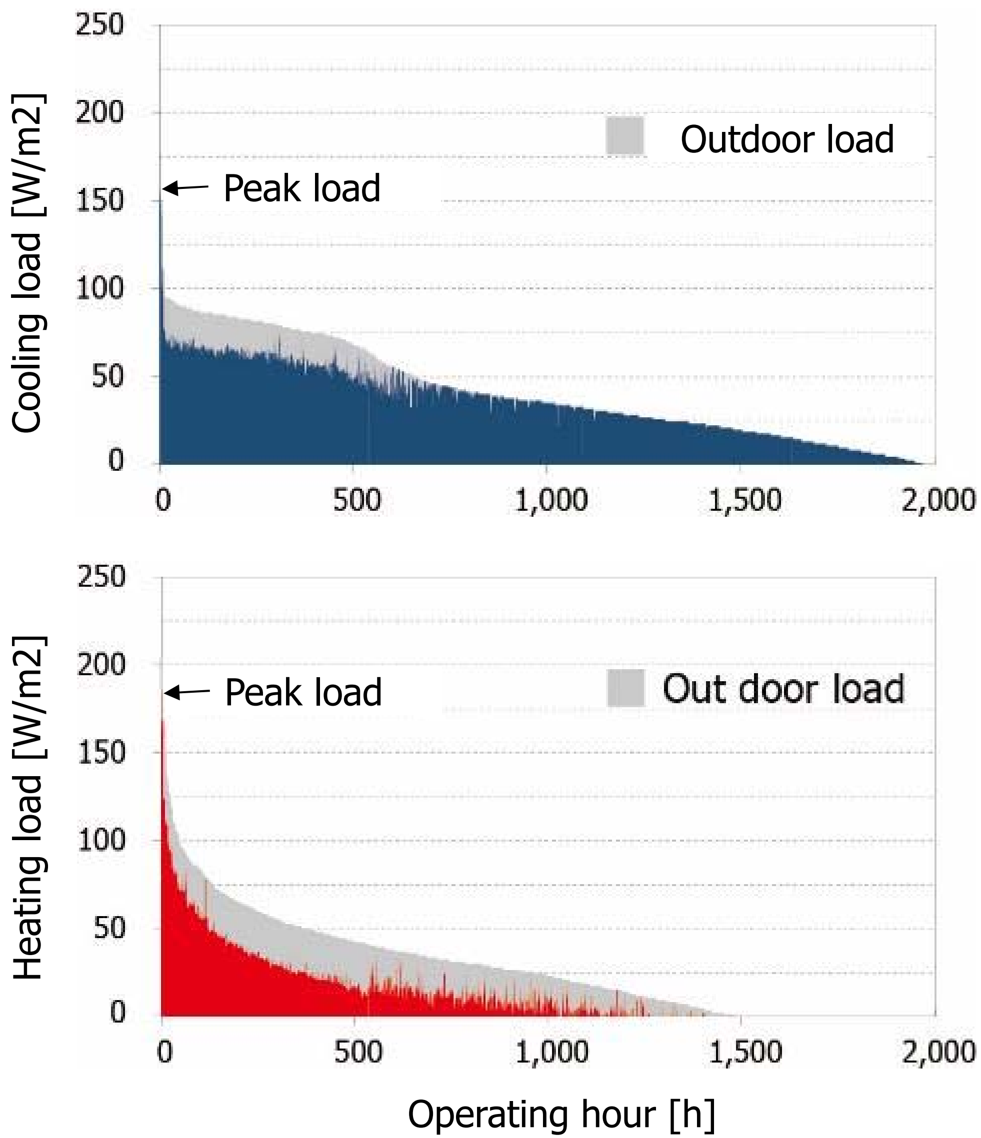
Control air humidity and air quality



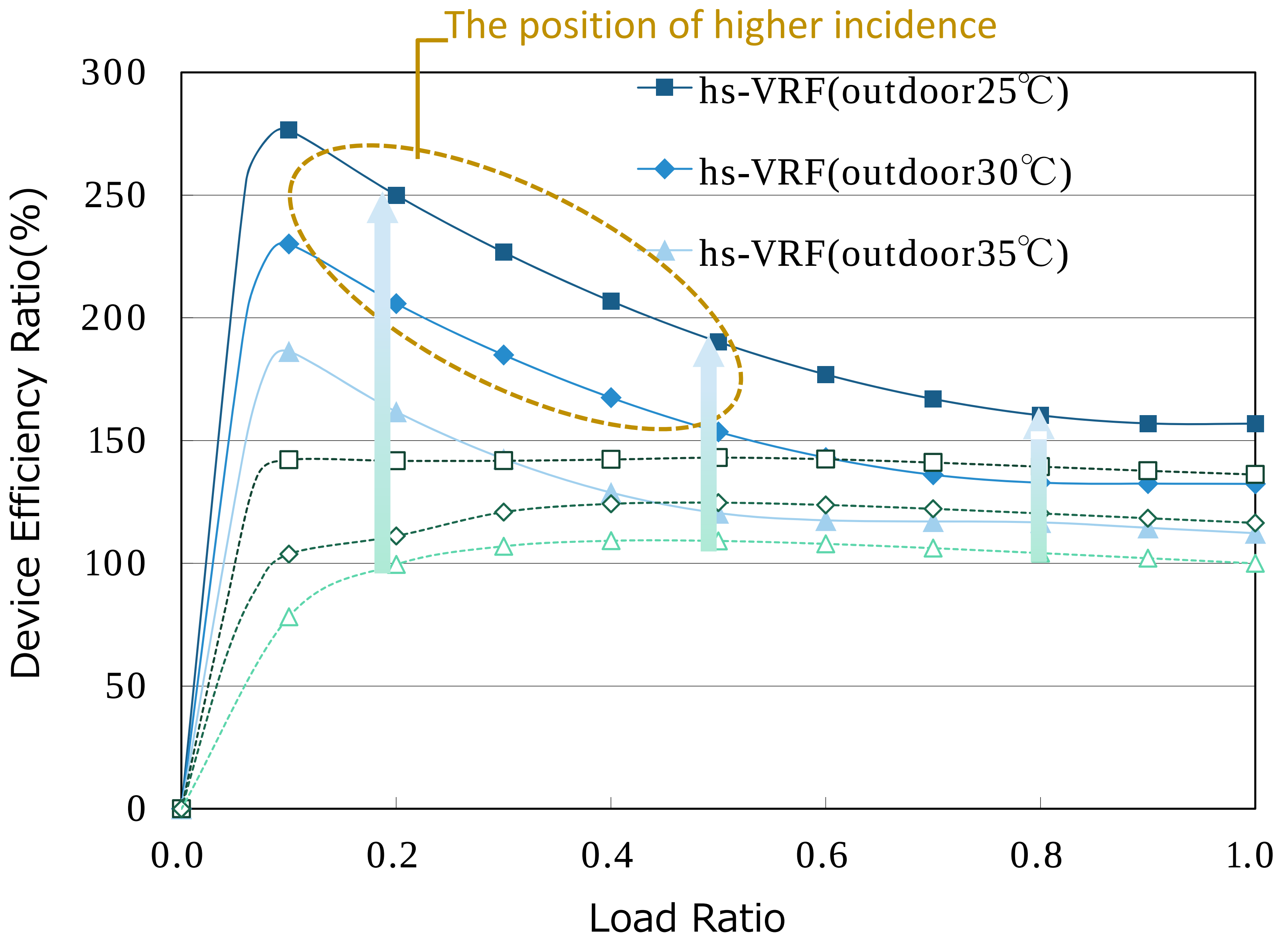
“DESICA” with air-volume control system depending on the CO_2 concentration for TIC

Improvement of part-load efficiency

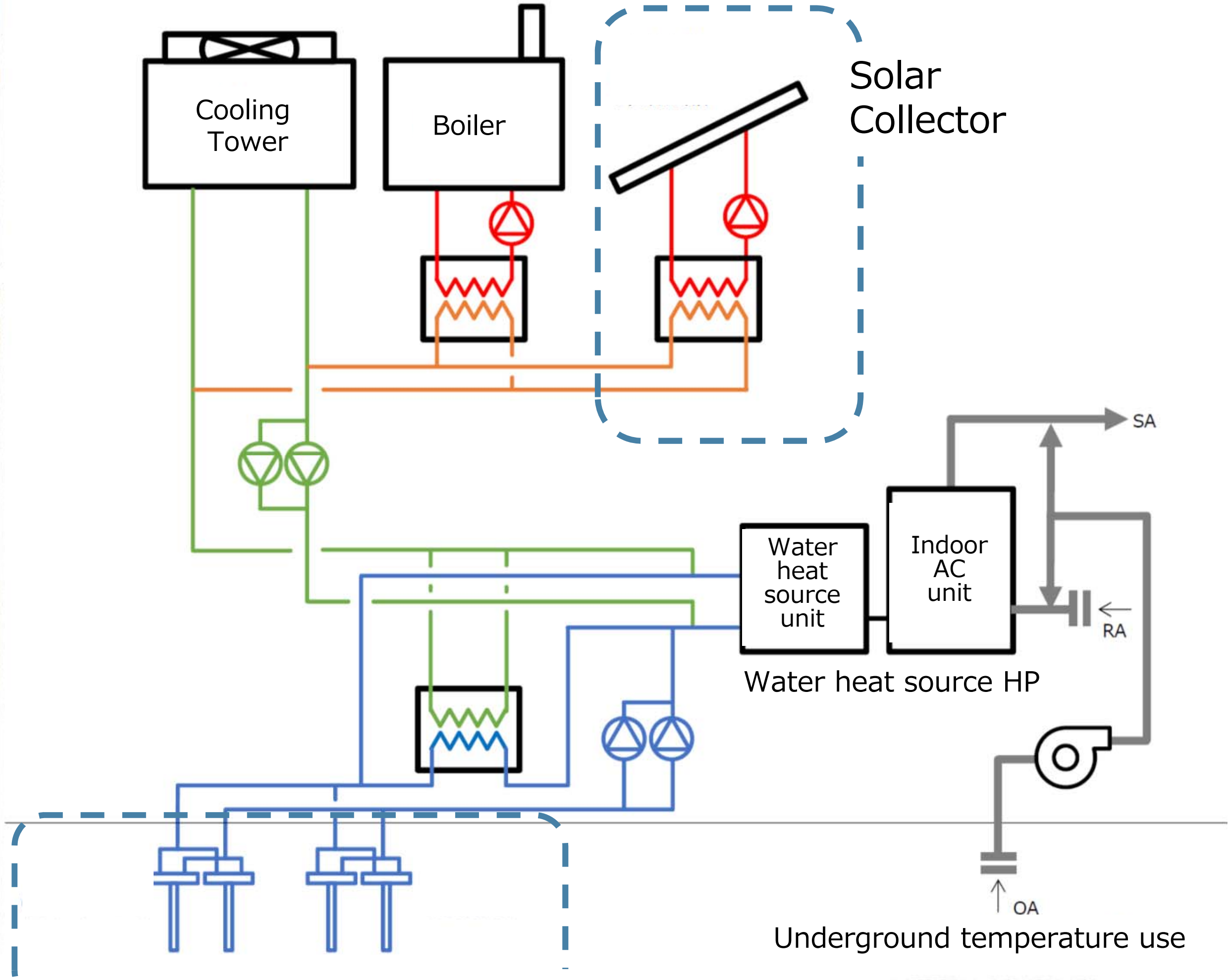
- Annual cooling and heating load distribution of an office.
- Most cooling and heating loads are less than 50% of peak load.
- Operation period at part-load is very long.



hs-VRF system (New VRF system for TIC)



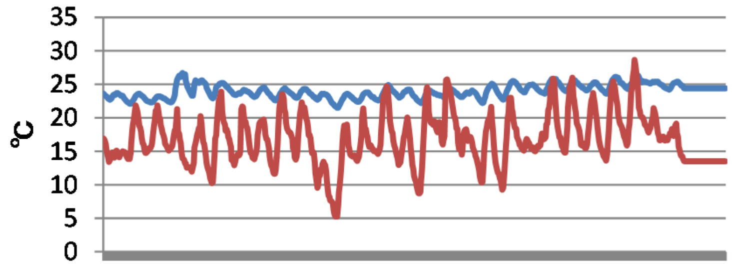
Solar and geothermal VRF

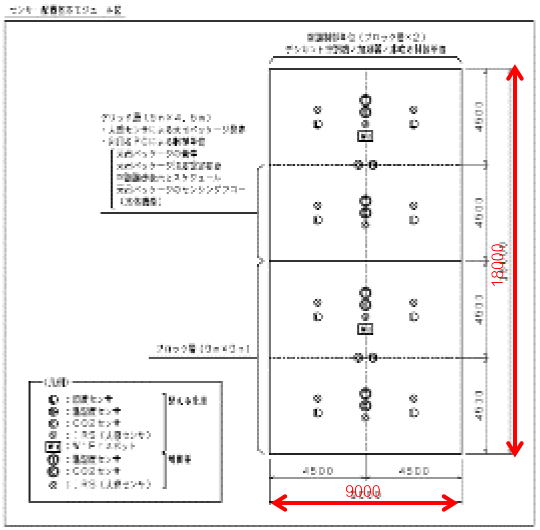


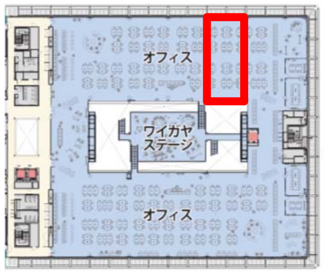
Real time visualization of indoor environment

4.5m×4.5m:Human sensor

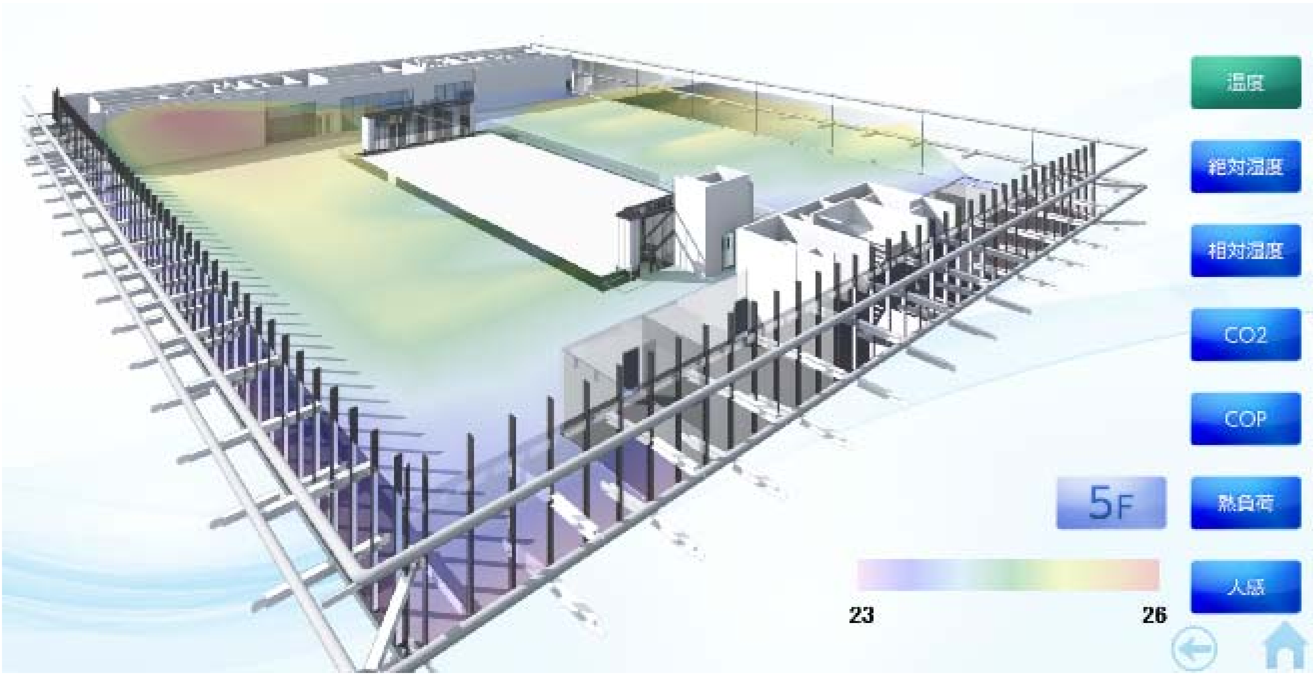
4.5m×9m: Temperature, humidity, CO_2,





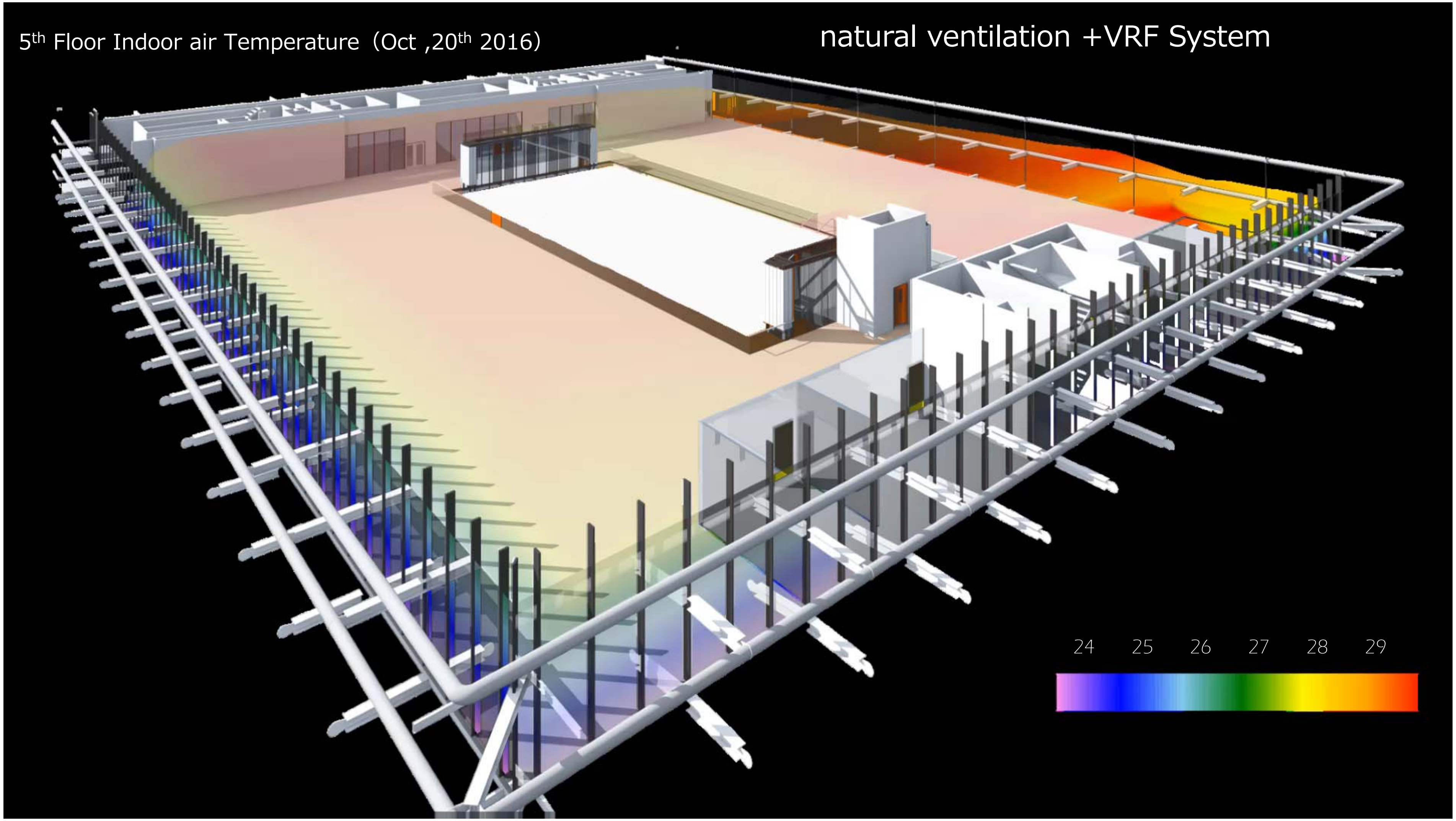


Sensor layout

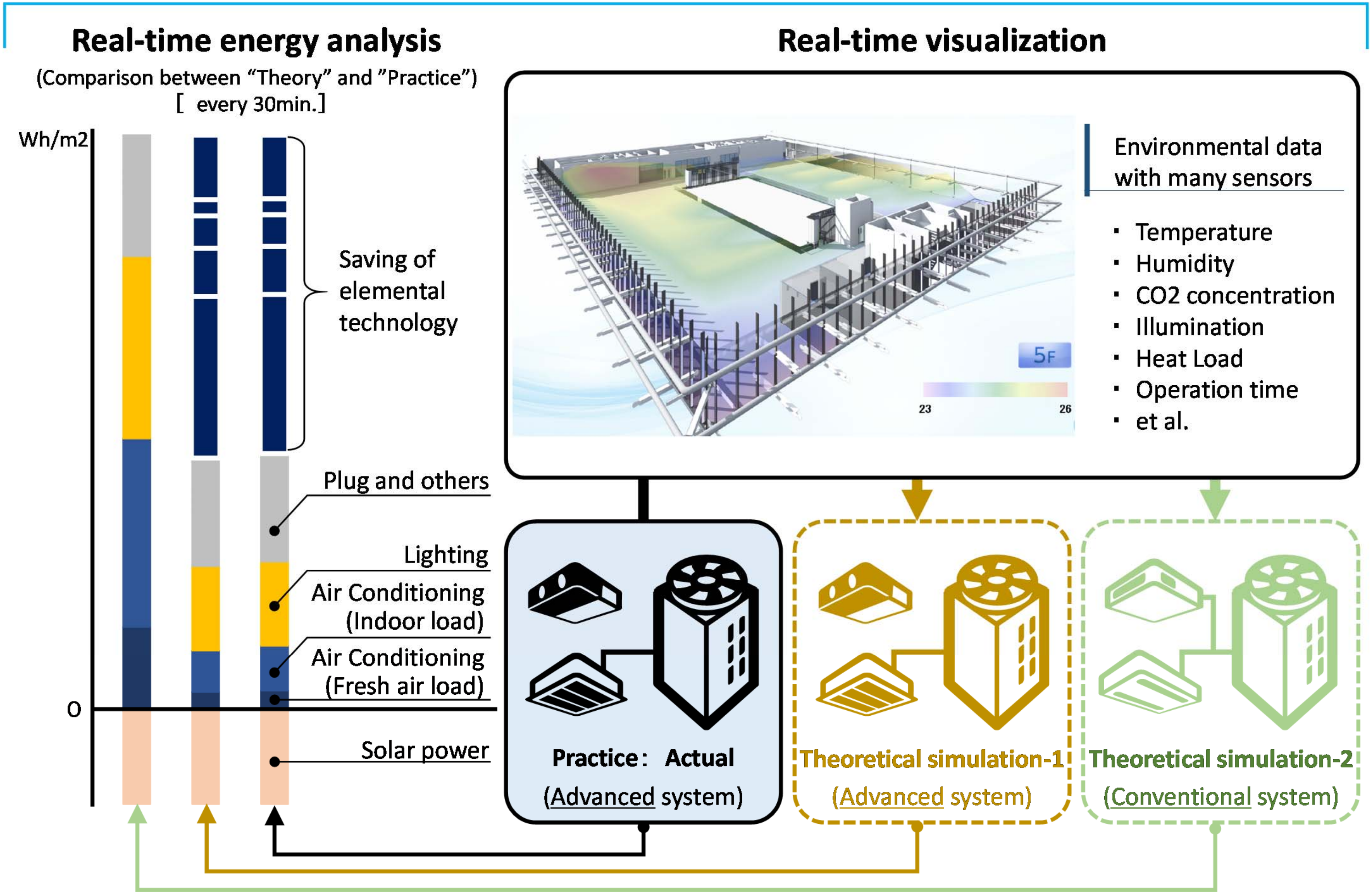


Indoor environment real time contour

Real time visualization of indoor environment



Real time commissioning



LEED Platinum

85/110

U.S. GREEN BUILDING COUNCIL
LEED PLATINUM
USGBC

LEED Score

敷地
Sustainable Sites
24/26

水
Water Efficiency
10/10

エネルギー
Energy & Atmosphere
23/35

材料
Material & Resources
7/14

空気質
Indoor Environmental Quality
11/15

新技術
Innovation in Design
6/6

地域特性
Regional Priority
4/4

85/110

3． ZEB Project Case Study 2

-Achievement of ZEB by architectural elements and education

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Super Eco-School "Mizunami" Middle School"

1．Background and Concept

2．Technology for ZEB

3．Education and Operation

1．Background and Concept

2．Technology for ZEB

3．Education and Operation

Four Keywords of this project

Living

- Enclosed in rich green
- A comfortable classroom to serve as the base of life

Learning

- Learning commons promoting voluntary learning
- Realization of a pleasant learning environment

Region

- Using local materials actively
- Deepen interaction with the community, rooted in the local

Environment

- Realization of zero energy school
- Operation system conducted by the students themselves

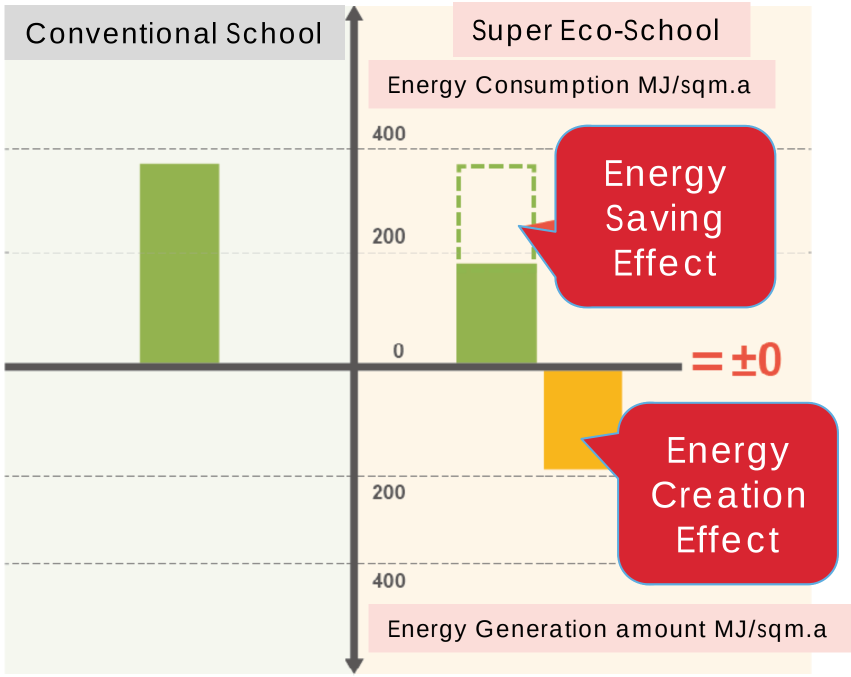
What is Super Eco-school ?

・Reduce energy consumption by thorough energy conservation

・Energy consumption is covered with renewable energy and annual energy consumption is made substantially Zero

"Promotion project of MEXT"

MEXT：Ministry of Education, Culture, Sports, Science and Technology



What is Super Eco-school ?

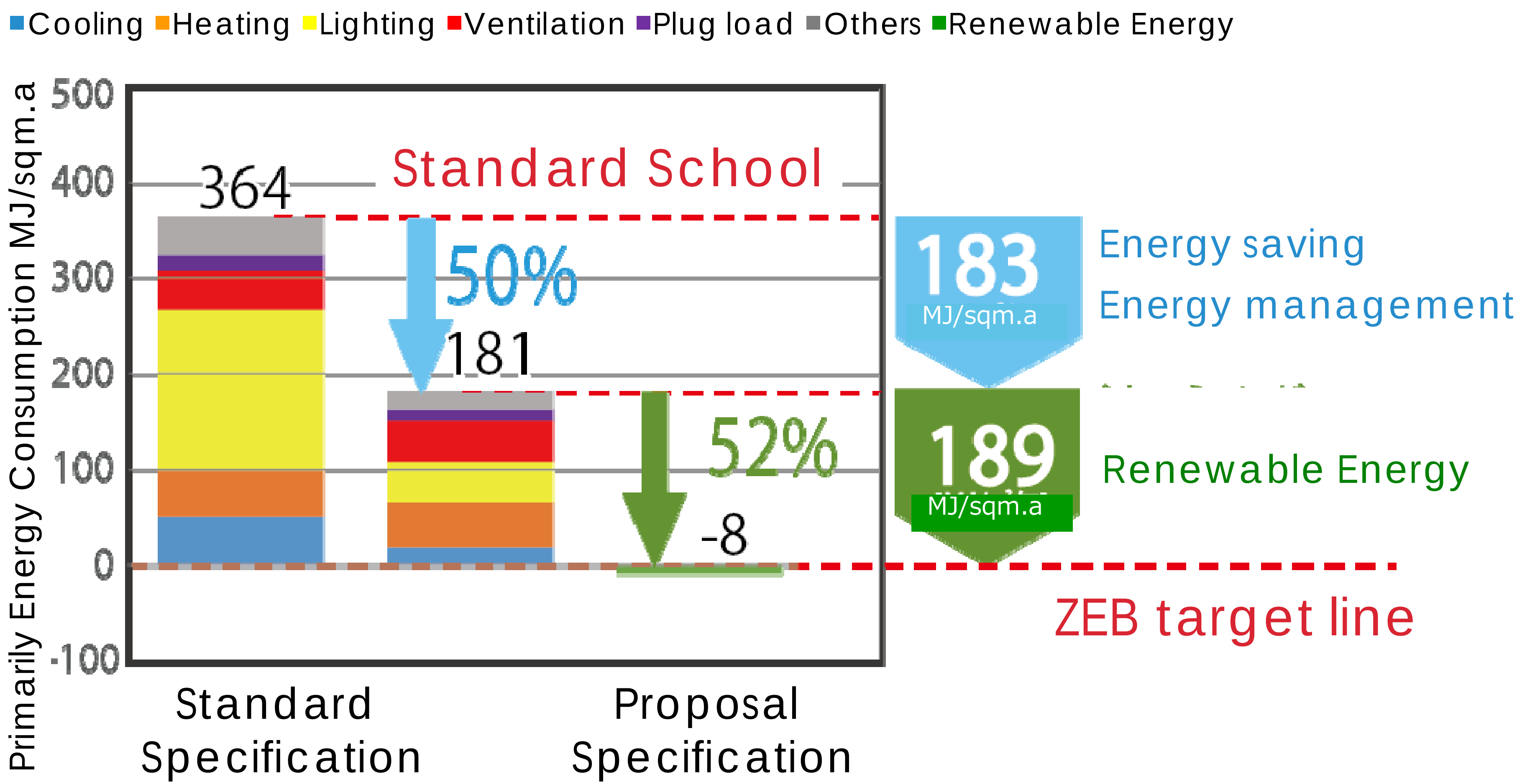
Subsidy system for project cost

■Super Eco School Demonstration Project
"MEXT" :Ministry of Education, Culture, Sports, Science and Technology
＋5 millions $

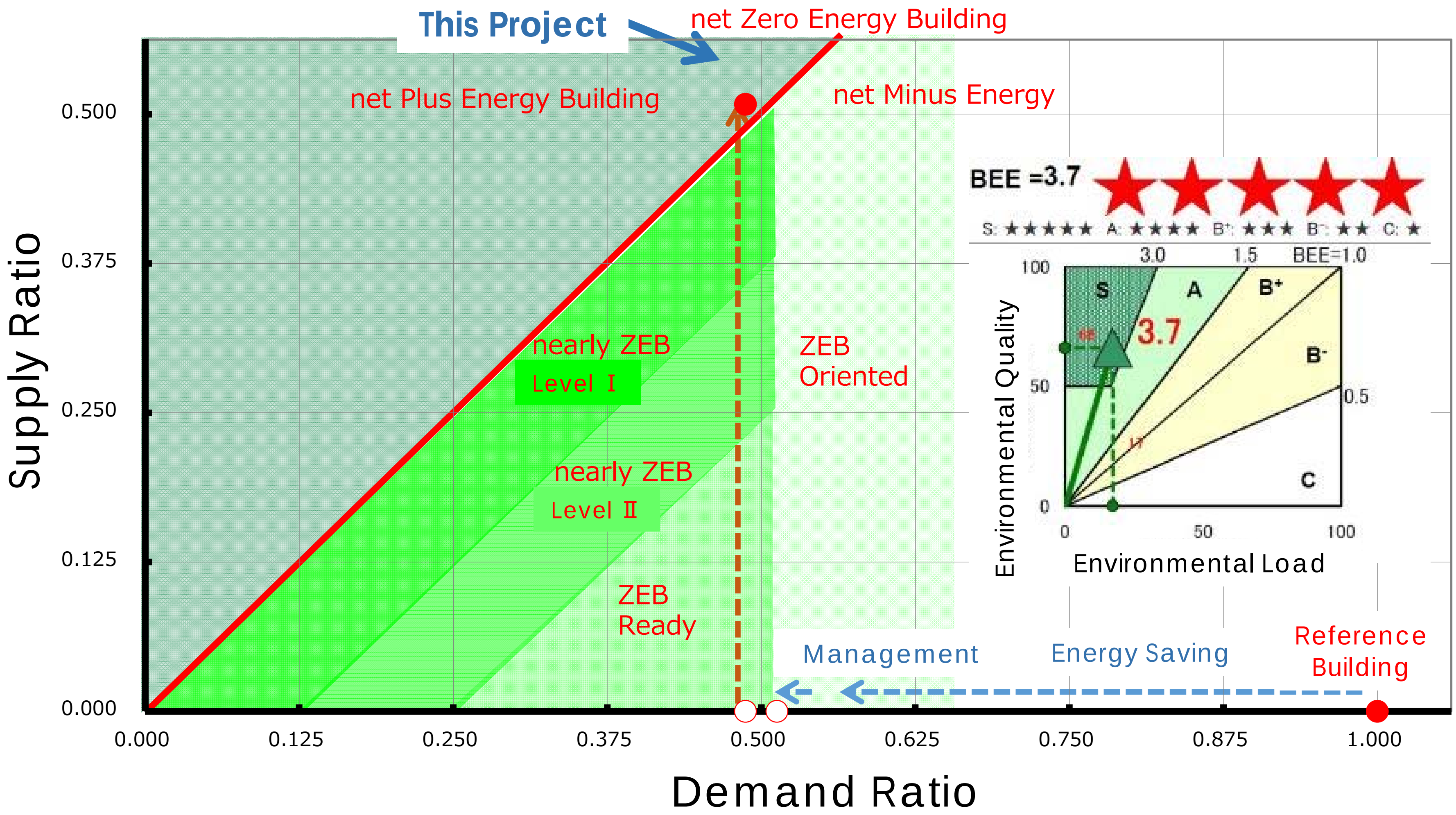
■Sustainable Buildings Leading Project
"MLIT" :Ministry of Land, Infrastructure, Transport and Tourism
1.5 millions $

■Interior woodening support project
"Gifu prefecture"
0.5 millions $

Scheme for achieving zero energy



Level of ZEB in this project



Toward achieving Zero Energy Building

Instead of automatically controlling everything, utilize SI (Student Intelligence) to lead to environmental learning

Encourage school to zero energy promote environmental education

Super Eco-school

1. System operated by students

Eco activities by students themselves

- Eco monitoring
- Student's own activities

2. Zero Energy System as Mizunami method

Use natural energy based on industry and climate

- Natural Ventilation
- Underground Heat Exchange
- Daylighting
- Solar Energy

3.Lighting,HVAC ,Water saving system

Energy saving efficiently

- Reduction of Heat Load
- Heat exchange CO_2 control
- Water Saving Equipment
- Power Saving LED lighting / Occupant detection sensor

1． Background and Concept

2． Technology for ZEB

3． Education and Operation

Project site

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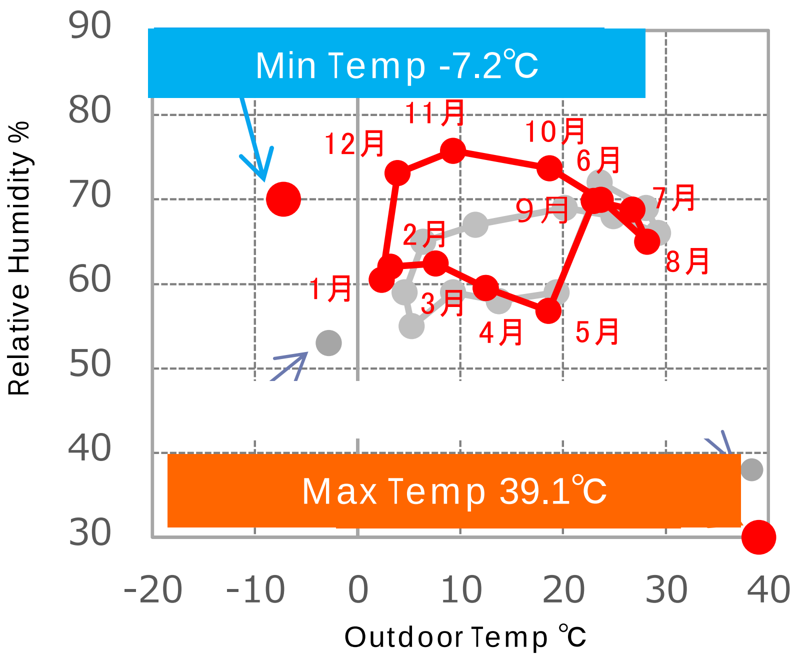
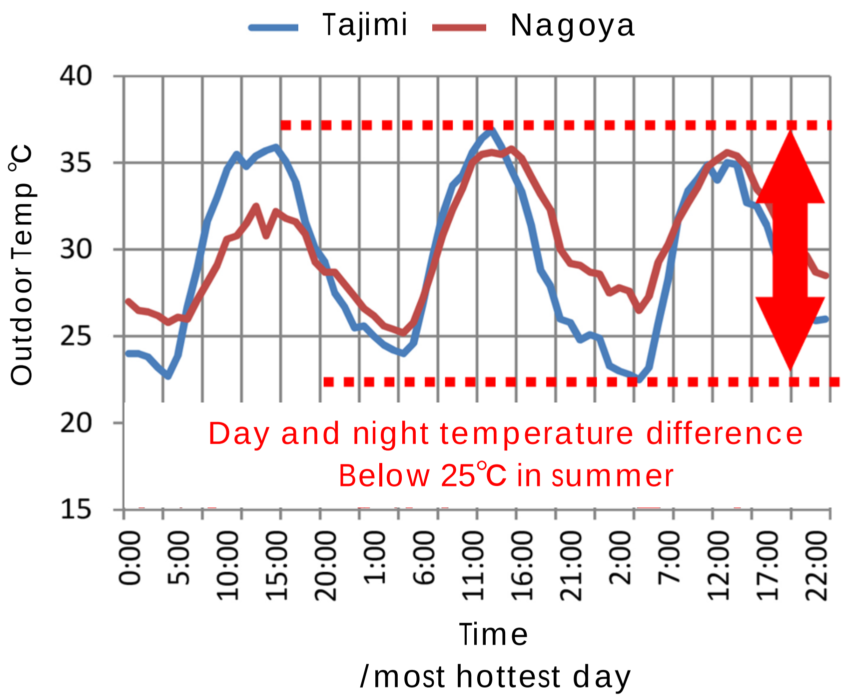
Project site

Mountain slope site with urban area and river in the south

Climate conditions of the site

The site is a basin sandwiched between mountains.
High temperature and day and night temperature difference in summer.

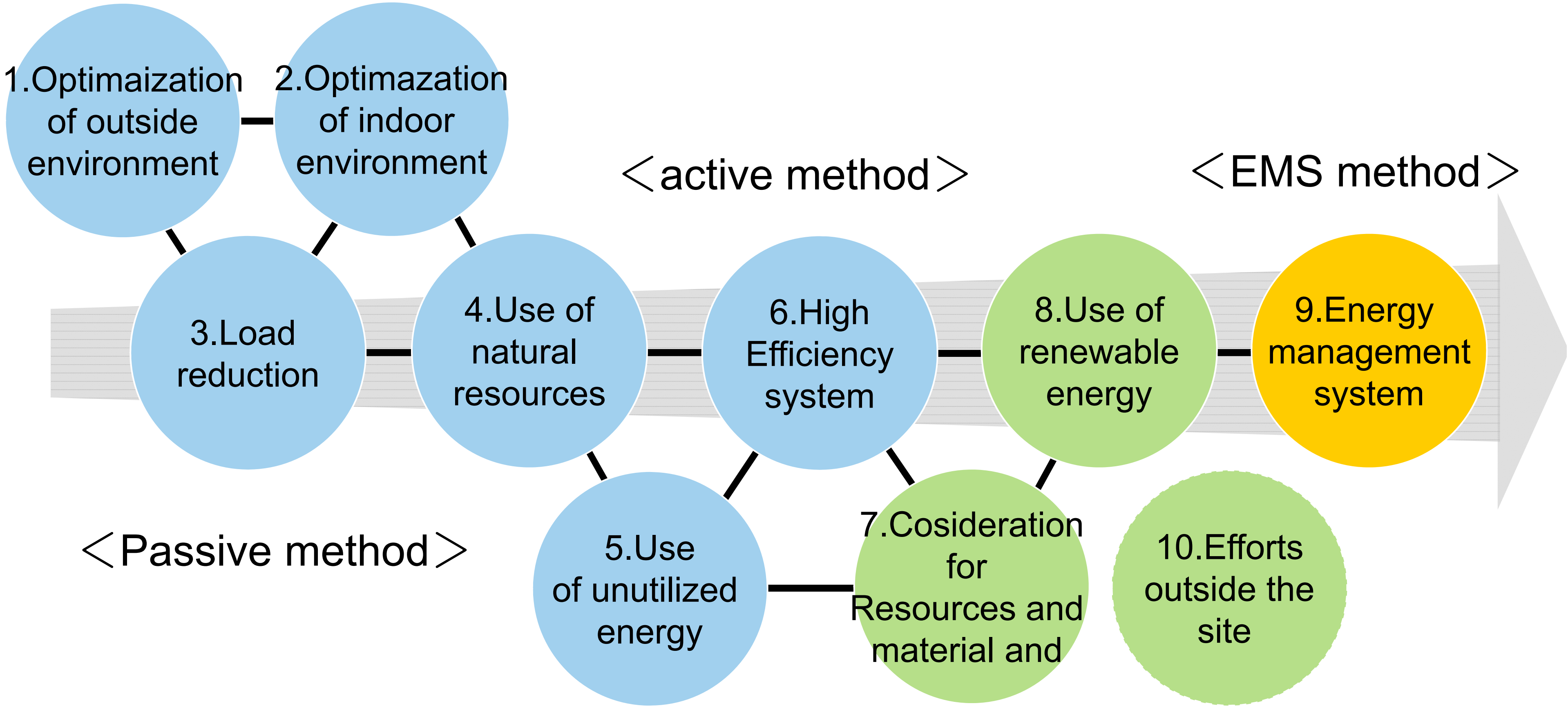




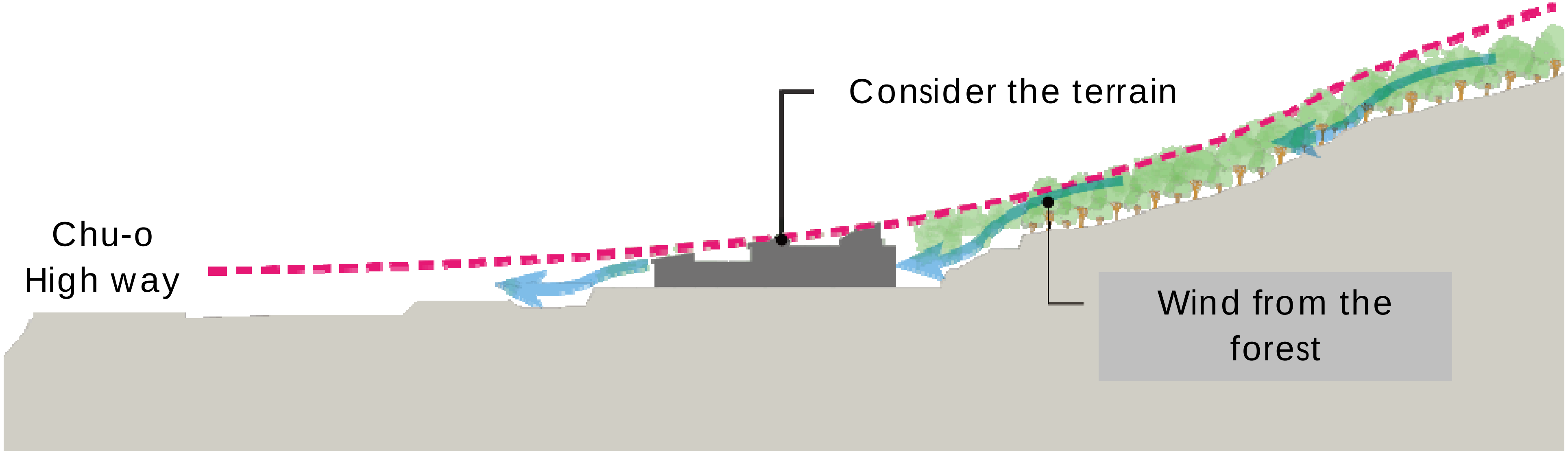
Source: Extended AMEDAS Weather Data 2002

Month

Design process of achieving zero energy

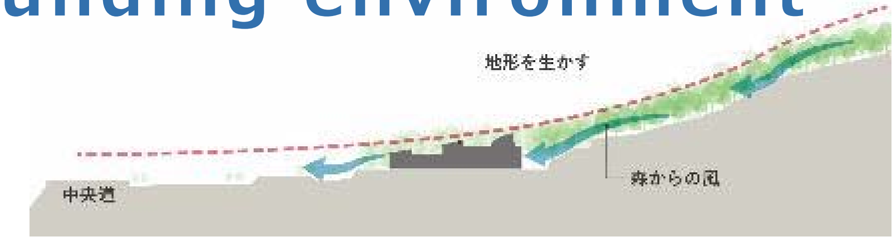


Placement of building along ridgeline of mountains



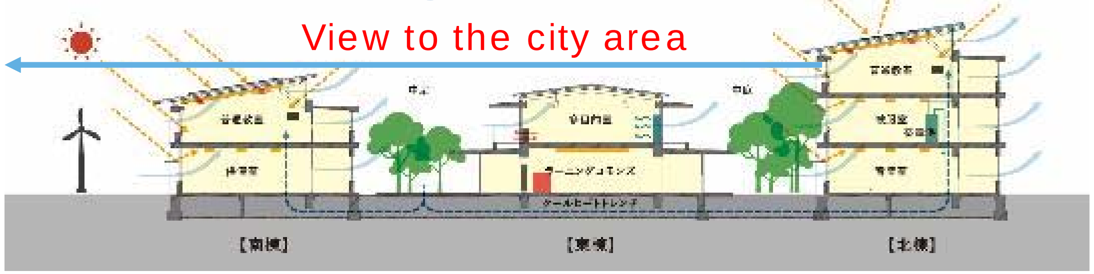
Familiar with the surrounding environment

Arranged along the slope of the
mountain facing the south,
the building height was kept low



Familiar with the surrounding environment

From any classroom you can have a view to the city



Familiar with the surrounding environment

The School building with a horizontally spreading mountain back

Exterior view from the main gate

Courtyard surrounded by the building

Enclosed in rich greenery

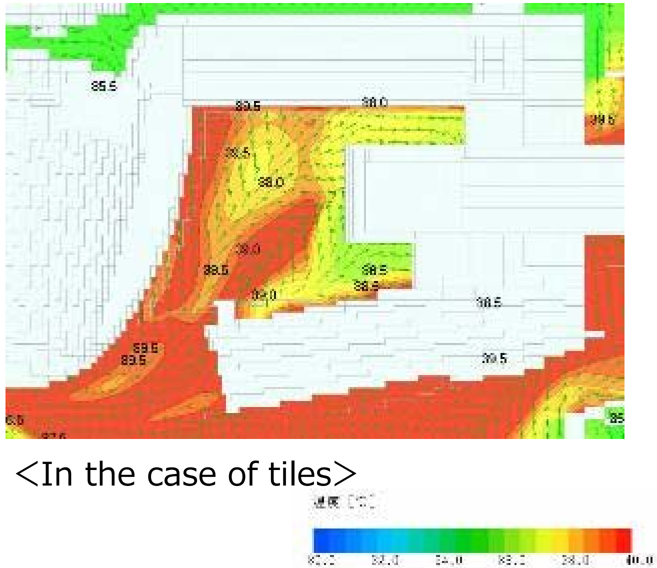
Two type of forest leading “Breeze” and “Sunlight“

“Breezing” forest

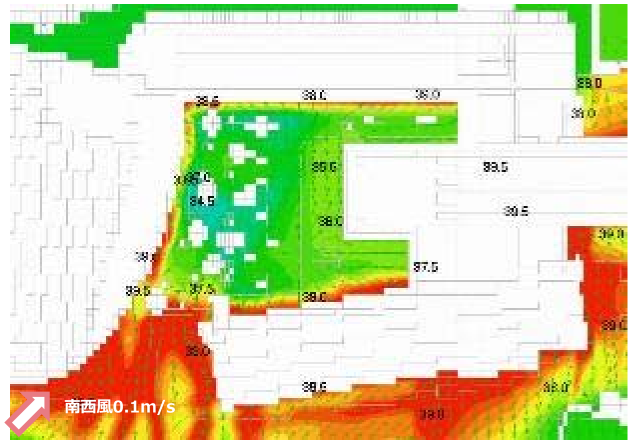
“Sunlight“ forest

Planting with tall trees

- Reduction reflection from the ground with the shade.
- Reducing the heat environment of the courtyard by lowering the surface ground temperature.
- Lower the air temperature from the outside to the classroom in the summer



<In the case of tiles>



<In the case of lawn and trees>

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High comfort classroom

A classroom that feels warm, making use of wooden beams

Bright classroom with both north and south Daylighting using gradient roof

Multipurpose room utilizing wooden beams

Facing the "Breezing" Forest, a place surrounded by greenery

Utilizing the materials of the local area of Mizunami

Tiles

Produced at the factory in the city from the soil in the vicinity of Mizunami

Hinoki plywood

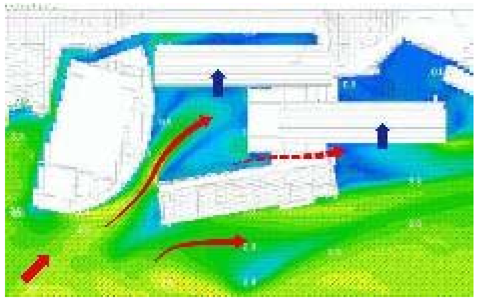
Utilizing plywood of Hinoki from Gifu Prefecture as a wall finish

Cedar/ Hinoki Flooring

Use cedar from Gifu prefecture for consolidation flooring
Conference room only Mizunami hinoki

Spiral staircase with shellfish motif

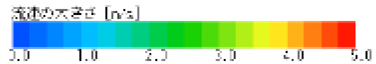
Arrangement of the building leading the wind



Wind to the courtyard goes through the whole school building

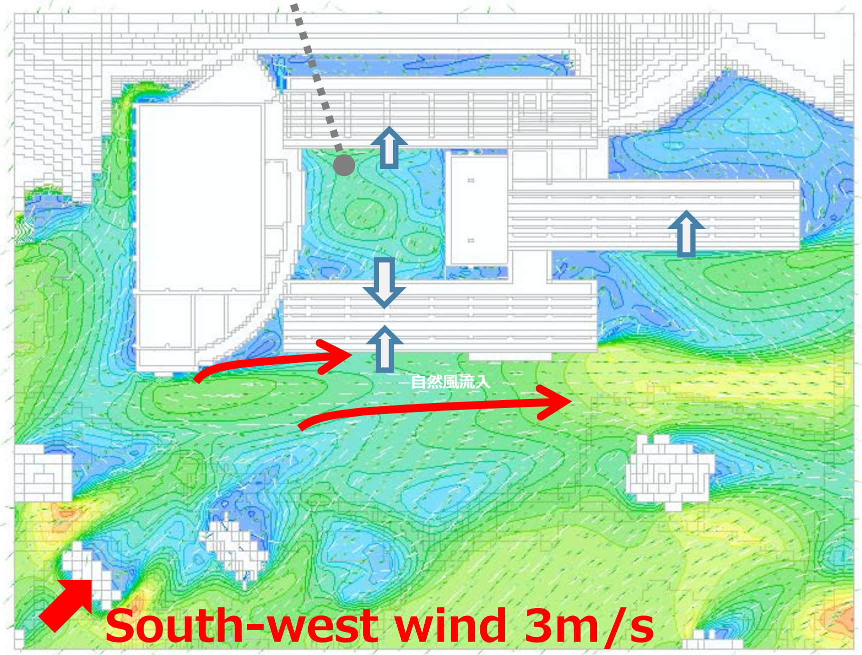
Arrangement of the building leading the wind

- Based on the wind flow simulation, the building layout of the South wing was tilted by 10 degrees.
- We curved the outer wall of the indoor playground.



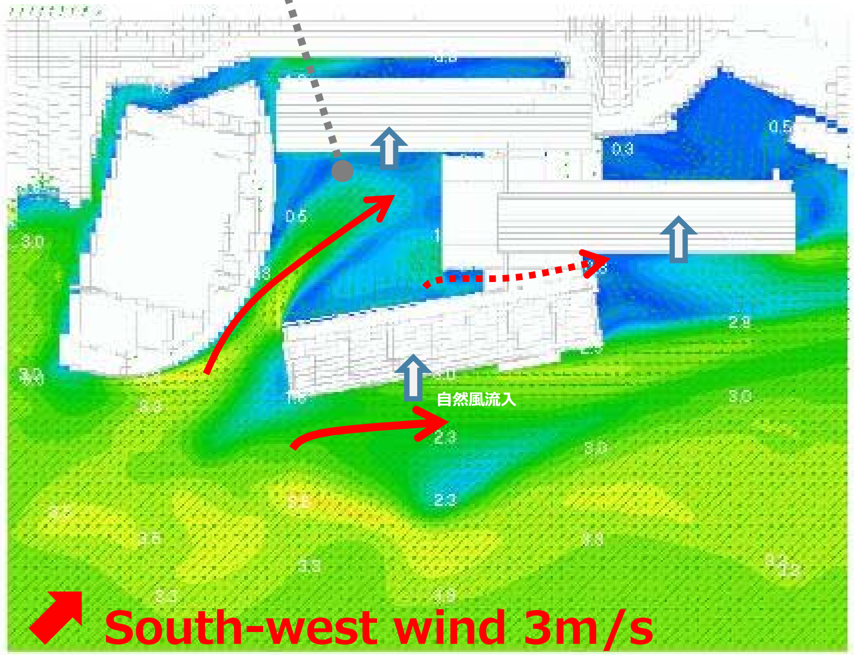
No tilt

Since natural wind is not blown into the courtyard, wind speed is small and natural ventilation is not promoted.



Tilted by 10°

Wind flowing down the inner courtyard without the wind speed falling



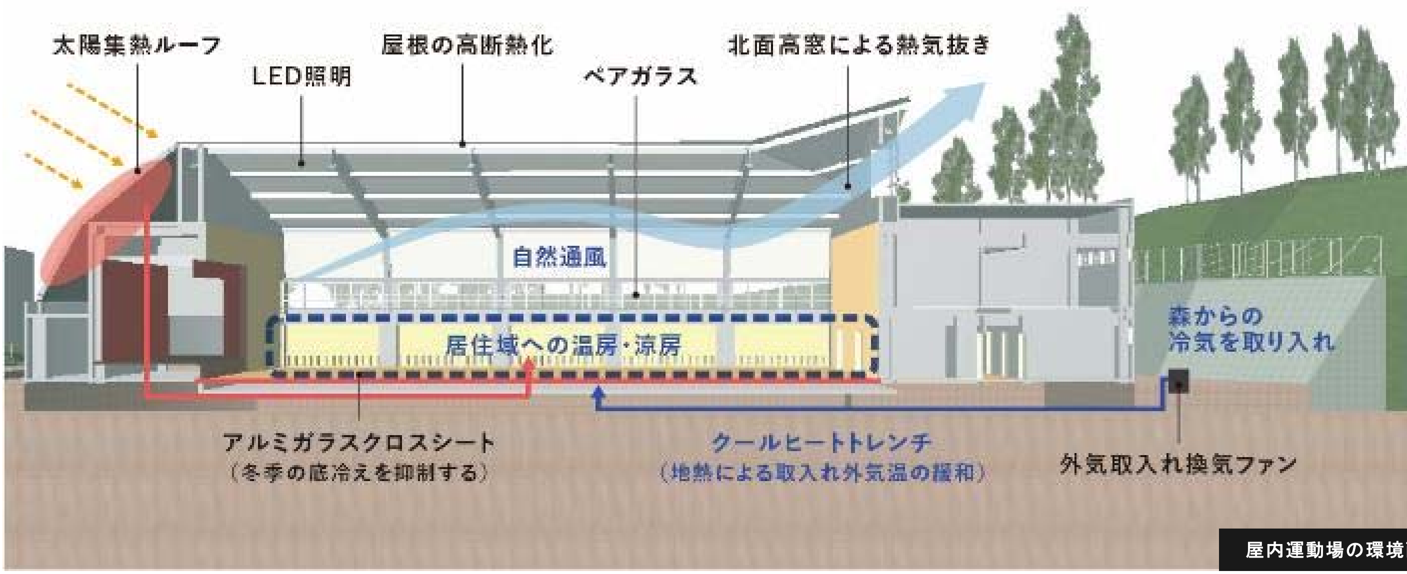
Cross section of the building and technology for ZEB

Natural ventilation system passing through the hall

Indoor playground like a whale shape

Solar collector roof

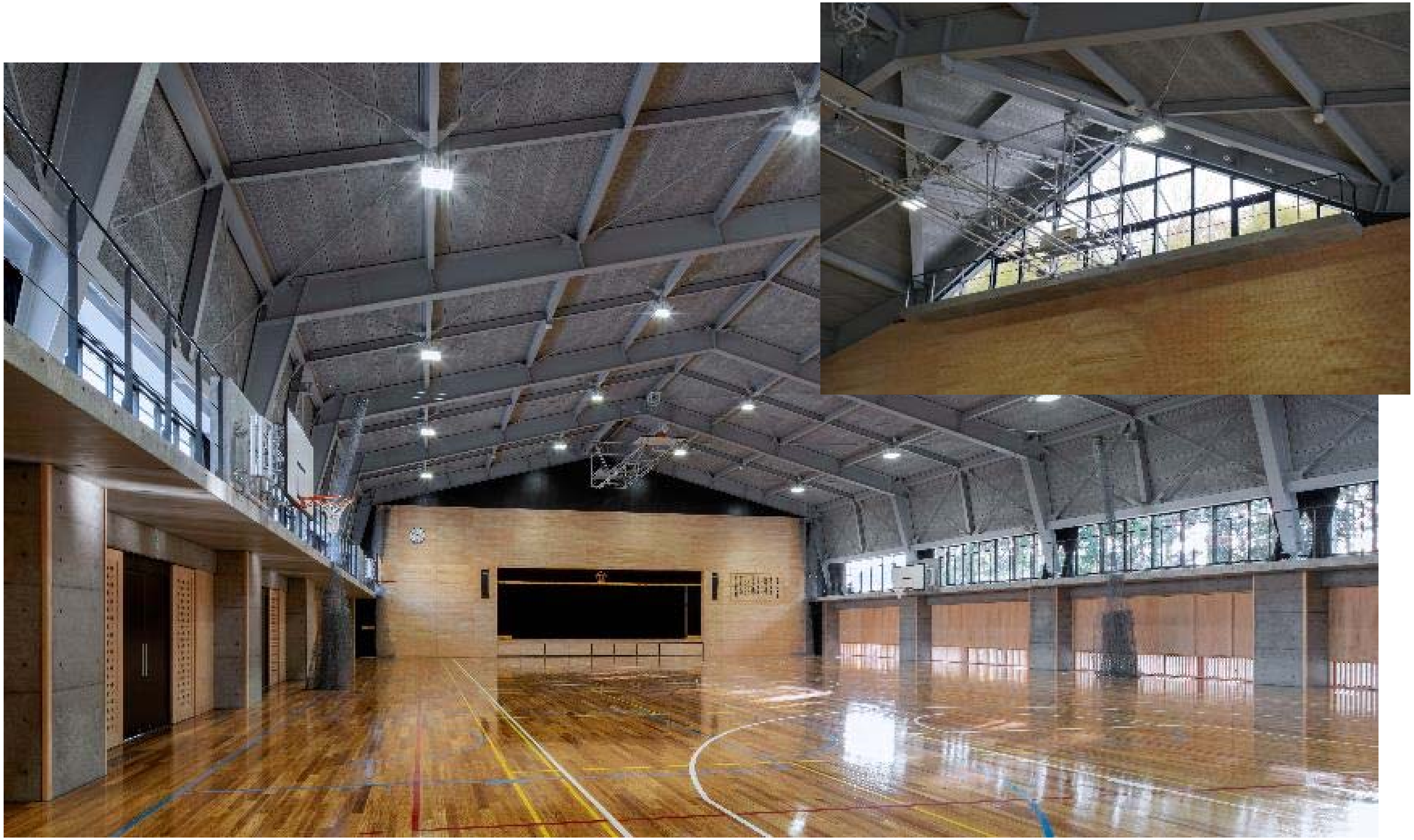
Collect solar energy and warm air. Send to arena.



屋内運動場の環境配慮イメージ

Natural ventilation window

Perform efficient hot venting from high windows



Light shelf

Guide light through the diffusion film into the classroom

Learn the changes in the sun altitude for each season on the scale of the science room

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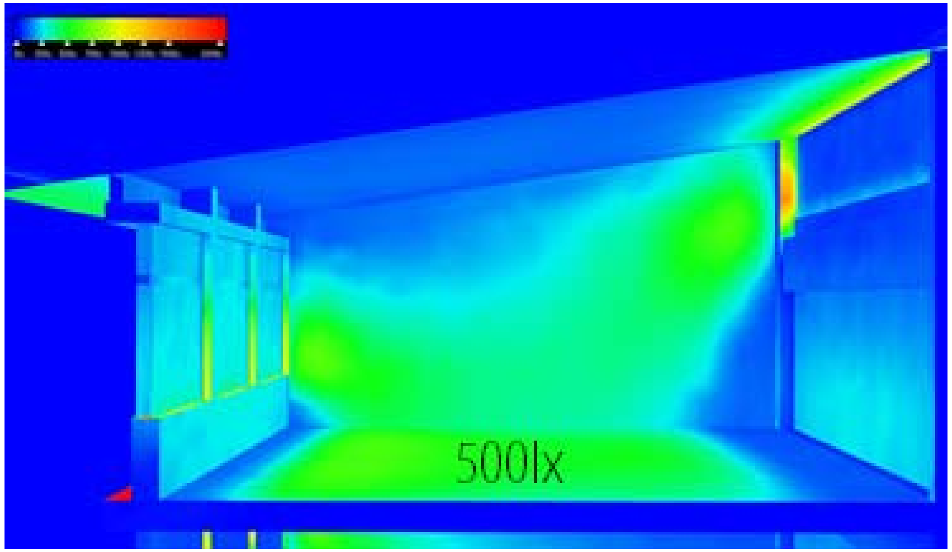
Light shelf

Perform lighting simulation only with natural lighting
Reduce lighting energy as much as possible by natural lighting on both sides



Ordinary classroom

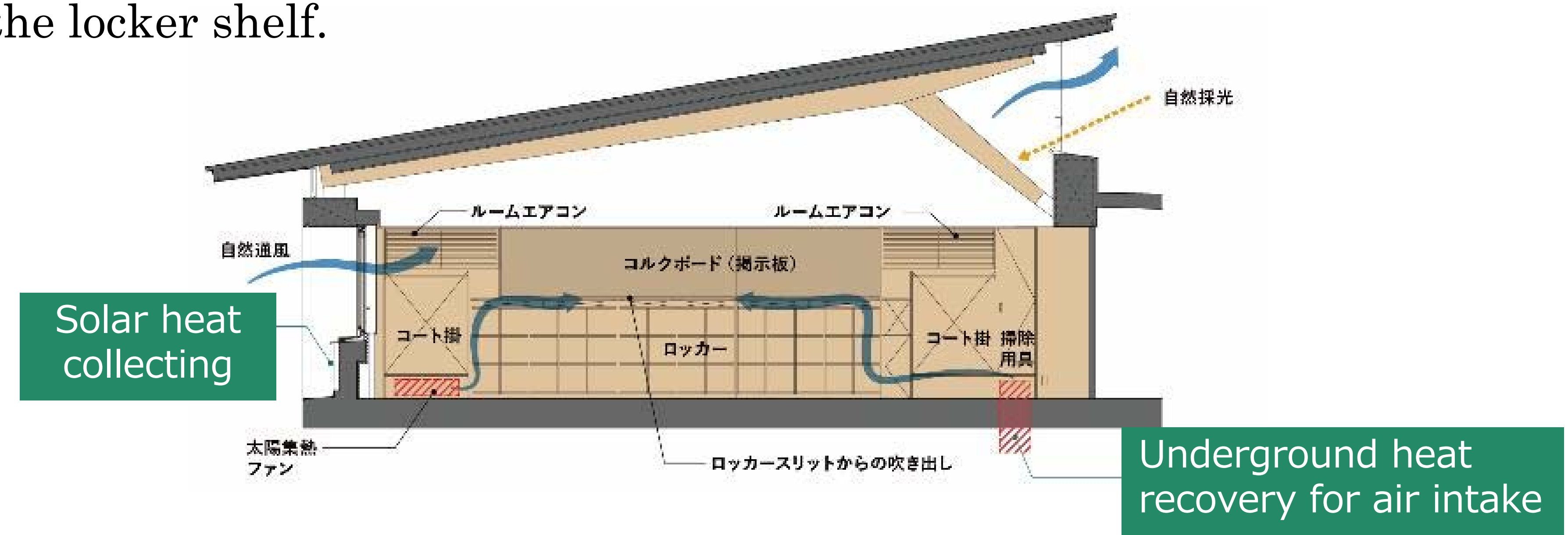
Think about their living environment and carry out eco activities

Ordinary classroom

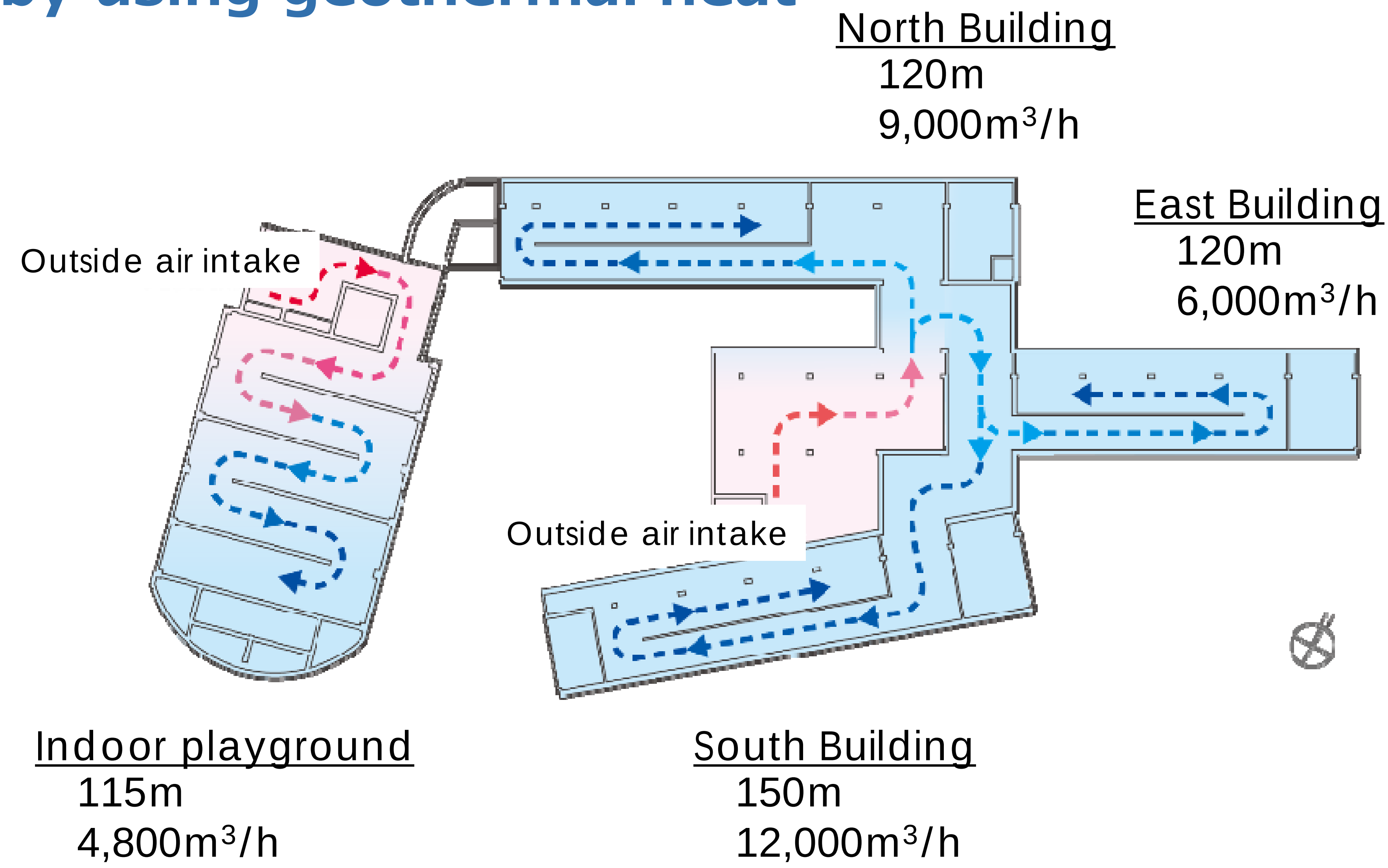
Students themselves think about a comfortable and energy-saving environment

Underground heat recovery and Solar heat collecting

Blow out solar heated warm air or air cooled by geothermal heat from the locker shelf.

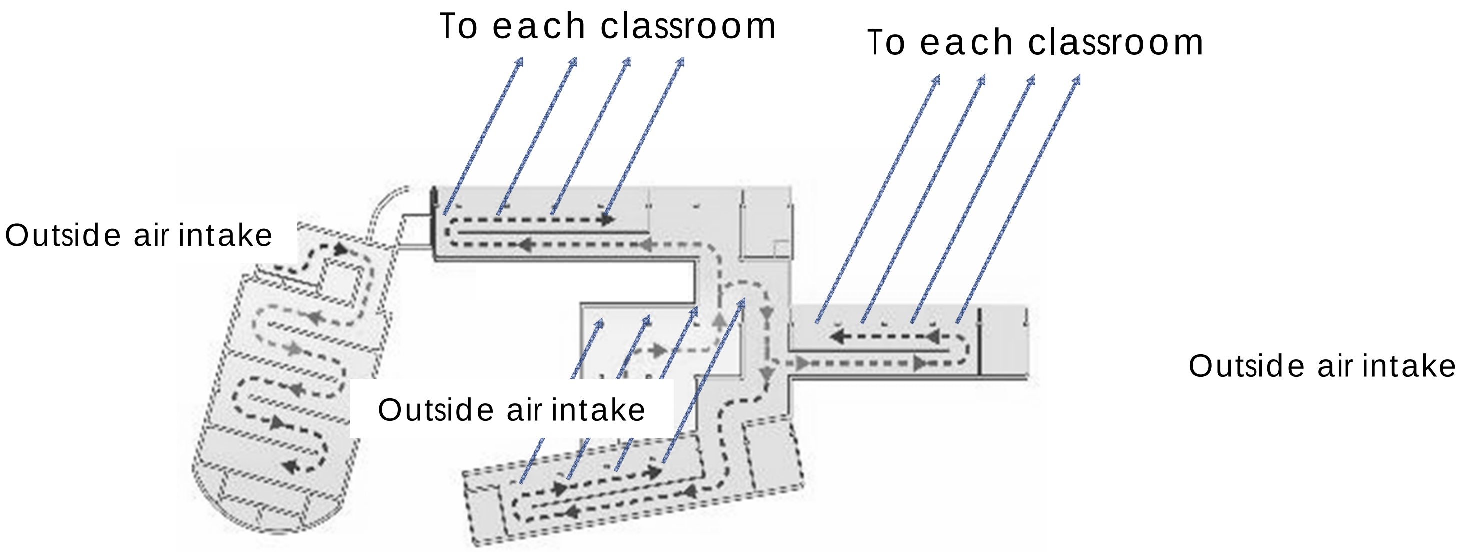


Air cooled and warmed by using geothermal heat



Underground heat recovery

Enhance students' interest by making intake and routes visible



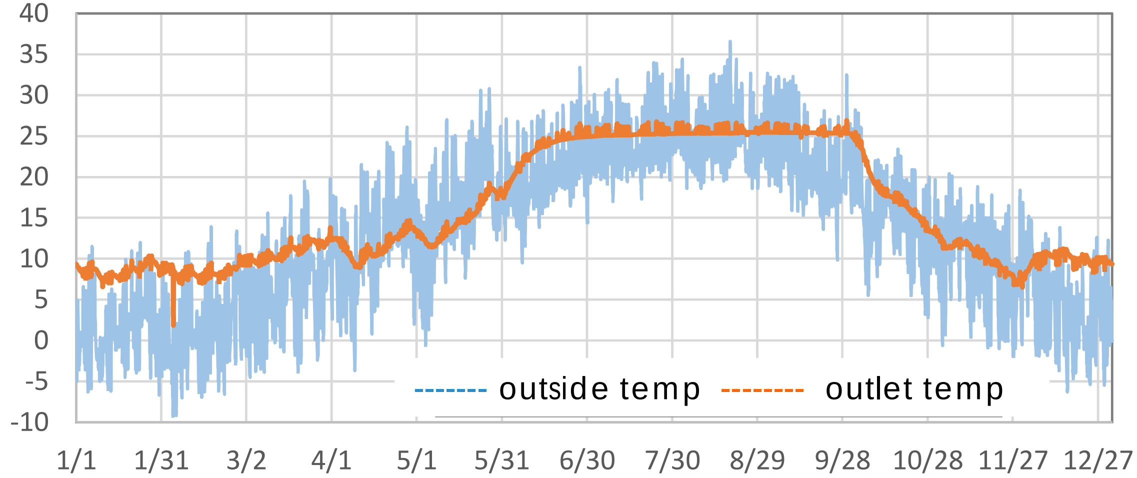
Air intake under spiral staircase

Window to observe the underground pit

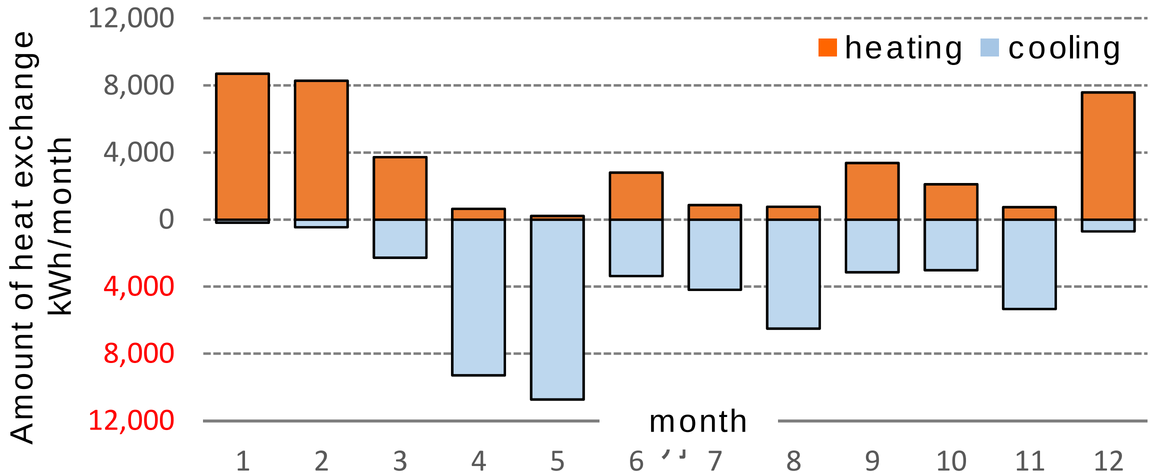
Prediction of cooling and heating effect by using geothermal heat

Outlet temperature

Summer : 25～26℃
Winter : 10～12℃

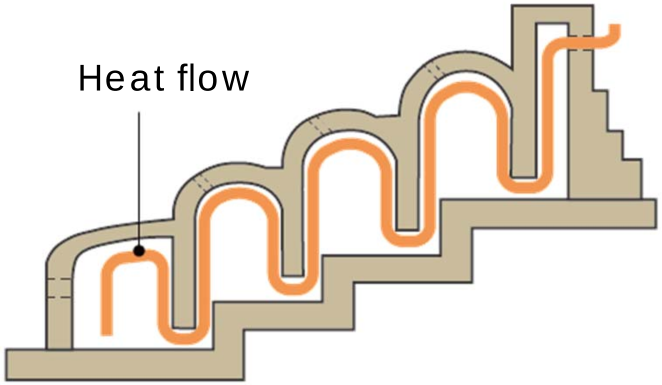


Cooling and heating Calculation



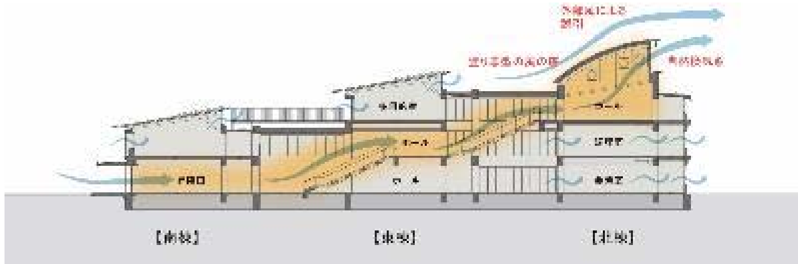
Natural Ventilation

Use the principle of ascending heat in a pottery baking kiln



Natural Ventilation

Air continually rises to the upper floor and heat escapes from the ventilation window in the wind tower



Mechanism for encouraging natural ventilation throughout the building

Solar power panels and accumulators batteries

Install up to 120 KW solar cells on the slope roof

Part of the electricity generated is stored in the storage battery and it can be used even during a power outage.

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Wind power generator

Wind power generator 1kW that can sense wind direction and wind speed

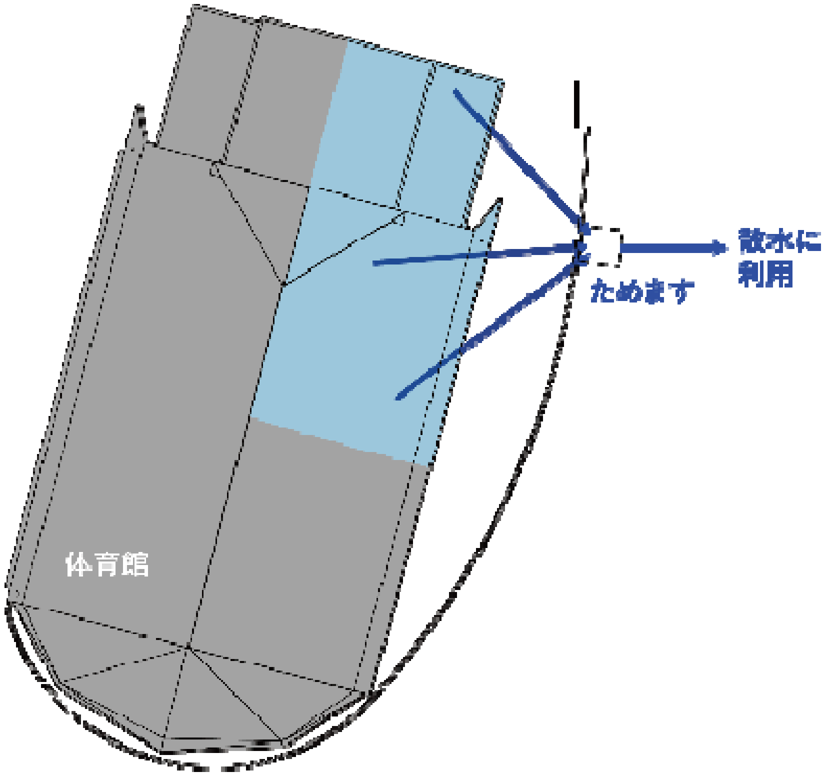
Placed at the entrance to the "Breezing" forest

Roof top greening

Increase the insulation performance of the building and create a green landscape

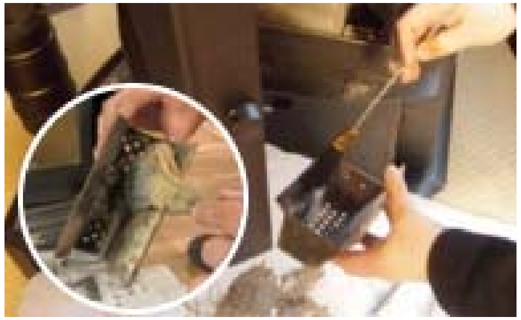
Rainwater retention

Rainwater falling on the roof of indoor playground is used for watering for planting



Pellet stove

Heating equipment using pellet fuel utilizing local waste wood waste



1． Background and Concept

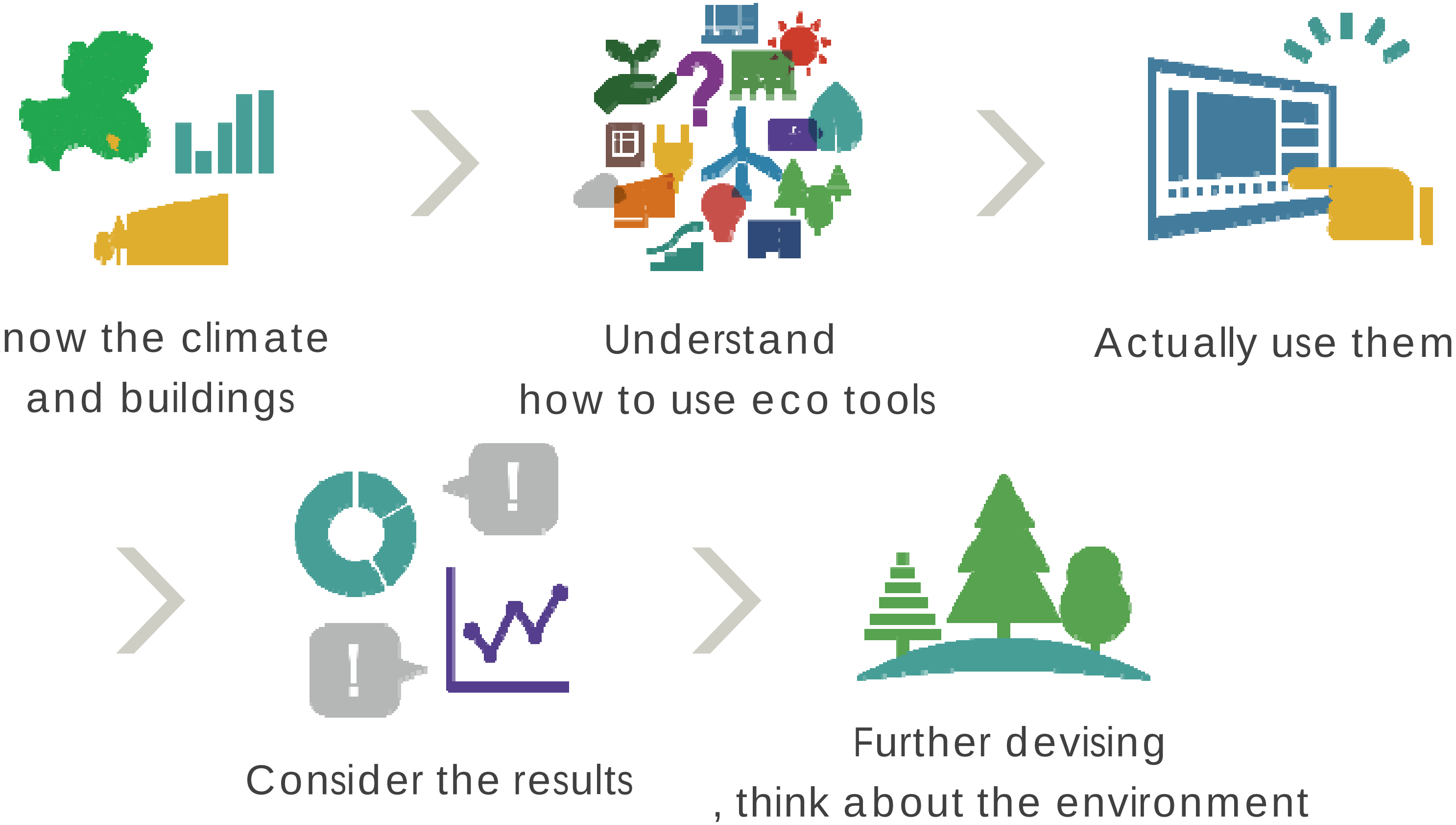
2． Technology for ZEB

3． Education and Operation

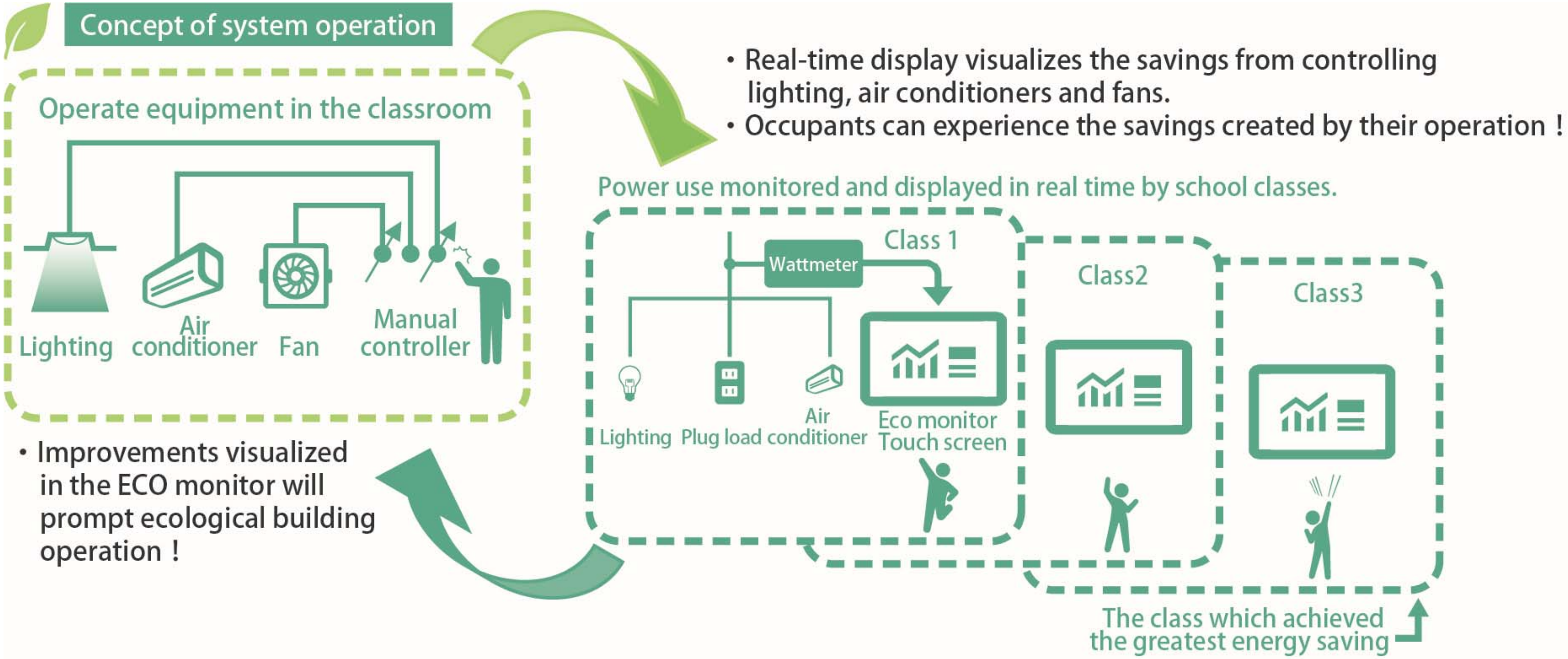
Operation management

SI /student intelligence drives the operation of ZEB

Teachers and students have deepen their understanding of buildings and realize zero energy

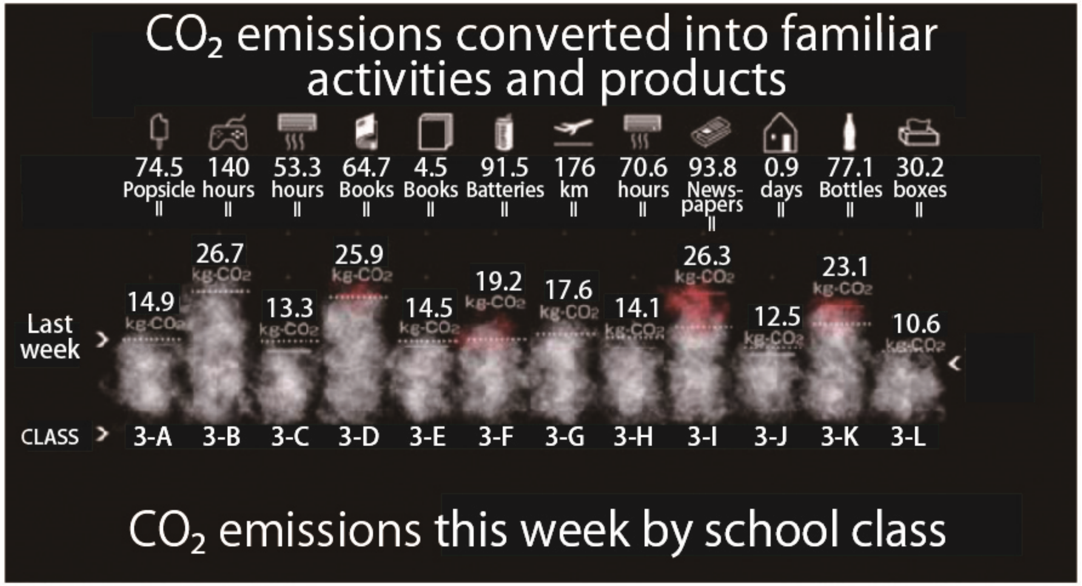


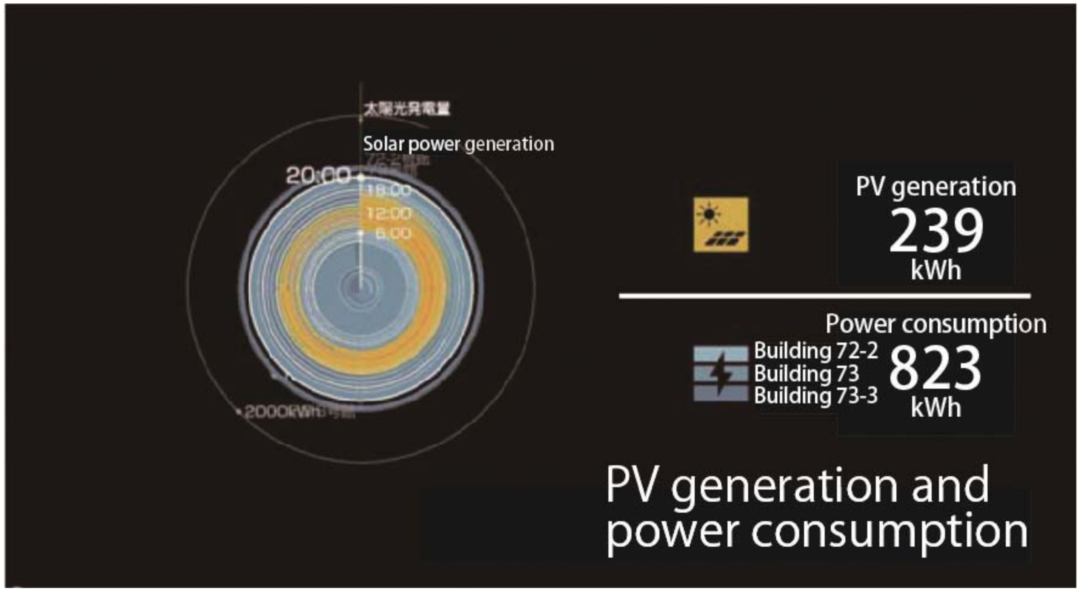
Eco monitoring



The concept of real-time eco monitoring

Eco monitoring





Example of real-time eco monitoring

Eco monitoring

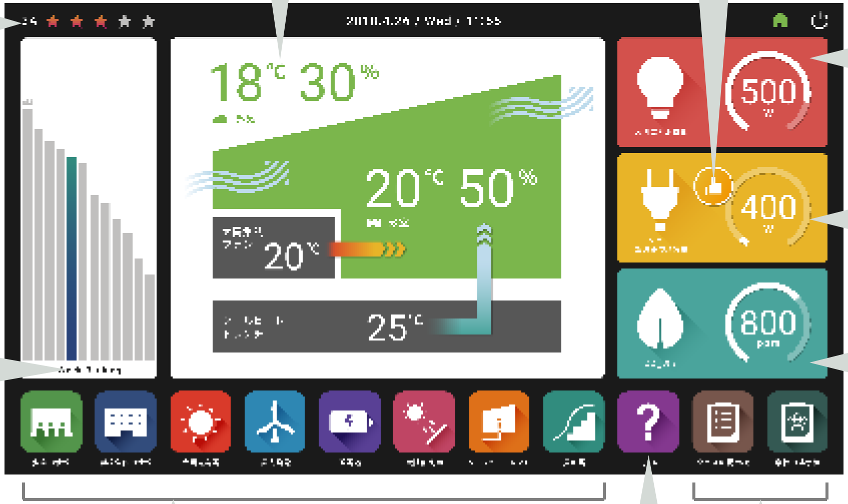
Get information visually by simple operation like a smartphone

Environment Information

Eco sign for good behavior

Energy Saving rate

Energy Saving Ranking



Lighting power

Plug load / HVAC power

CO2 Concentration

Icons for Eco tool

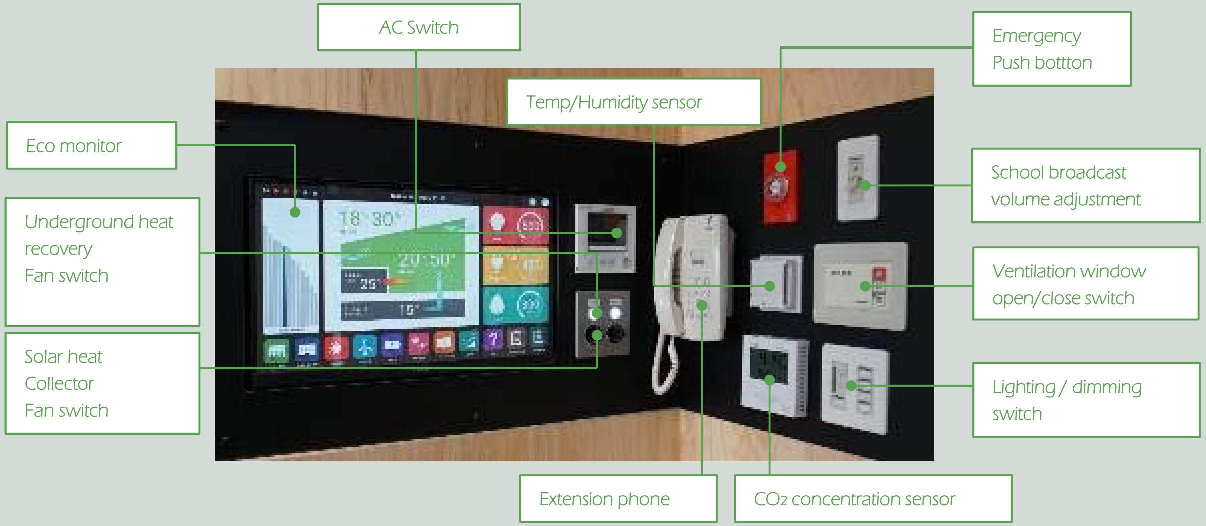
Q / A

Information

Eco monitoring

Touch panel monitor for students themselves to take action by obtaining information on indoor temperature and humidity and power consumption

Eco monitor panel and switch



Conclusion

・In order to aim for ZEB, It is necessary to take regional and climate into account for building.

・It is important to consider not only for energy saving but also for the surrounding environment.

・Adopt the latest technology in consideration of operation

・Continuing ZEB realization by working on education system for operation.

NIKKEN

EXPERIENCE, INTEGRATED