

Introduction of ZEB in Japan

-Energy Efficiency Building Design and performance evaluation-

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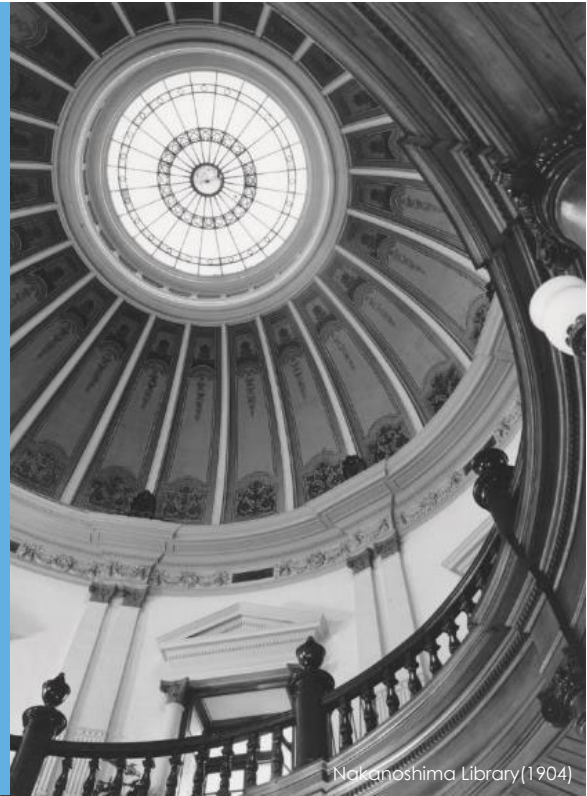
CONTENTS

- 0** Company Introduction
- 1** ZEB in Japan
- 2** ZEB Project Case Study 1
-Achievement of ZEB by state-of-the-art technology
- 3** ZEB Project Case Study 2
-Achievement of ZEB by architectural elements and education

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)

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ORGANIZATION

PLANNERS

- Urban Development
- Urban Design & Planning
- Landscape Design
- Urban Infrastructure
- Project Management

ARCHITECTS

- Office, Government
- Mixed Use, Residential
- Retail, Hotel, Hospitality
- Hospital, Wellness
- Sports, Culture, Education
- Airport, Station
- Life Cycle Design
- Industrial and Research

ENGINEERS

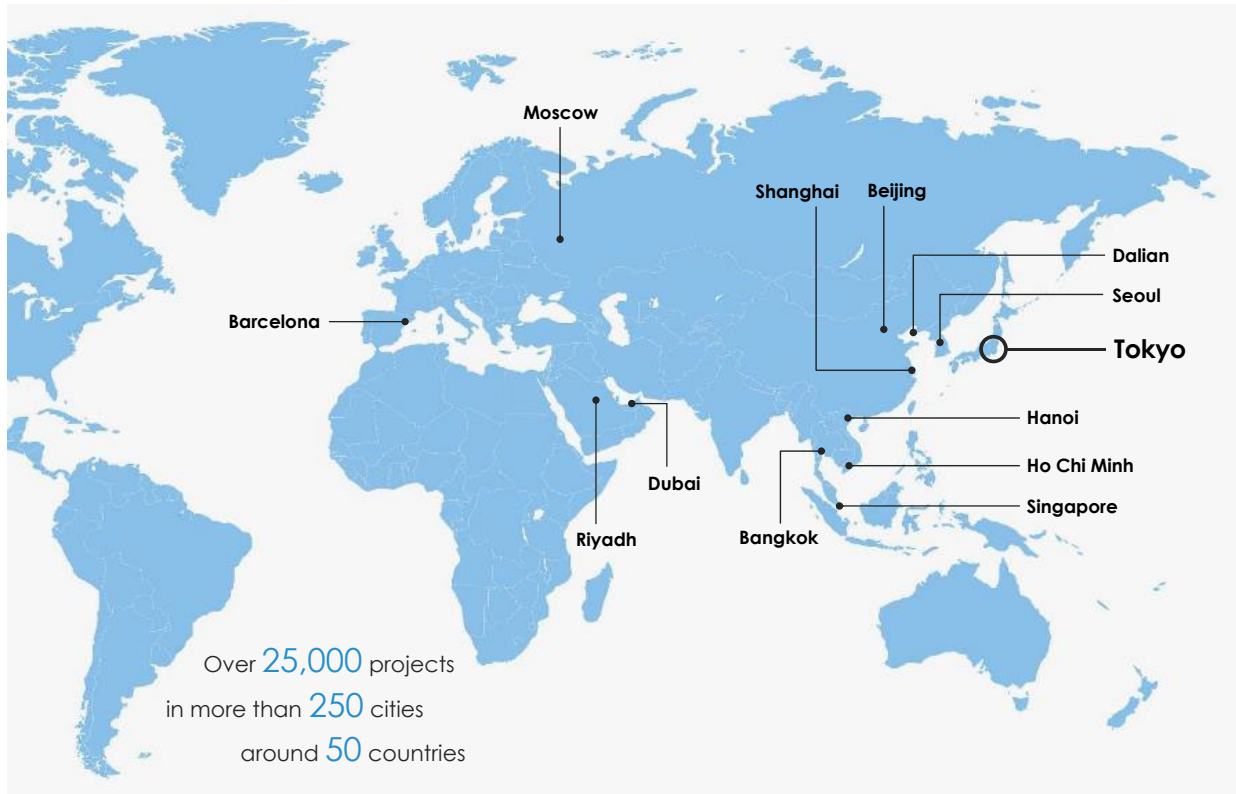
- Structural Engineering
- MEP, Environment
- Disaster Planning

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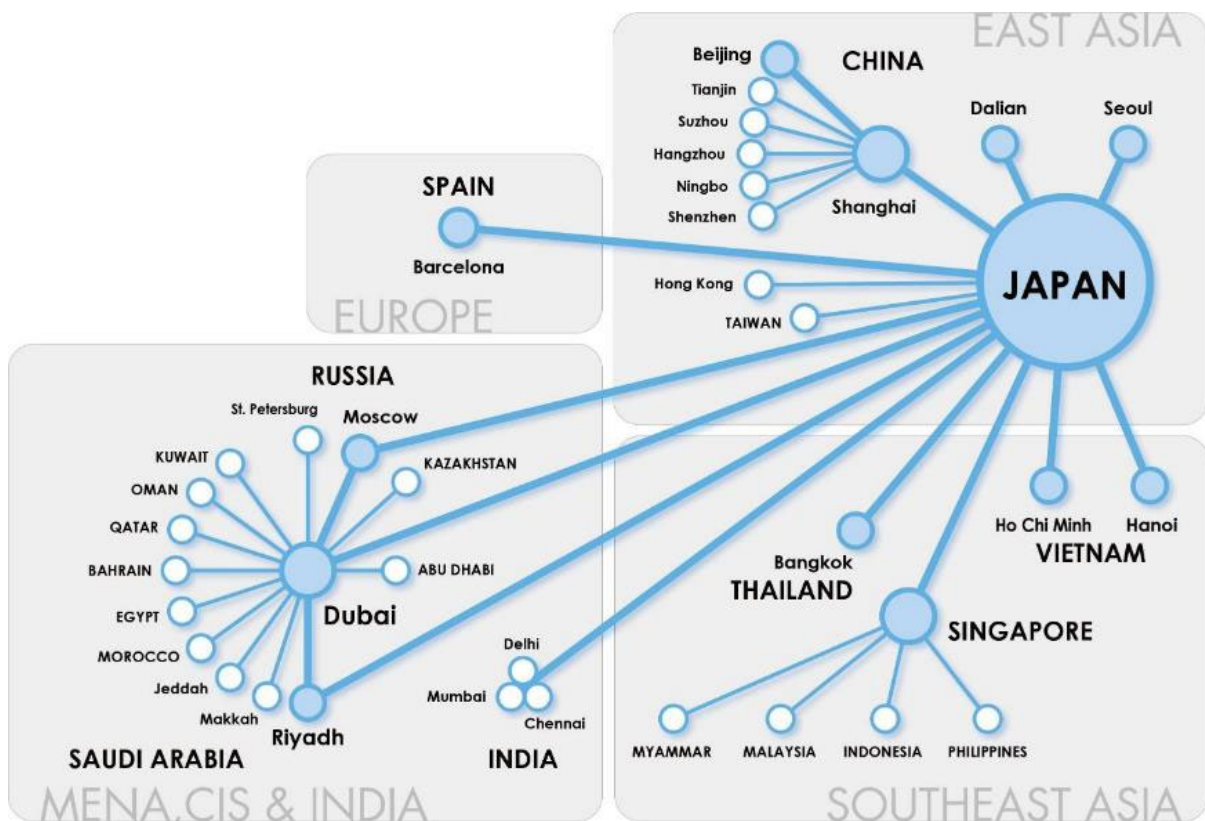
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GLOBAL REACH

12 Oversea Offices



GLOBAL NETWORK

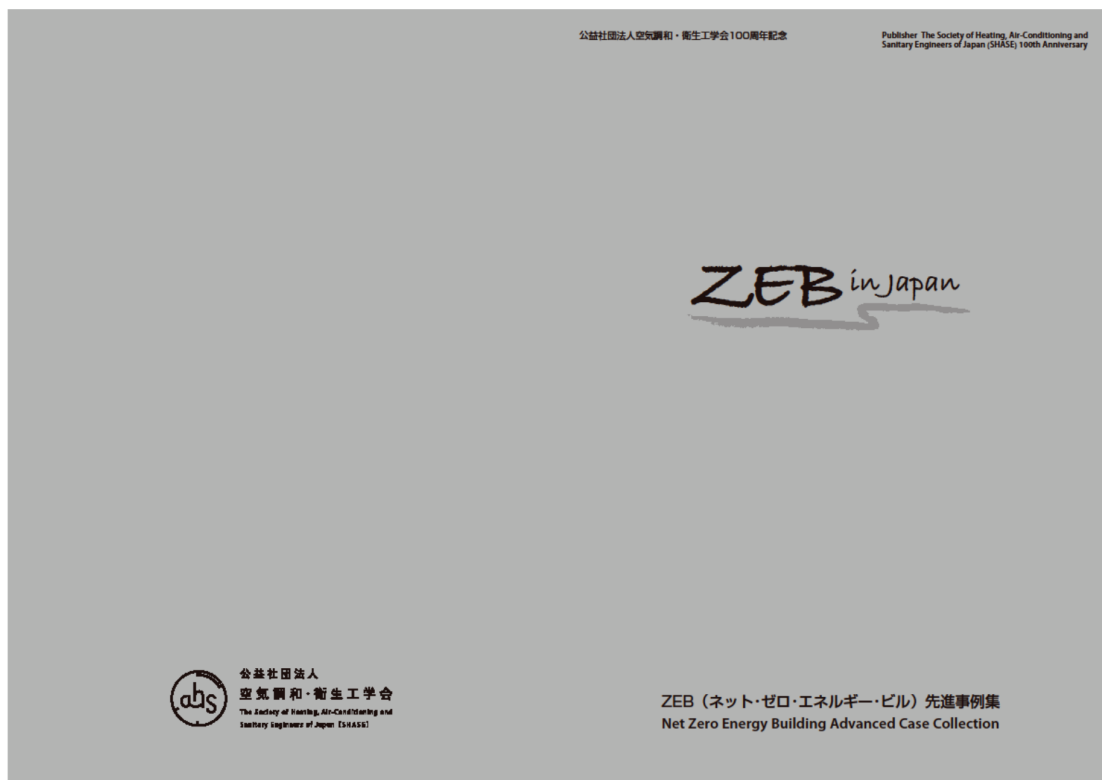


1. ZEB in Japan

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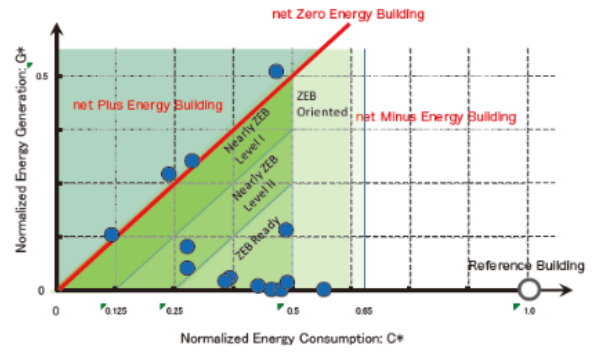
ZEB in Japan



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



- No. 1 Unnan City Hall
- 2 Shimizu Corporation Headquarters
- 3 ZEB Demonstration Building, TAISEI Corporation
- 4 KT Building
- 5 Takenaka Corporation Higashi Kanto Branch 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 Building
- 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

Daikin Industries, Ltd. Technology and Innovation Center



Daikin Yodogawa factory



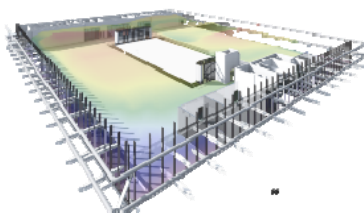
Daikin TIC (Technology and Innovation Center)



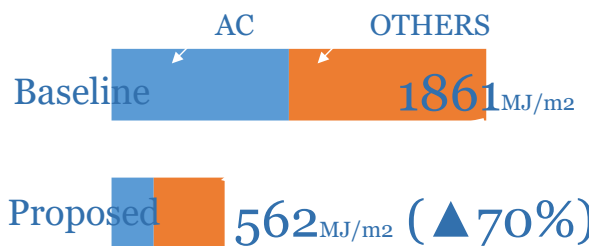
New Technology

Innovative Cx

Top level Energy and Environment



Carbon Management

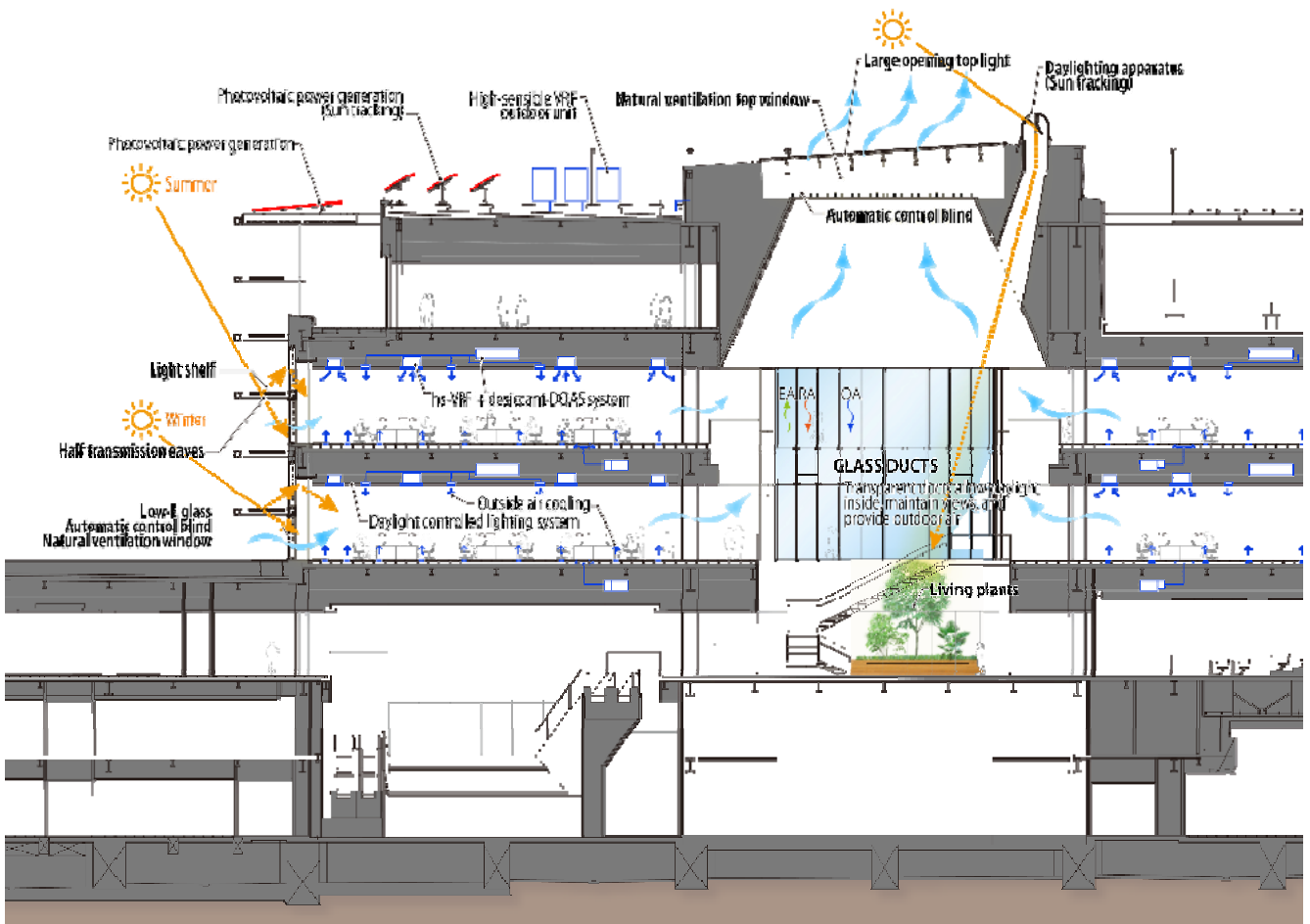
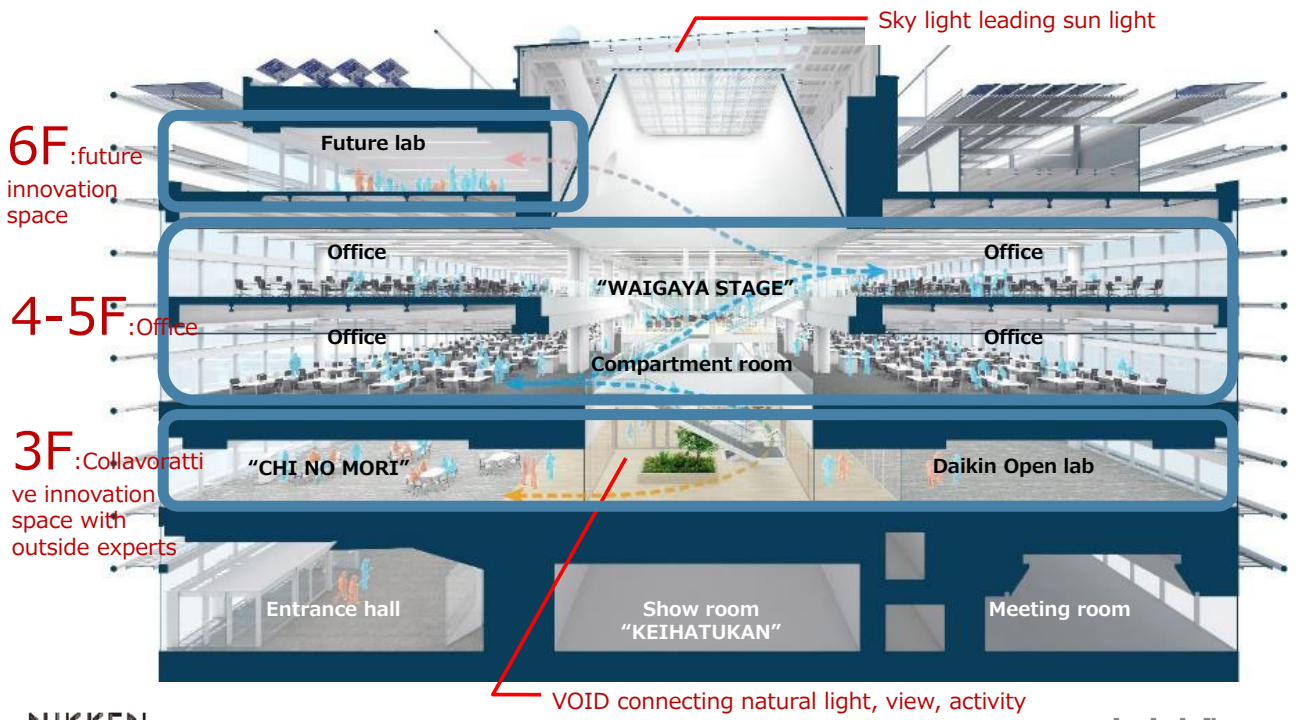


ZEB
LEED Platinum

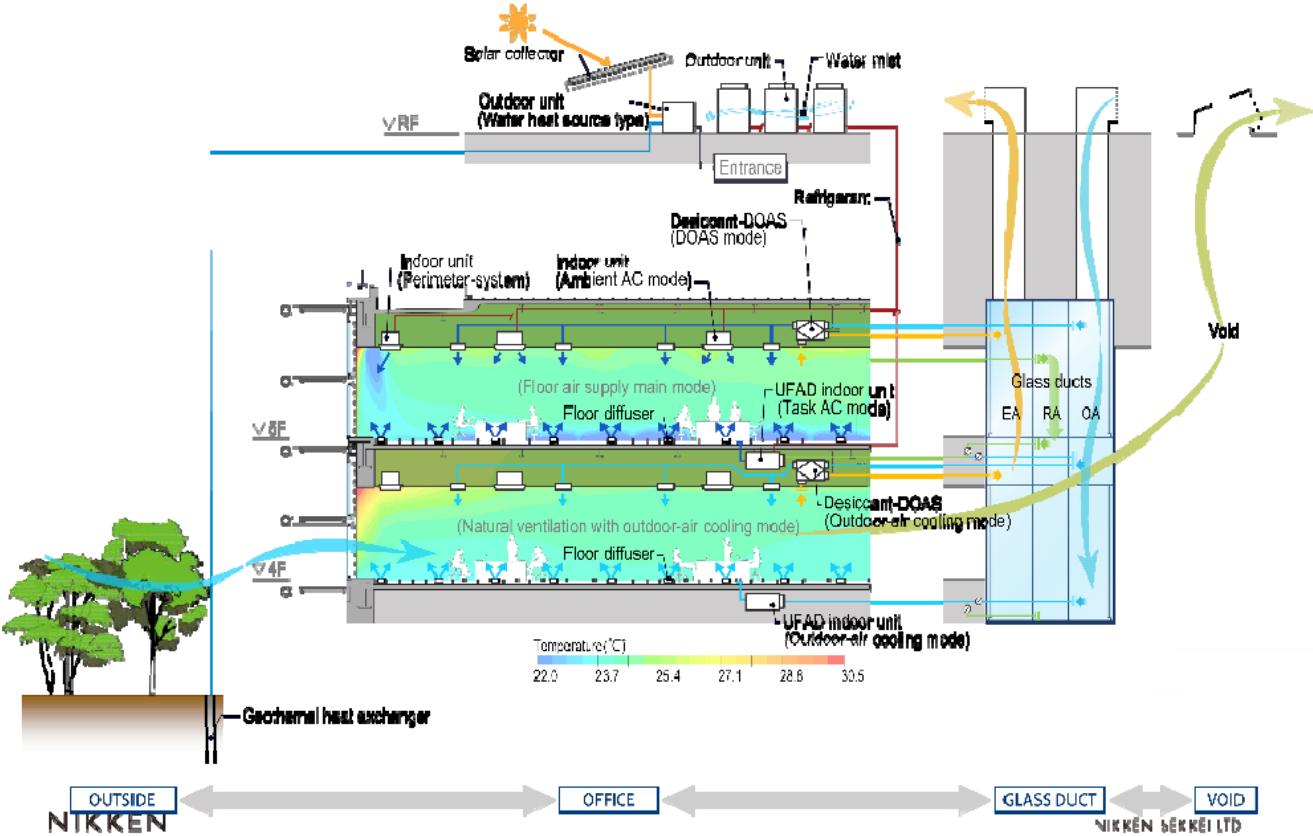


South-north cross section of Office zone

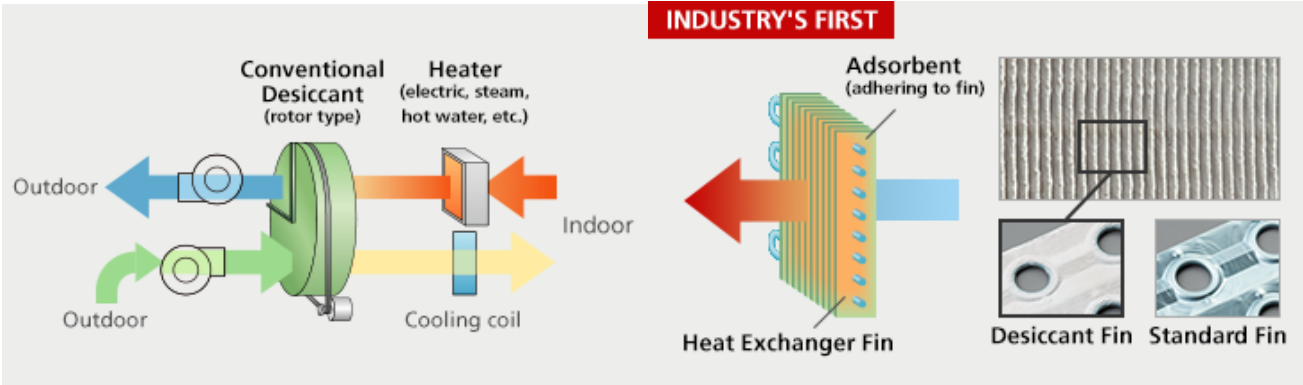
← 60m×60m×2layers → Mega floor office (≒6,000m²)



HVAC system -Passive and active method



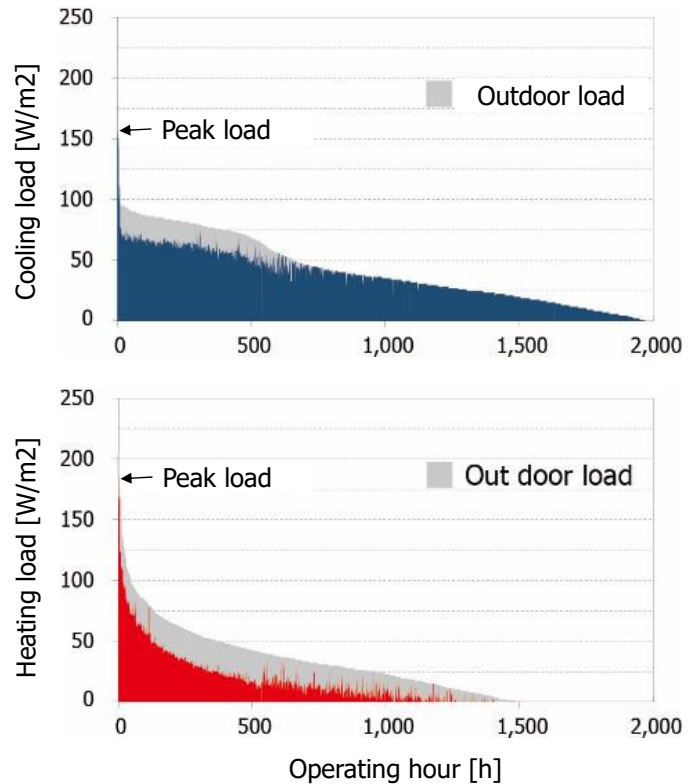
Control air humidity and air quality



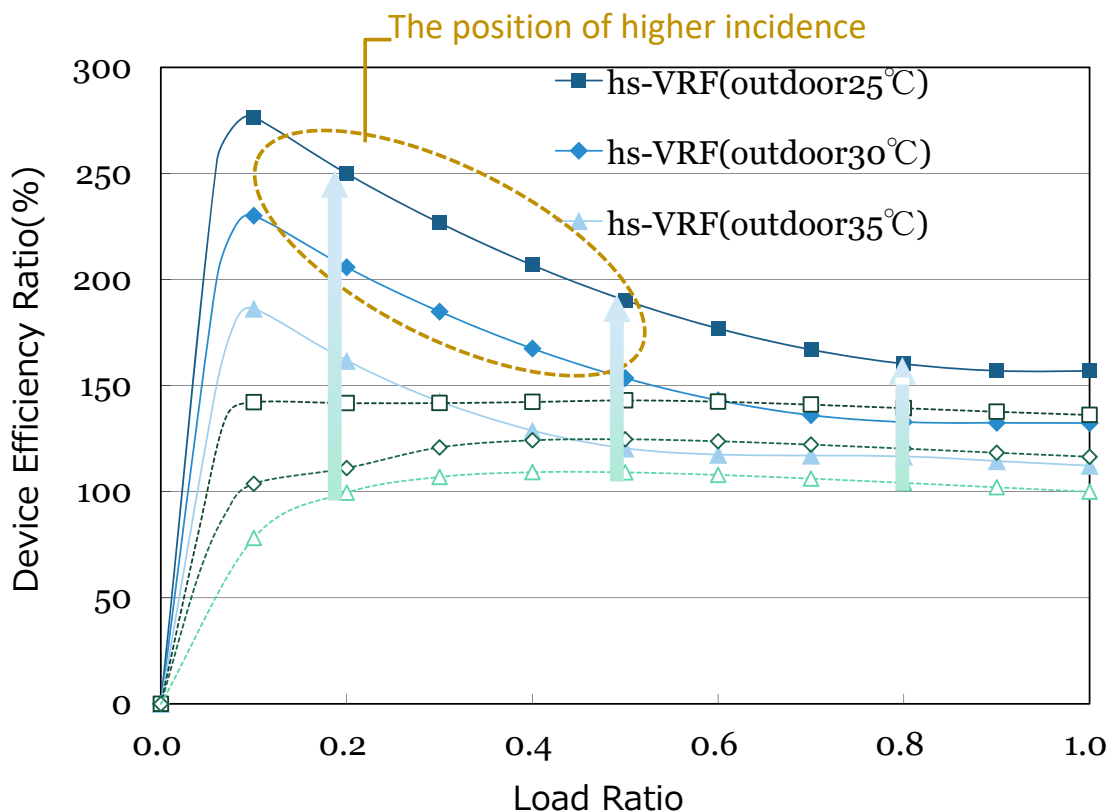
“DESICA” with air-volume control system depending on the CO₂ concentration for TIC

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.



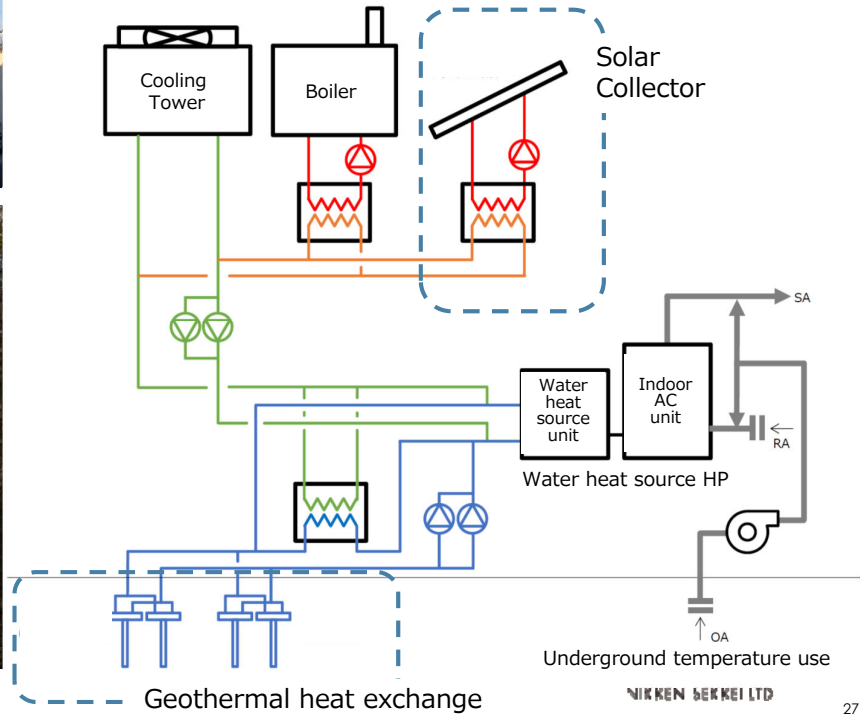
hs-VRF system (New VRF system for TIC)



Solar and geothermal VRF



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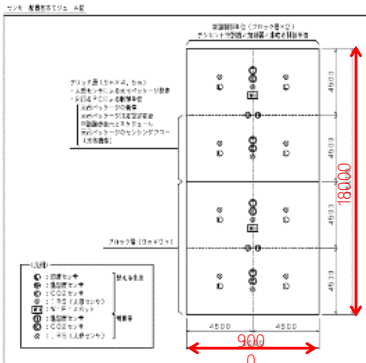
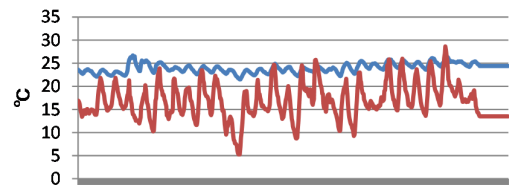


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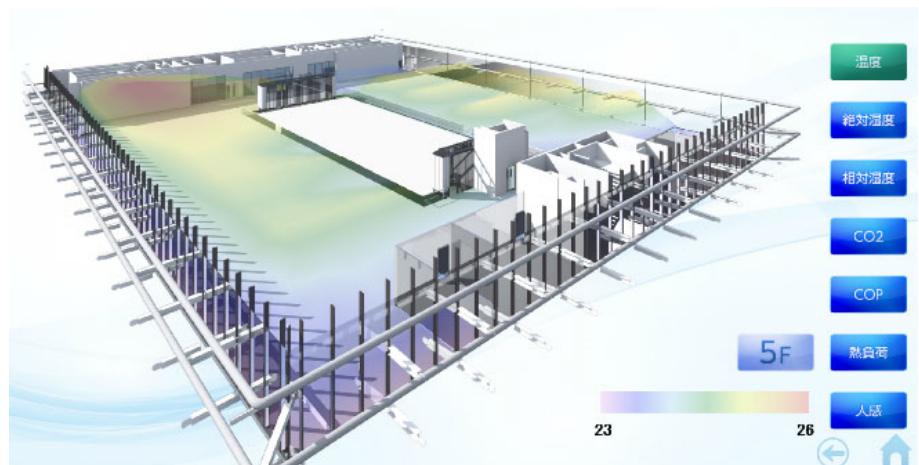
Real time visualization of indoor environment

4.5m×4.5m: Human sensor

4.5m×9m: Temperature, humidity, CO2,



NIKKEN Sensor layout



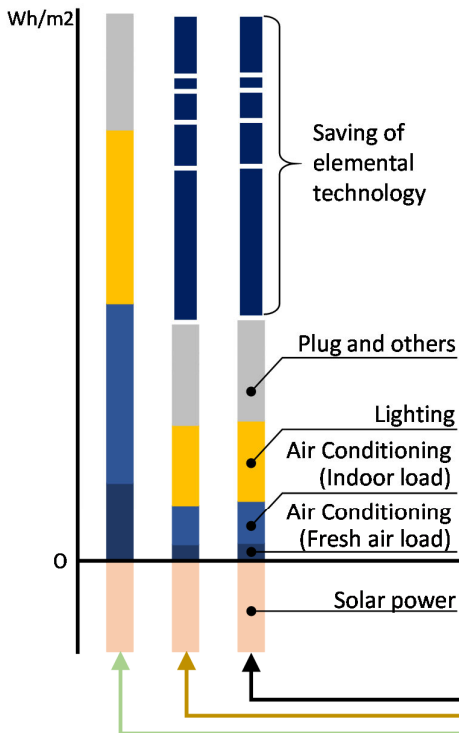
Indoor environment real time contour

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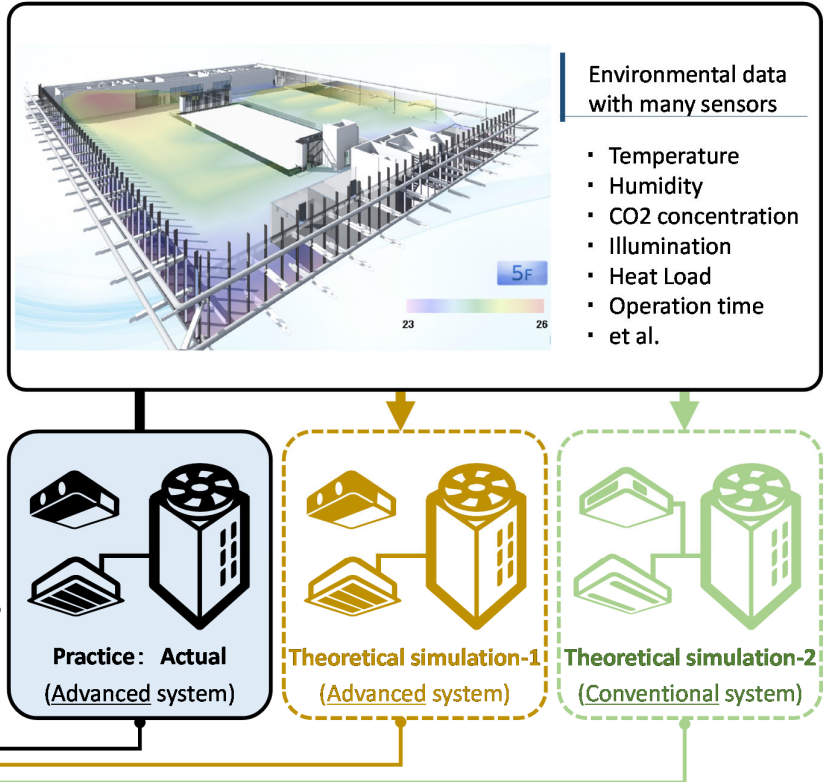
Real time commissioning

Real-time energy analysis

(Comparison between "Theory" and "Practice")
[every 30min.]



Real-time visualization



LEED Score

敷地 Sustainable Sites 24/26

水 Water Efficiency 10/10

エネルギー Energy & Atmosphere

材料 Material & Resources 7/14

空気質 Indoor Environmental Quality 11/15

新技術 Innovation in Design

地域特性 Regional Priority 4/4

6/6

23/35

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

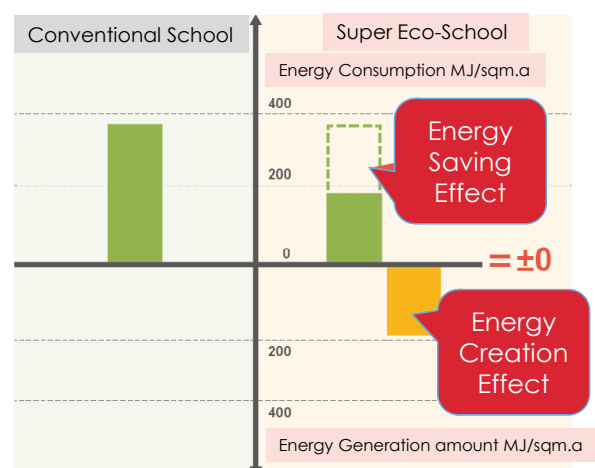
- Realization of zero energy school
- Operation system conducted by the students themselves

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

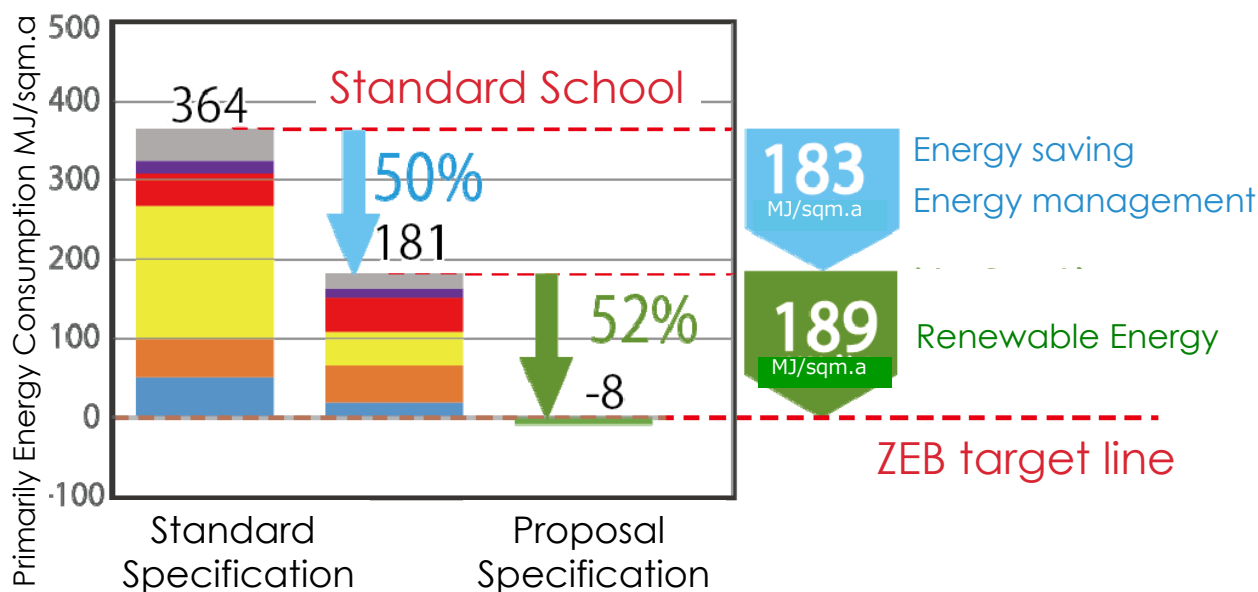
“MLIT” :Ministry of Land, Infrastructure, Transport and Tourism
1.5 millions \$

■ Interior woodening support project

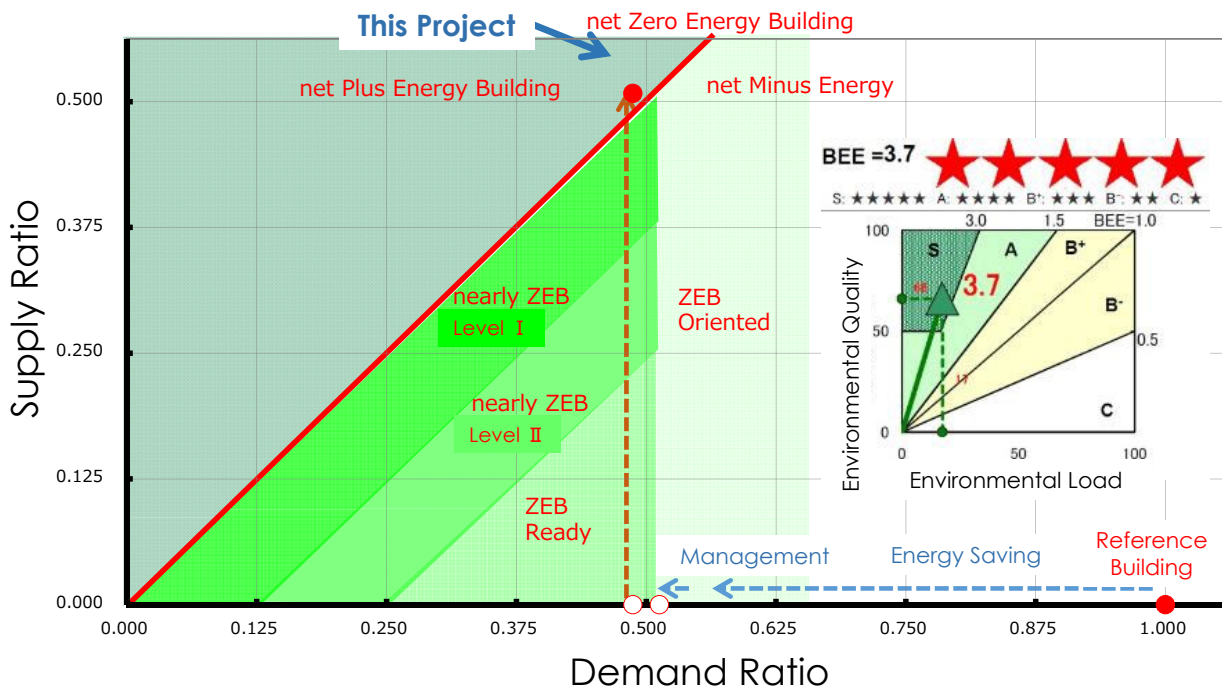
“Gifu prefecture”
0.5 millions \$

Scheme for achieving zero energy

■ Cooling ■ Heating ■ Lighting ■ Ventilation ■ Plug load ■ Others ■ Renewable Energy

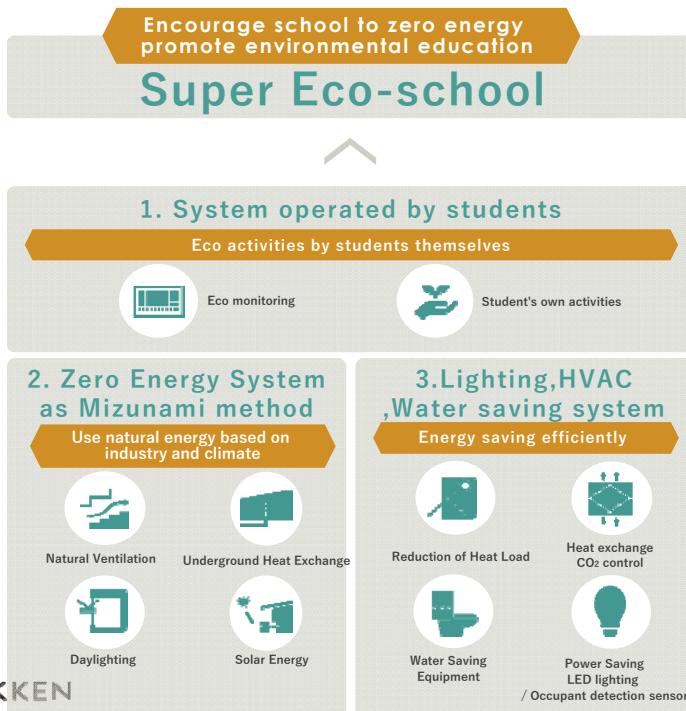


Level of ZEB in this project



Toward achieving Zero Energy Building

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



1. Background and Concept

2. Technology for ZEB

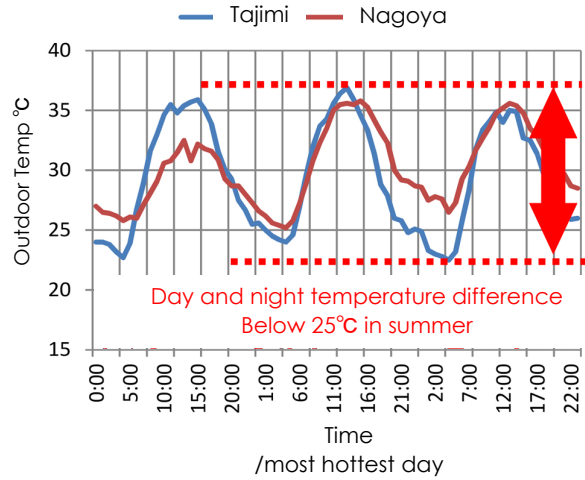
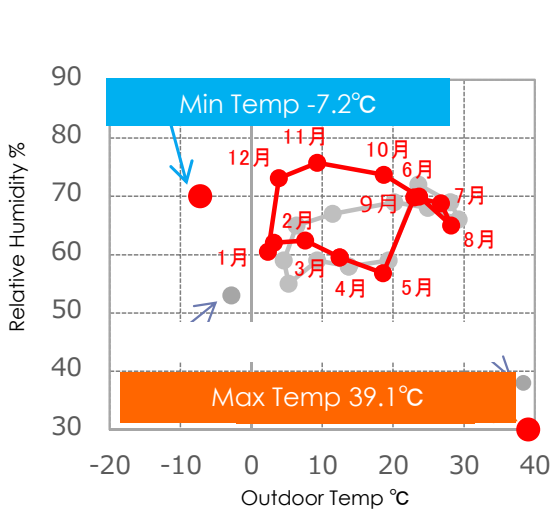
3. Education and Operation

Project site



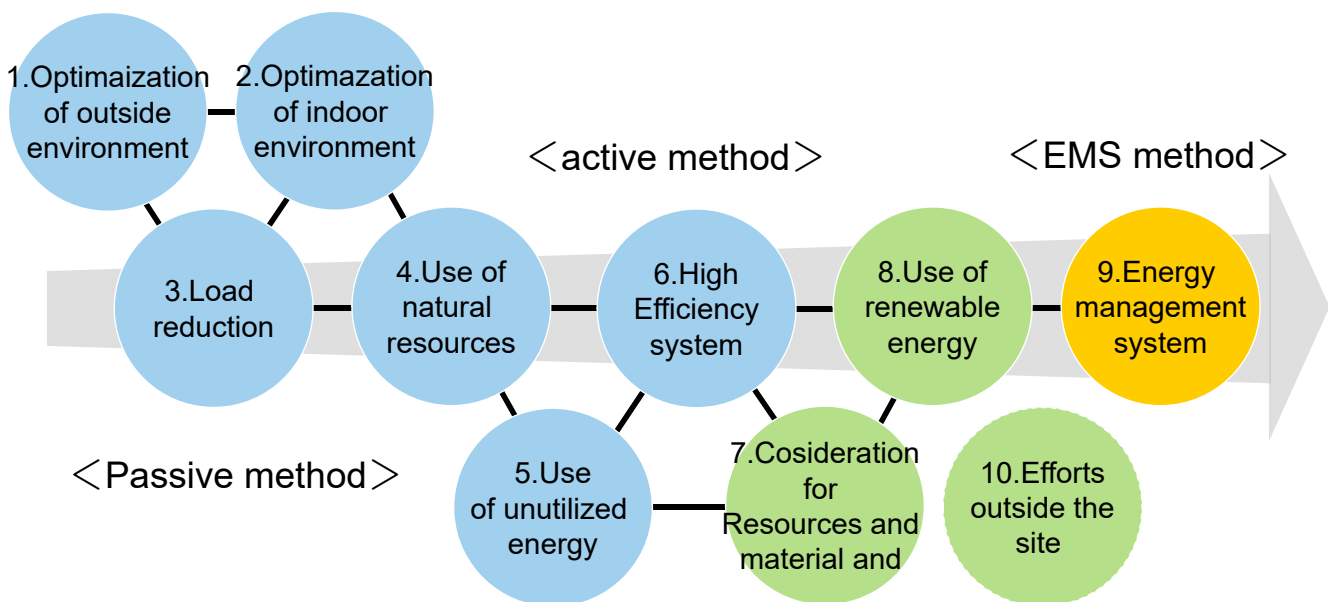
Climate conditions of the site

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

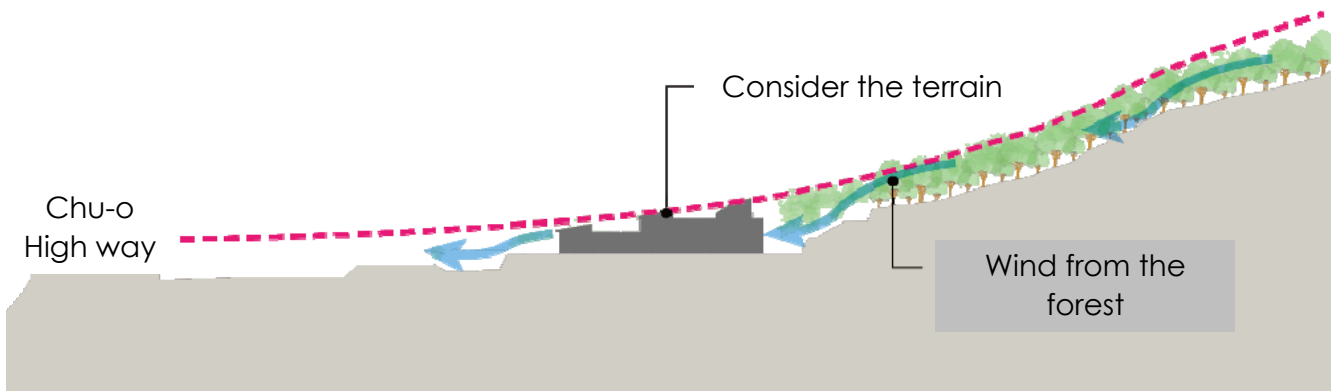


Source: Extended AMEDAS Weather Data 2002

Design process of achieving zero energy

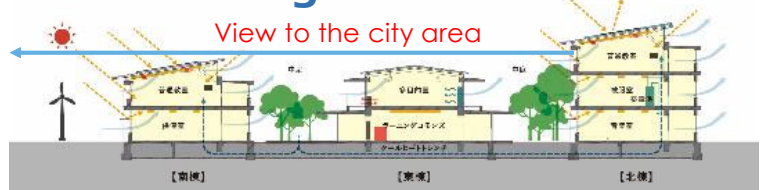


Placement of building along ridgeline of mountains



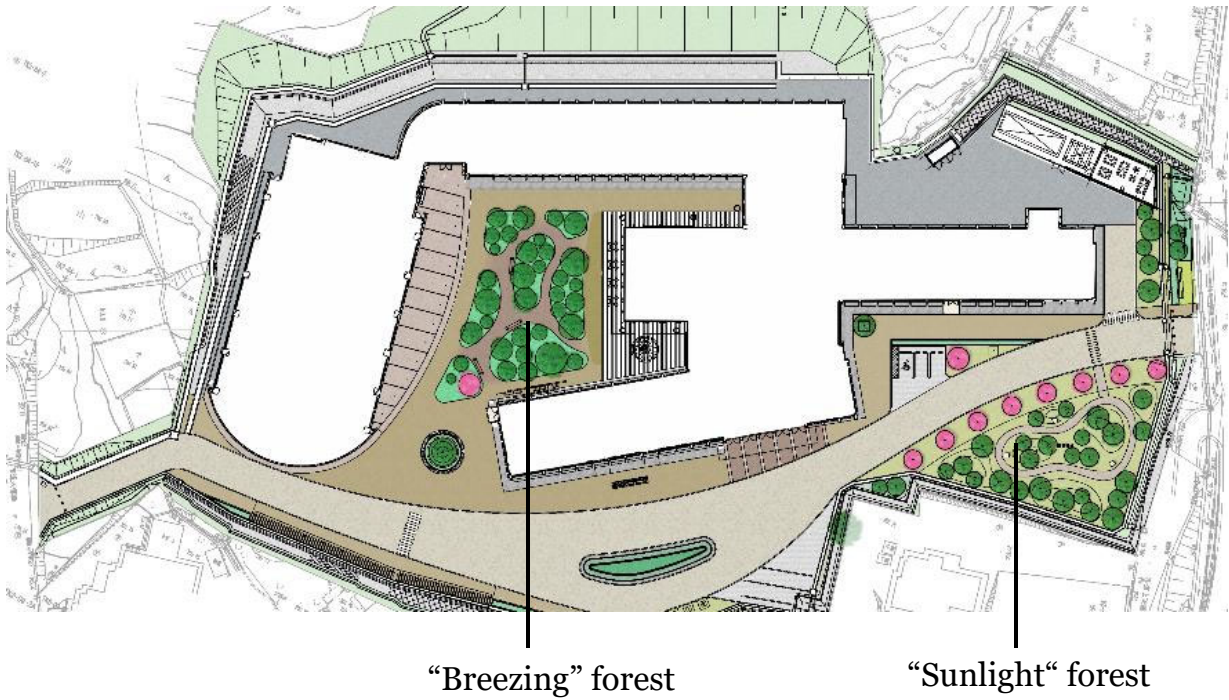
Familiar with the surrounding environment

From any classroom you can have a view to the city



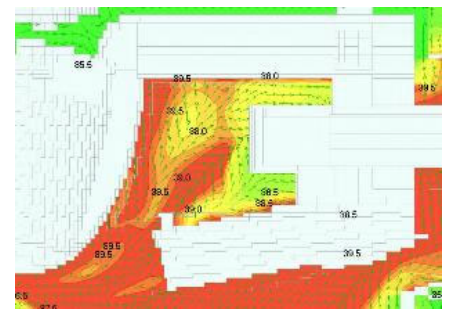
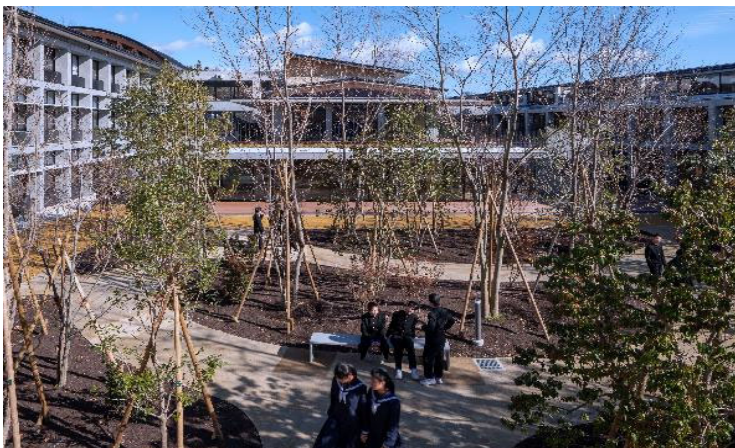
Enclosed in rich greenery

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

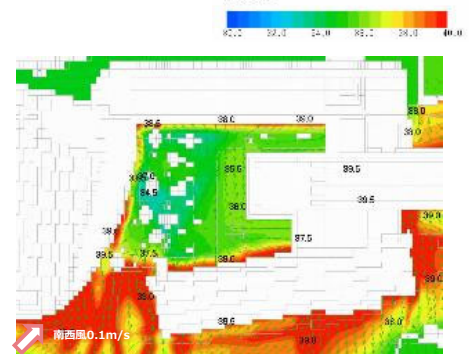


Planting with tall trees

- 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>

High comfort classroom

A classroom that feels warm, making use of wooden beams
Bright classroom with both north and south Daylighting
using gradient roof

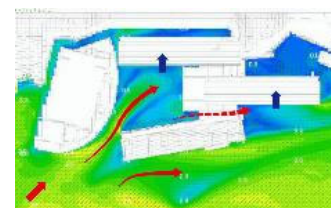


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Arrangement of the building leading the wind

Wind to the courtyard goes through
the whole school building



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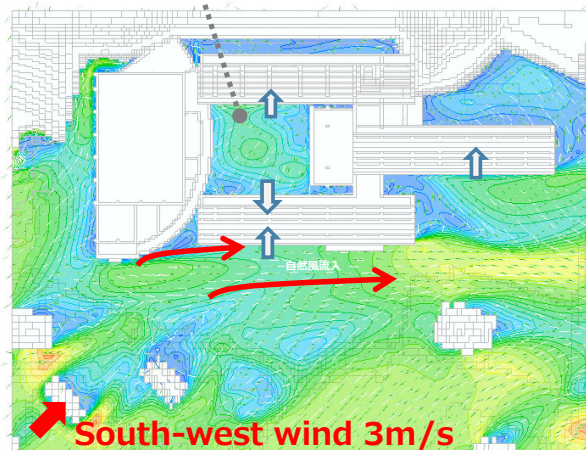
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Arrangement of the building leading the wind

- 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

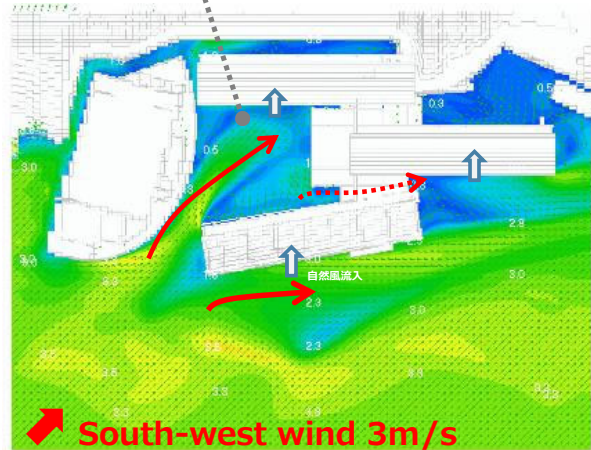
Since natural wind is not blown into the courtyard, wind speed is small and natural ventilation is not promoted.



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Tilted by 10°

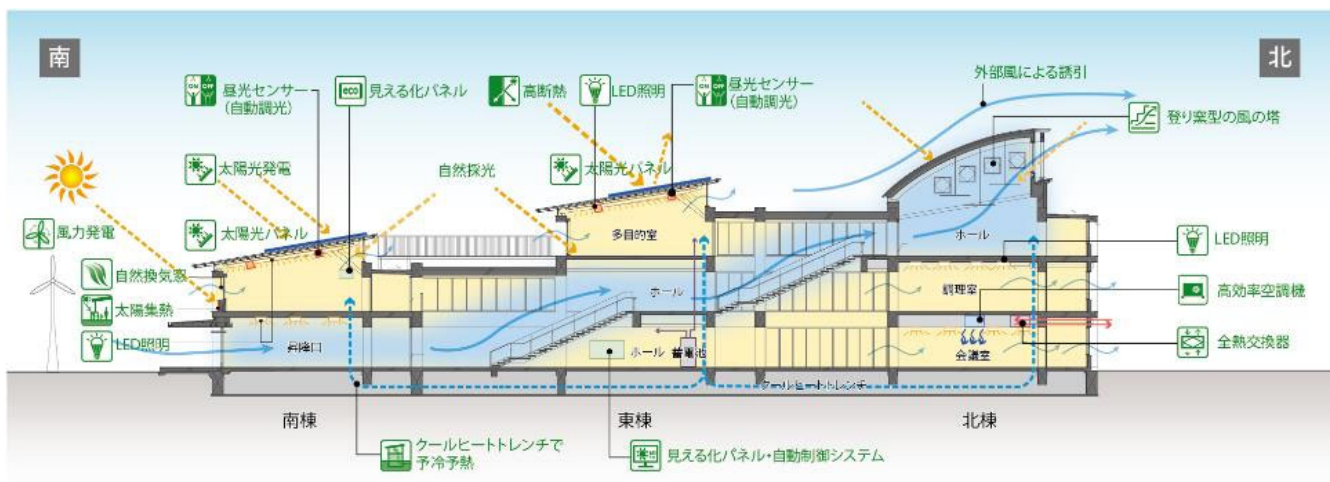
Wind flowing down the inner courtyard without the wind speed falling



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Cross section of the building and technology for ZEB

Natural ventilation system passing through the hall



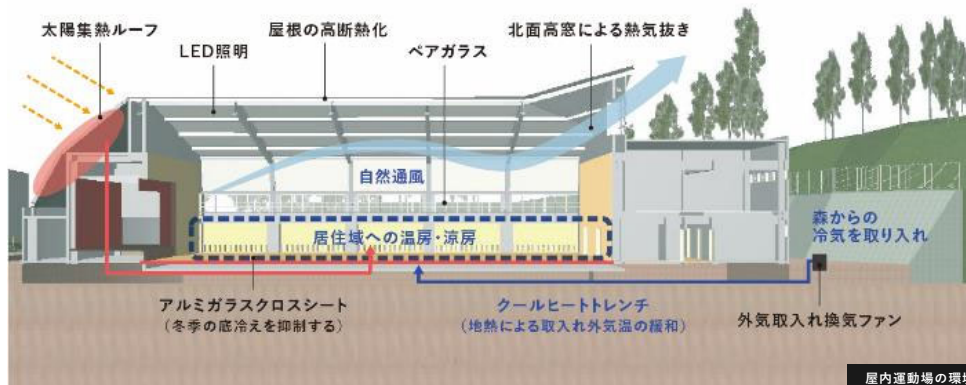
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Solar collector roof



Collect solar energy and warm air. Send to arena.



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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

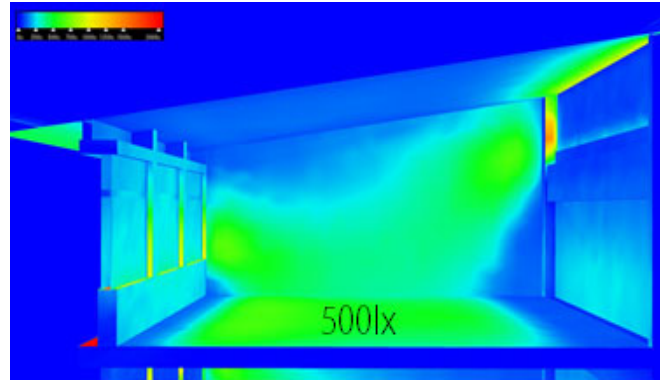


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Light shelf

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



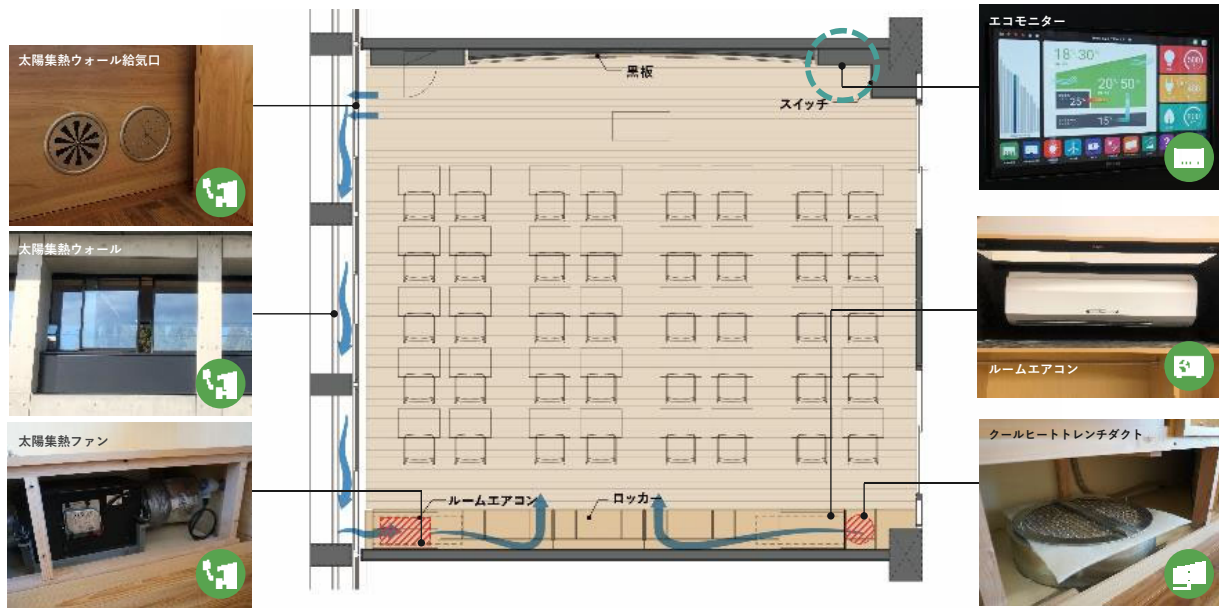
Ordinary classroom

Think about their living environment and carry out eco activities



Ordinary classroom

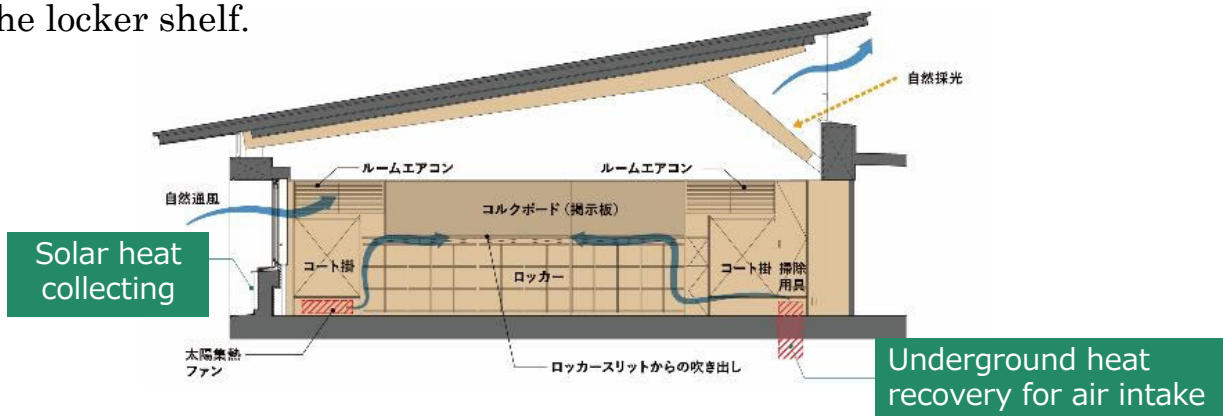
Students themselves think about a comfortable and energy-saving environment



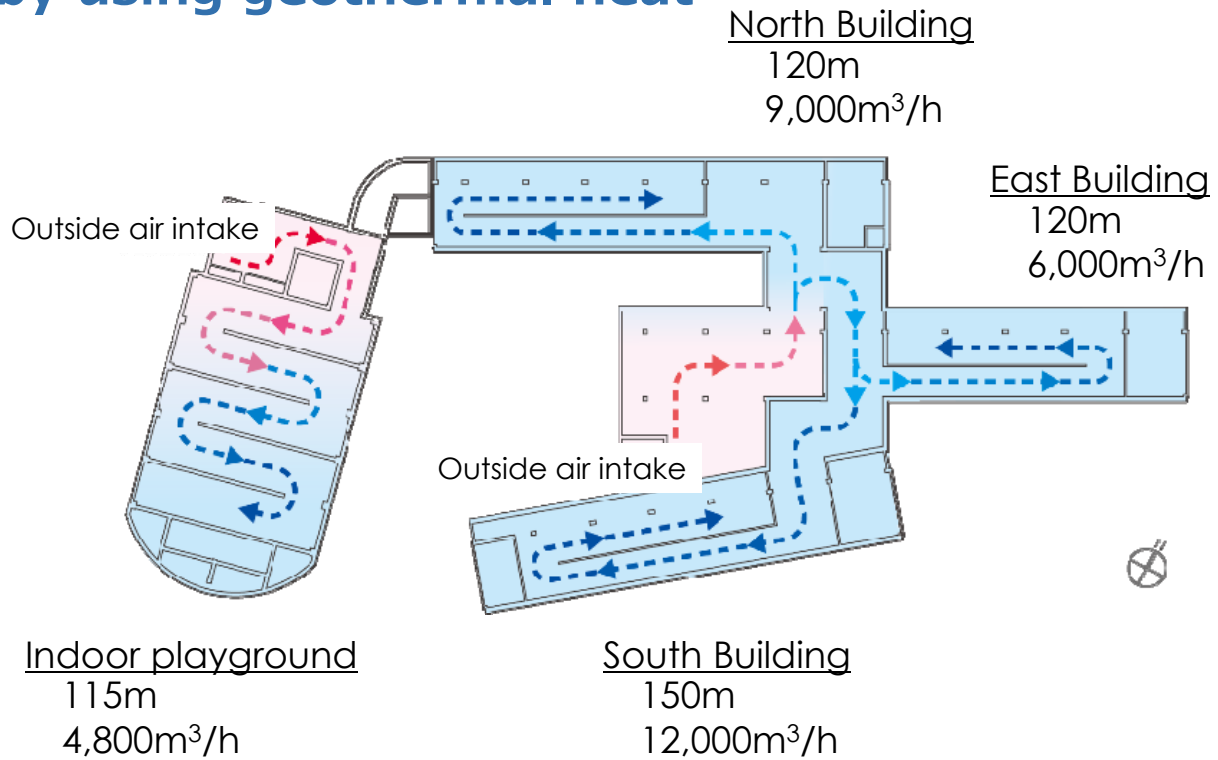
Underground heat recovery and Solar heat collecting



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



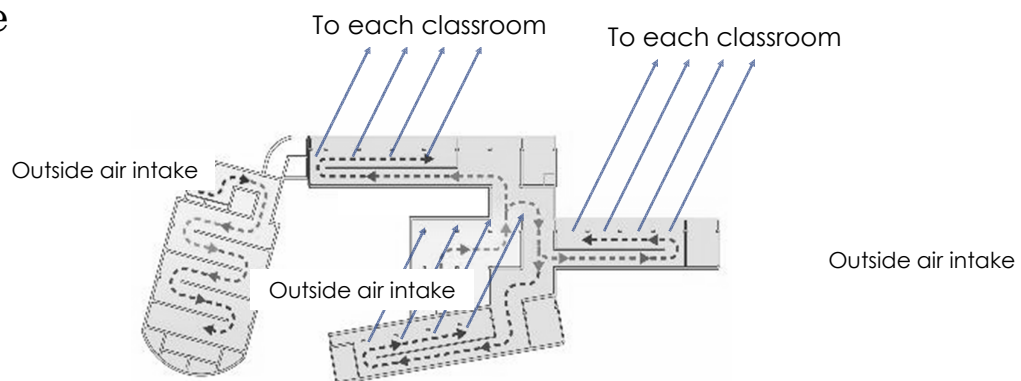
Air cooled and warmed by using geothermal heat



Underground heat recovery



Enhance students' interest by making intake and routes visible



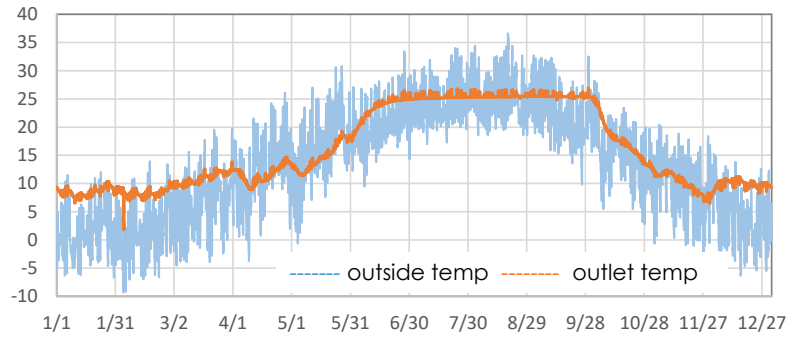
Air intake under spiral staircase



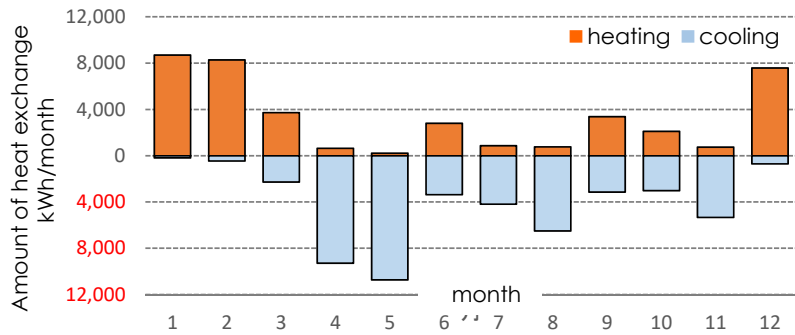
Window to observe the underground pit

Prediction of cooling and heating effect by using geothermal heat

Outlet temperature
 Summer : 25~26°C
 Winter : 10~12°C



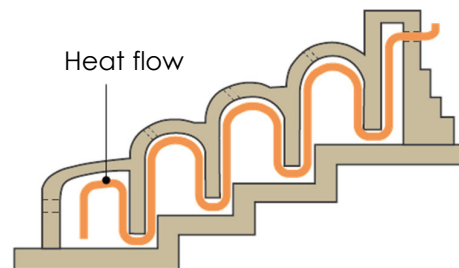
Cooling and heating Calculation



Natural Ventilation



Use the principle of ascending heat in a pottery baking kiln

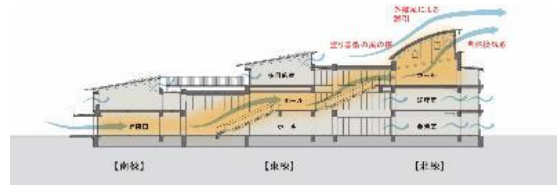


Natural Ventilation



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



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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



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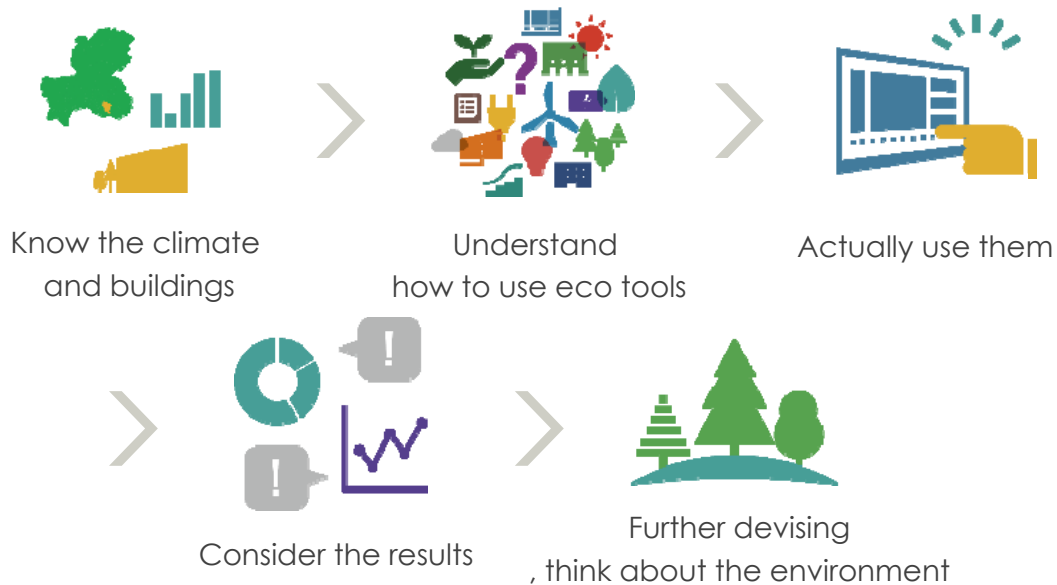


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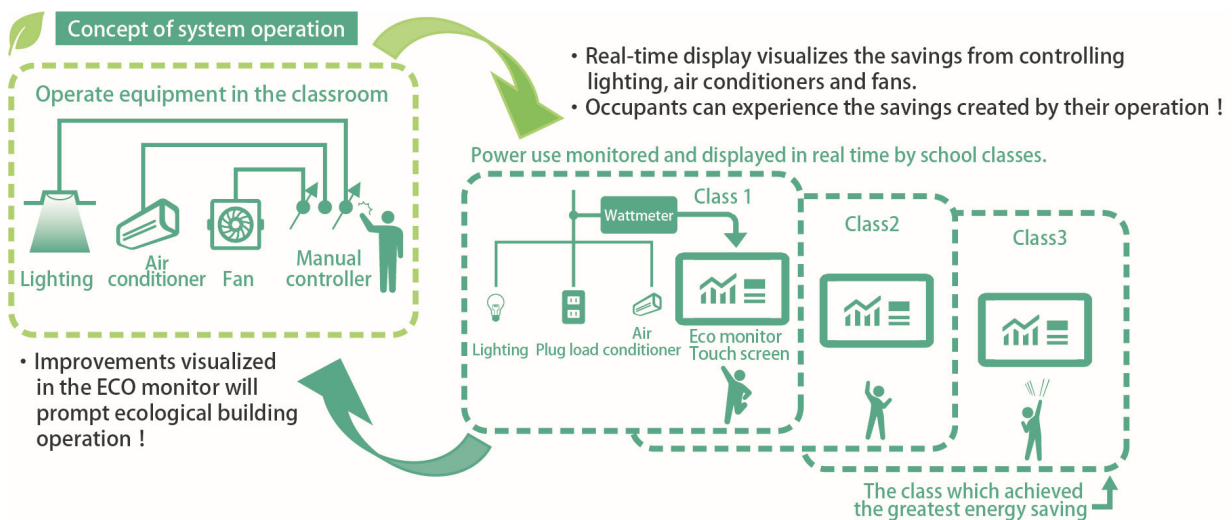
1. Background and Concept
2. Technology for ZEB
3. Education and Operation

Operation management

SI /student intelligence drives the operation of ZEB
 Teachers and students have deepen their understanding of buildings and realize zero energy

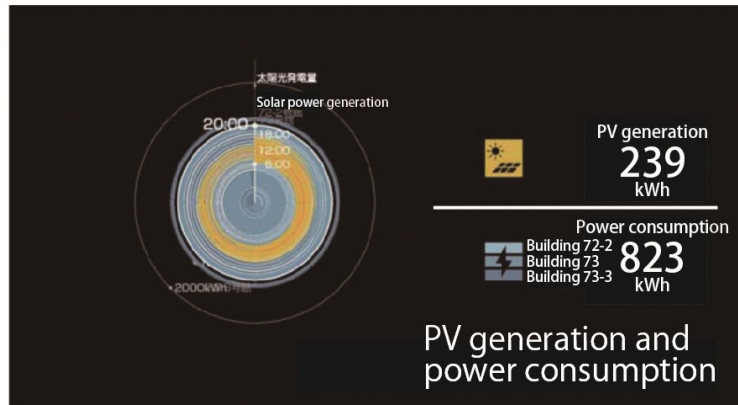
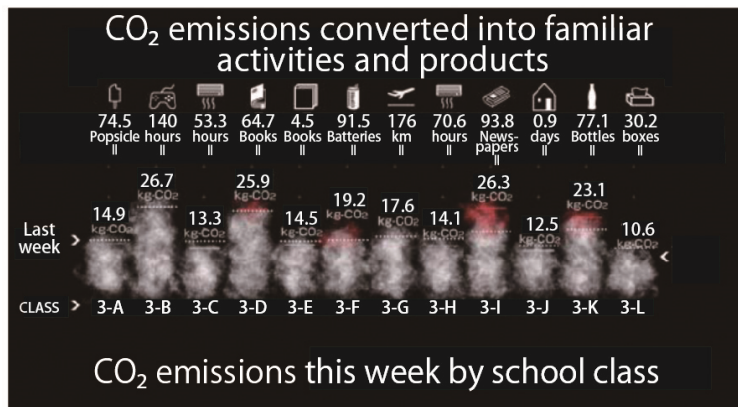


Eco monitoring



The concept of real-time eco monitoring

Eco monitoring



Example of real-time eco monitoring

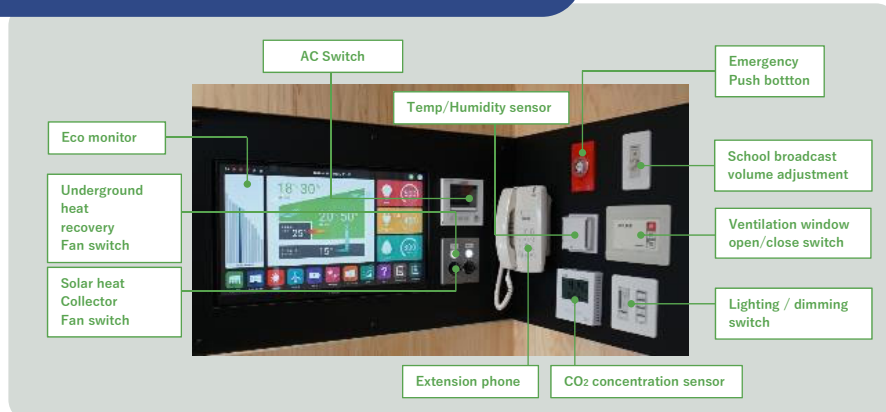
Eco monitoring



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.

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EXPERIENCE, INTEGRATED