The Verification and Implementation of Practical Renovation for net-ZEB Office

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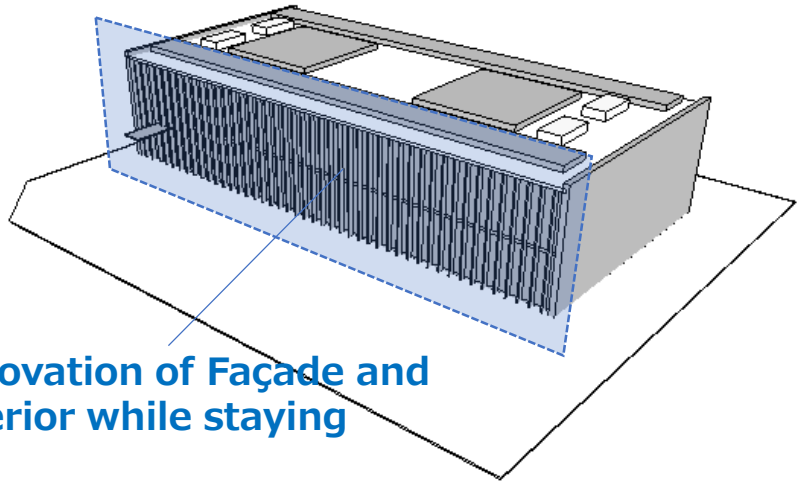
Background

Promotion of “Energy saving Renovation of Existing middle and small stock buildings”

- Company’s branch offices or Local government offices in local cities
- Offices with 10,000 m2 or less occupy 98% in Japan
- Urgent issues in Japan

Promotion of “Renovation of Façade and Interior while staying”

- There are few constructions to completely renovate energy saving exterior
- Minimization of perimeter thermal load is essential in small office
- Renovation while staying is important for tenants



Characteristics of this renovation project

- Net ZEB first renovation project in Japan
- Renovation while staying the office that is actually used
- ZEB office with thorough passive

Building Outline

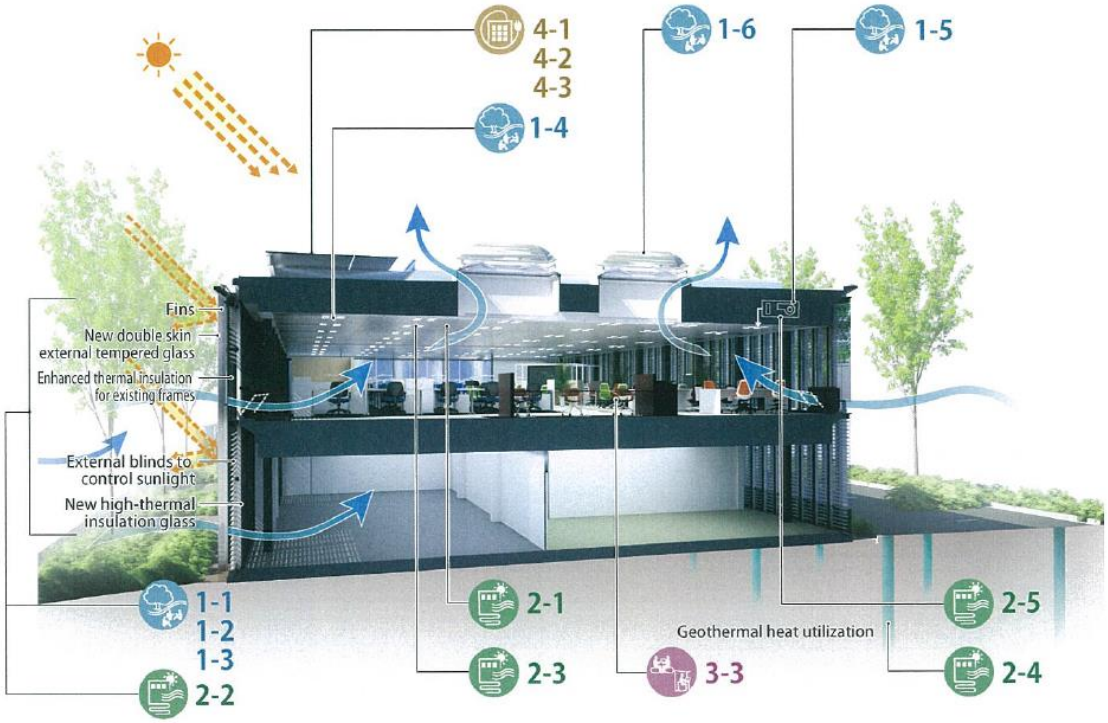
Building type：office
Location ：Chiba City, Japan
Site area：1,432.02 □
Structure･size：RC･S, 2 stories
Height ：8.1m
Building area：679.52 □
Gross floor area：1,318.11 □
Completion ：2003
Completion of Renovation：2016
Design & Built ：Takenaka Corporation

Exterior of the building after renovation

Interior of the building after renovation

The contents of planning and technologies

- Thorough reduction of Façade Thermal Load
- Maximization of utilize Natural Ventilation and Daylighting
- Improvement of Workplace Productivity and reduction of Energy Consumption by Changing Work Style
- Direct utilization of Geothermal and Solar Heat
- Increase of comfort by Radiating Air-Conditioning, Dessicant Air-Conditioning, Wellness Control etc.
- Improvement of BCP as a result



Integrating most advanced technologies for ZEB

Concepts of this office ZEB renovation

Change the theory of comfort

Create super energy-saving building

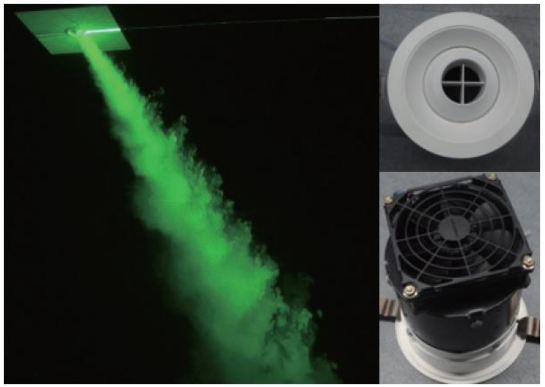
Think smart work-style

Become resistant to disaster

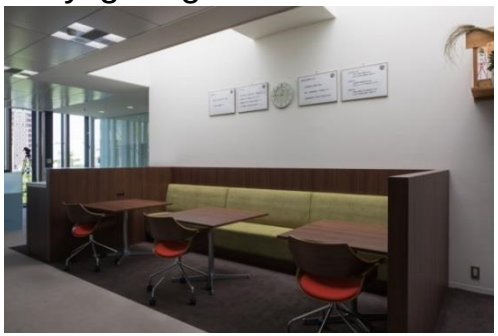
Change the theory of comfort

Daylighting from both sides

Natural ventilator (auto control)



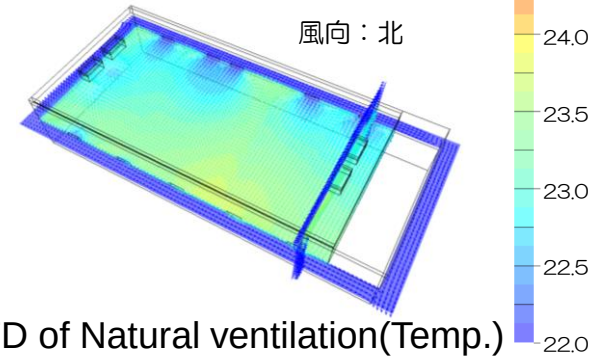
Personal diffuser



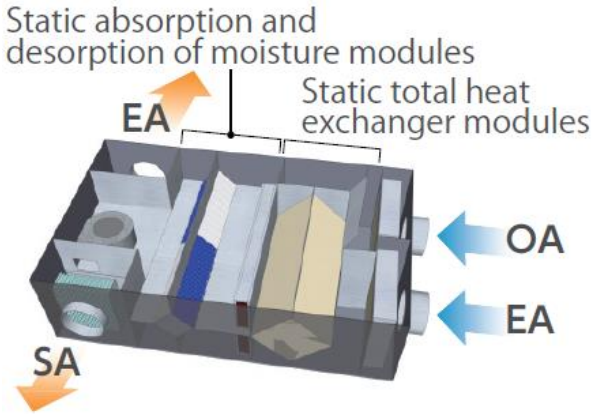
Daylighting from top-light

Natural exhaust (auto control)

Outside blind (auto control)



CFD of Natural ventilation(Temp.)



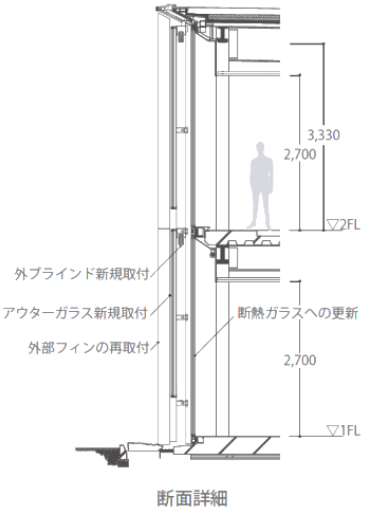
Low humidity by Desiccant Air-Conditioning

Create super energy-saving building

Exterior

Replace to high insulated glass

Radiation panel



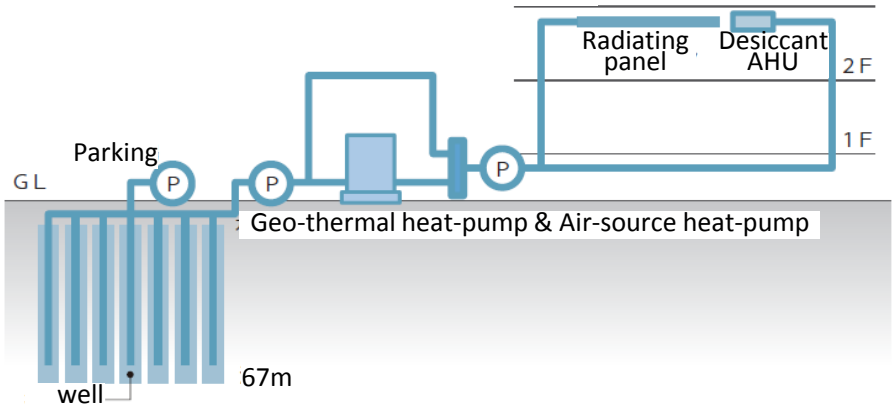
断面詳細

Double skin

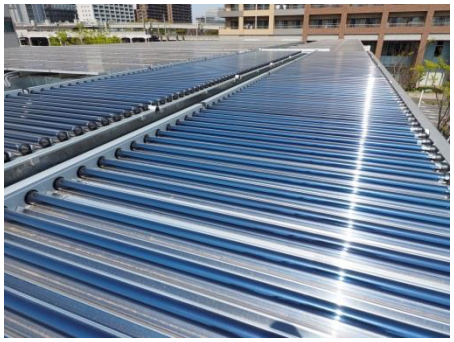
Ambient LED lighting 300Lx & Thermal human sensor

Create super energy-saving building

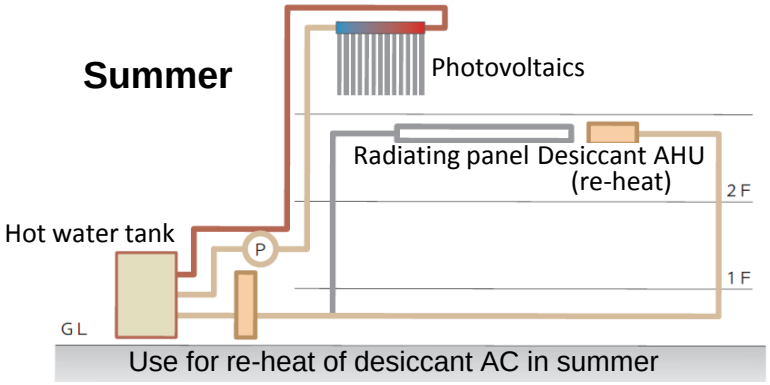
Geothermal pile

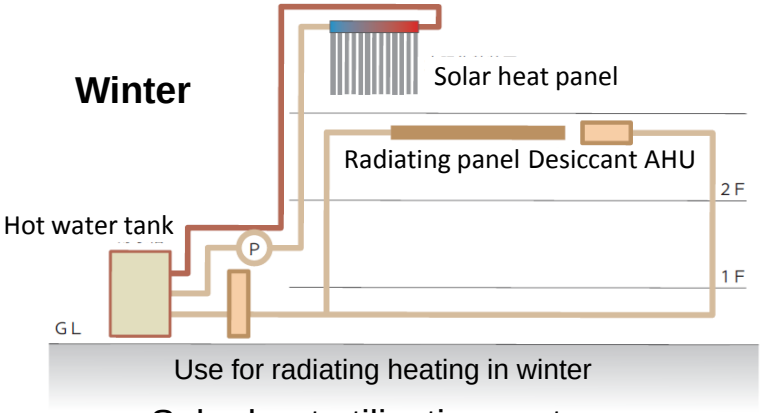


Geothermal utilization system



Solar heat panel





Solar heat utilization system

Think smart work-style

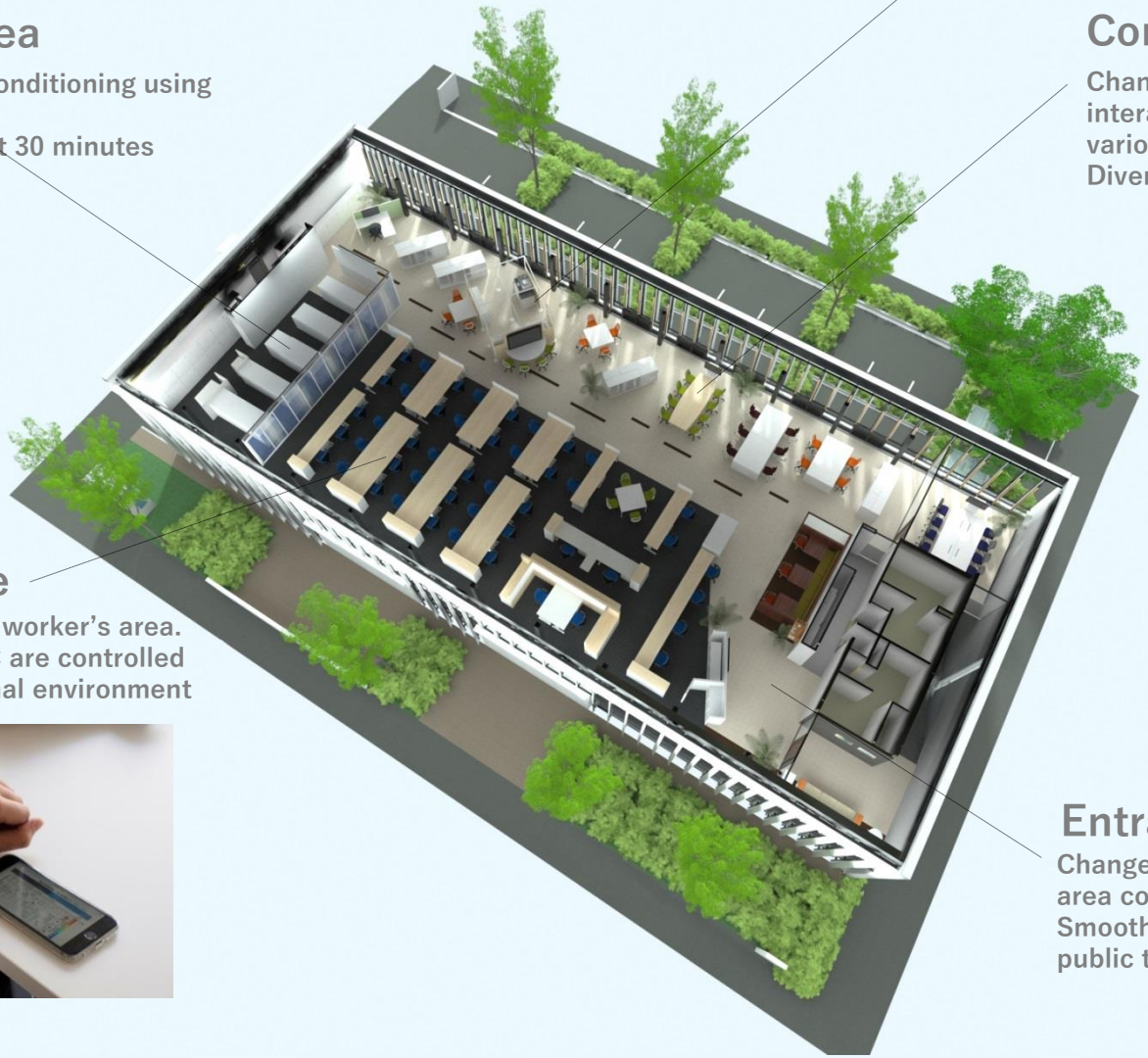
Reduction of power outlet consumption
by sharing copy machines and others

Filing area

Inactive air-conditioning using ventilation
Work for short 30 minutes

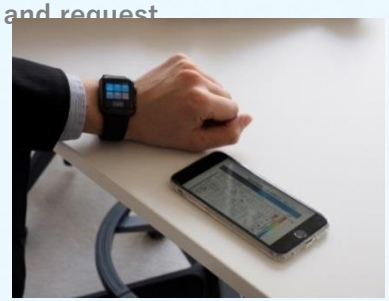
Communication area

Change of view, angle, and interactive face each other in various areas.
Diversity of communication



Workplace

Concentrate on worker's area.
Lighting and AC are controlled fitting to personal environment and request



Entrance area

Change to the office mode in this area coming back from outside.
Smooth mode change from public to private.

Become resistant to disaster

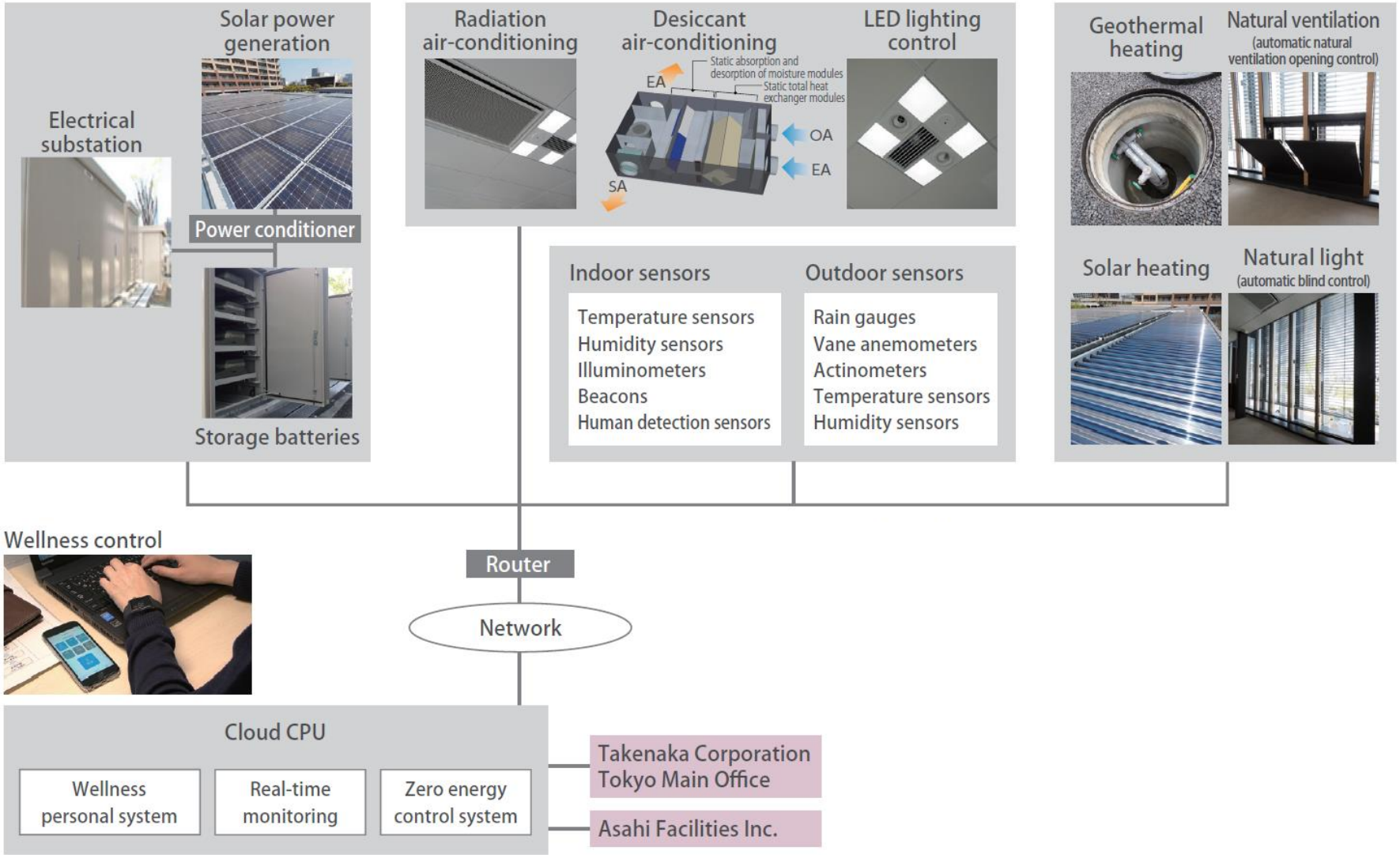
Devices on the roof

Photovoltaics panel

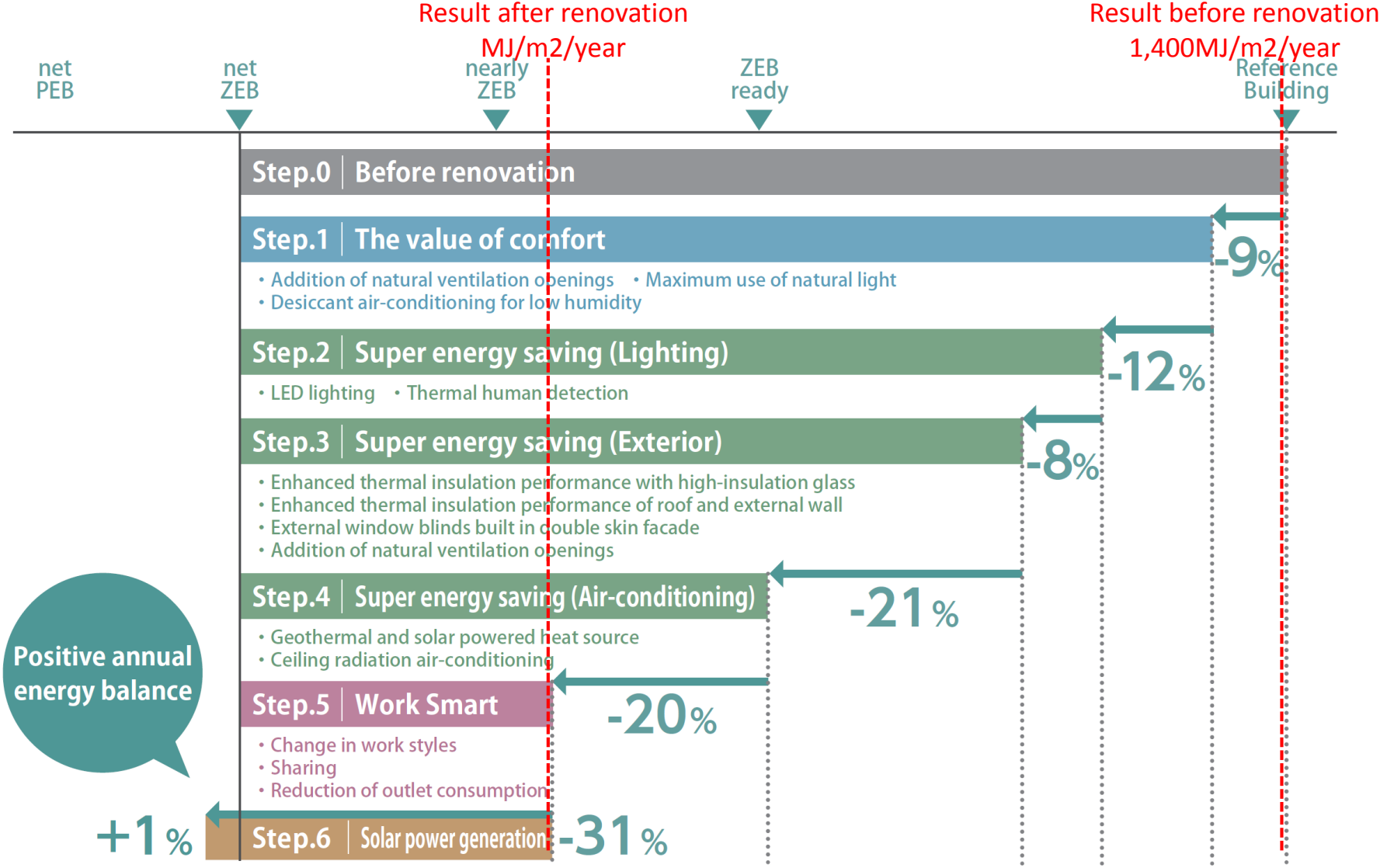
Solar heat panel

Re-use lithium-ion battery

Integrated control

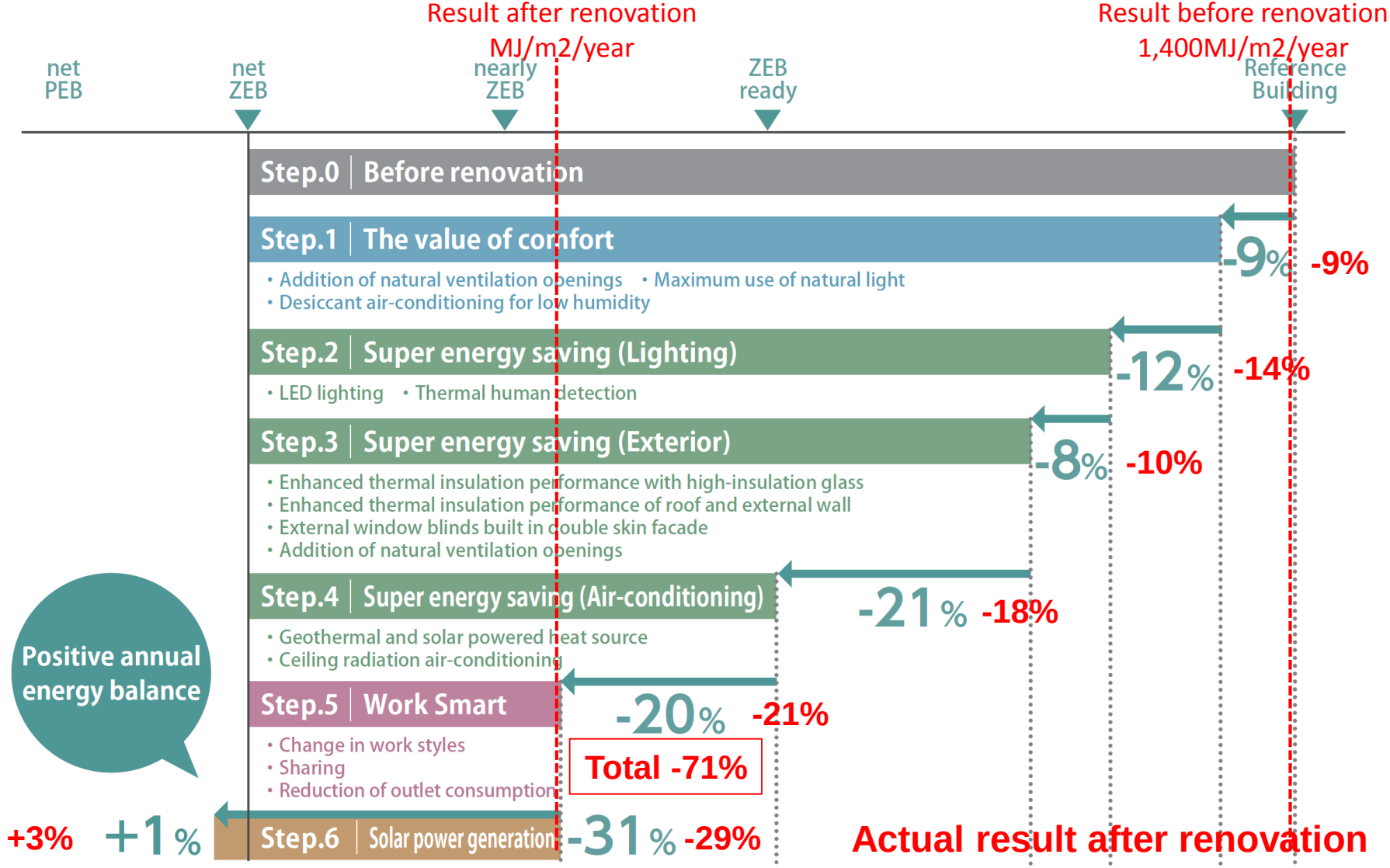


Integrated control system



ZEB ready： over 50% reduction of consumption
Nearly ZEB： approximately 75% reduction of consumption and also has renewable energy
Net ZEB： approximately 75% reduction of consumption and remain are canceled by renewable energy

The prediction of energy consumption and energy generation



ZEB ready： over 50% reduction of consumption
Nearly ZEB： approximately 75% reduction of consumption and also has renewable energy
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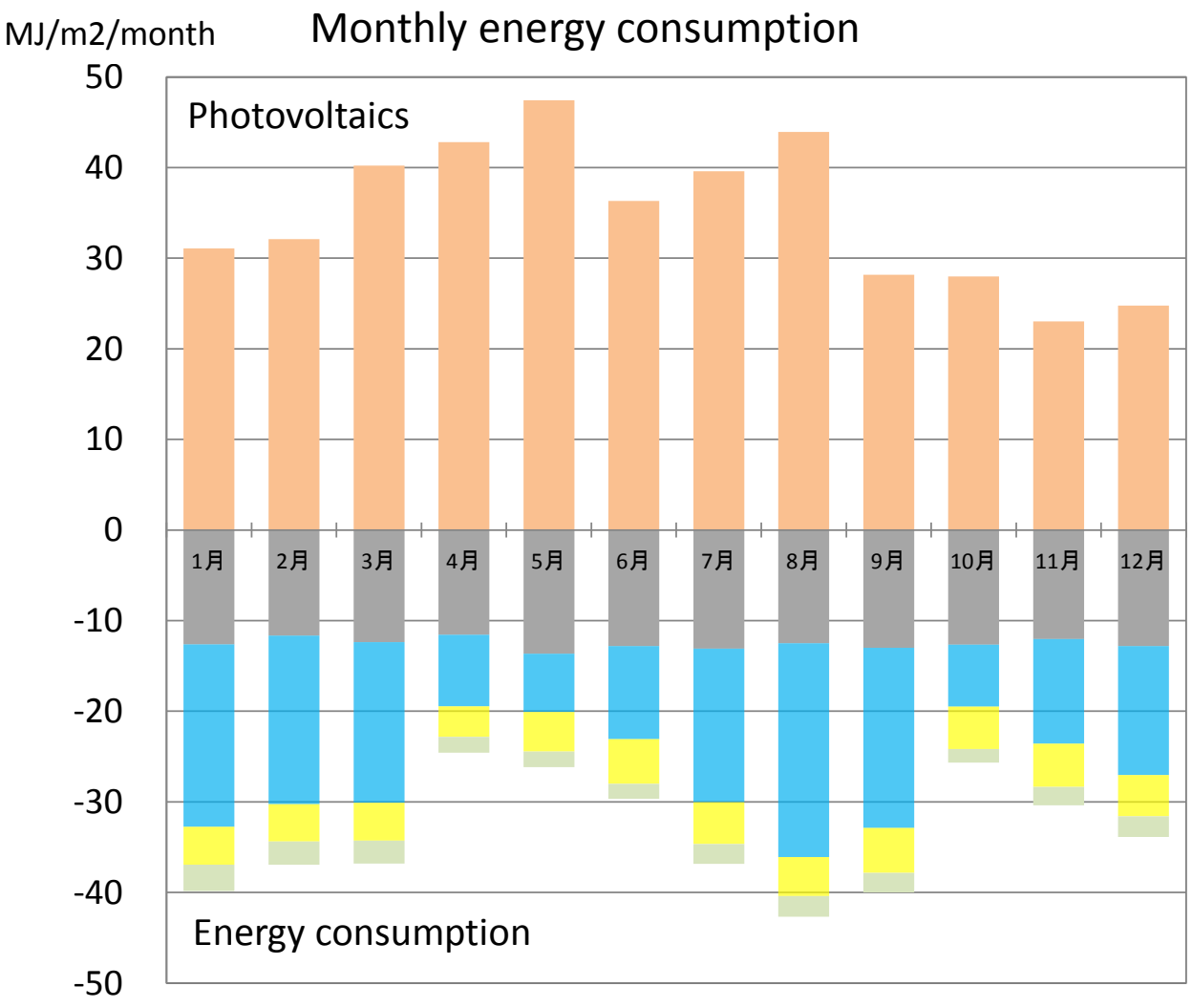
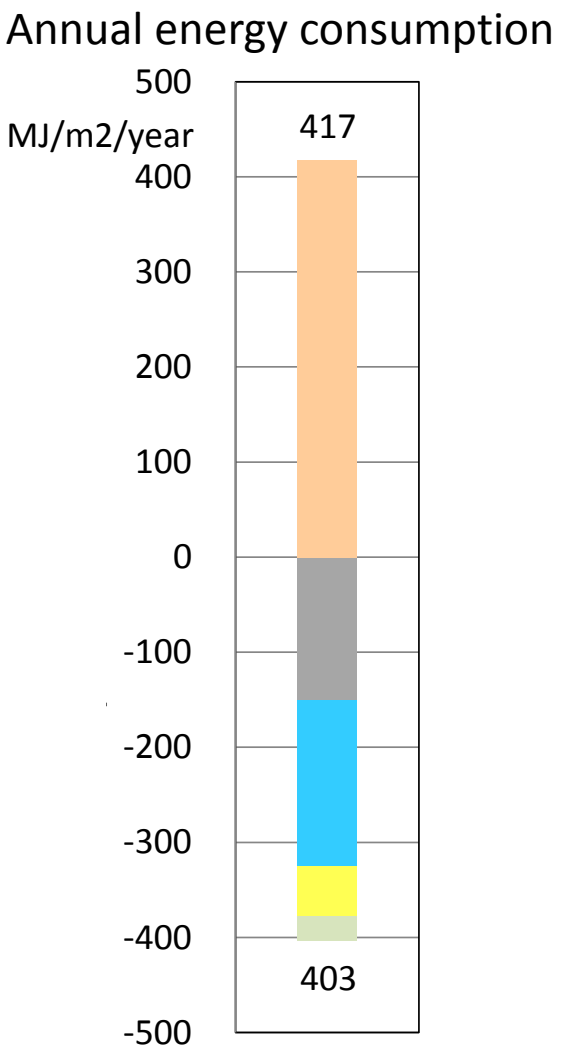
The prediction of energy consumption and energy generation

Actual monthly & annual energy consumption and Photovolta

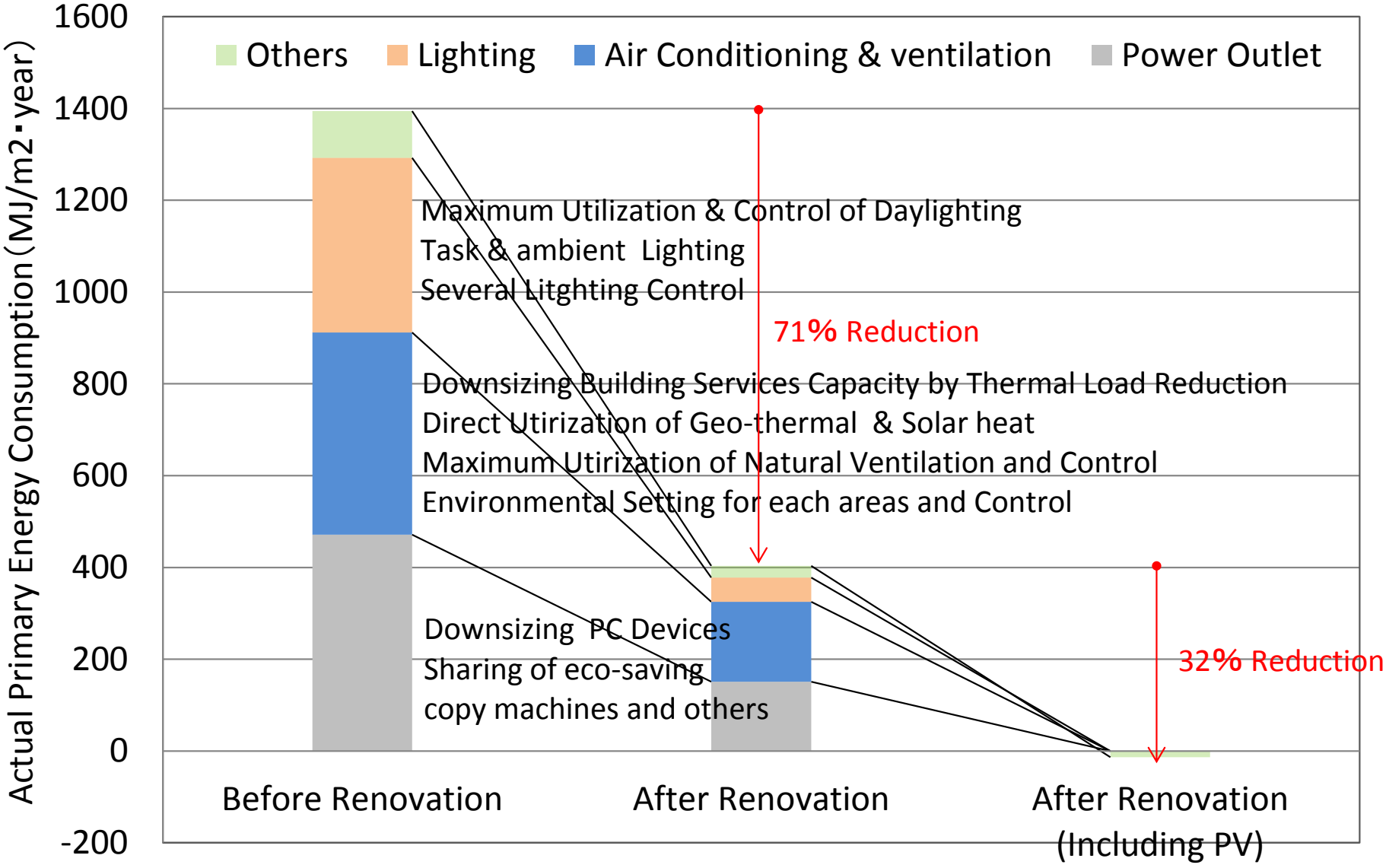
(May, 2016 – April, 2017)





Comparison before and after renovation

Actual primary energy consumption-

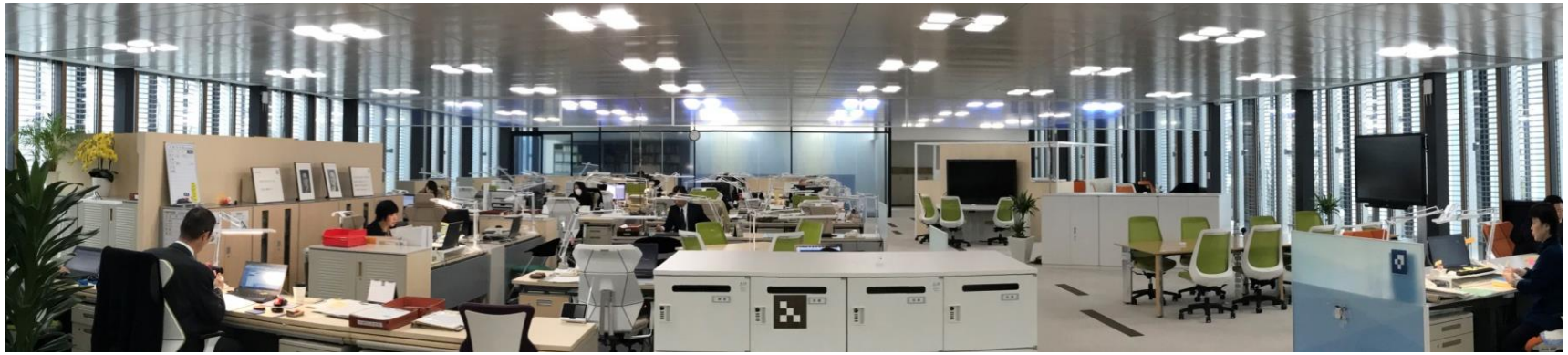


Indoor environment actual data

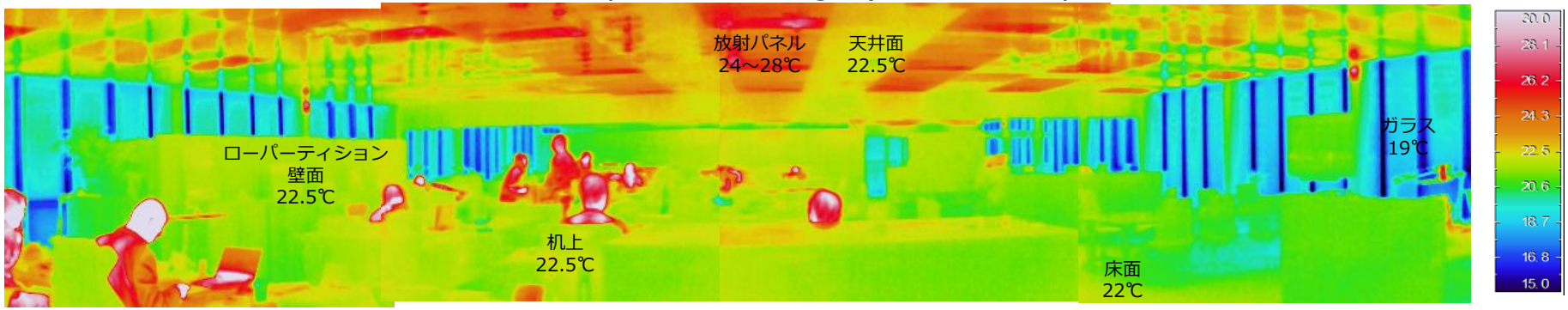
Example of winter indoor environment (Surface temperature)

Dec, 14, 2016　13:00　room temperature setting 22℃

Visual Image



Thermal temperature Image (surface temperature)



Temperature difference between the ceiling, the floor, the furniture, the window, etc. is not so much. Radiation environment is nearly optimal for human body.

In Summary (ZEB renovation)

- We achieved net ZEB at this renovation office
- Improved comfort with radiation, low humidity, air flow feeling, bright light environment with daylight
- Downsizing of the facade thermal load is very important
- Big change of the office layout, change the environment setting point for each place, share copy machines, and we reduced power outlet consumption by 70%
- In addition to zero energy cost, overtime hours are greatly reduced by improving workplace productivity, and payback years is approximately under ten years.
- Effectively utilize geothermal and solar heat

In Summary (ZEB renovation)

- It is important to plan and execute comprehensively thinking about energy benefit, improvement of workplace productivity by improving work space recognition and comfort, improvement of BCP, increase of energy cost in the future, improvement of asset value of building.
- Our future task is further improvement of work style, compatibility between comfort improvement and energy consumption reduction.

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