Practical Renovation for net-ZEB Office
- Takenaka Higashi-Kanto Branch Office -

Nov, 28  2017

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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
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

![Diagram showing various elements like solar panels, ventilation, and air conditioning systems.](image-url)
Concepts of this office ZEB renovation

Change the theory of comfort
- Maximum use of daylighting, natural vent. & control
- Temperature control by radiant cooling & heating
- Humidity control by desiccant air conditioning
- Airflow control by personal diffuser

Create super energy-saving building
- Significant reduction of thermal load by renovation of facade
- LED task & ambient lighting & control
- Ceiling radiant cooling & heating
- Direct use of geo-thermal
- Direct use of solar heat

Think smart work-style
- Divide into 3 areas in the office
- Moving promotion of workers and Work-mode change
- Environmental setting at each area
- Space of common area and Sharing of machines
- Wellness control

Become resistant to disaster
- Operation time increase, BCP performance increase
- Photovoltaics panel
- Solar heat
- Battery
Change the theory of comfort

Daylighting from both sides

Natural ventilator (auto control)

Natural exhaust (auto control)

Outside blind (auto control)

CFD of Natural ventilation Temp.

Personal diffuser

Low humidity by Desiccant Air-Conditioning
Create super energy-saving building

**Exterior**

Replace to high insulated glass

**Double skin**

Radiation panel

Ambient LED lighting 300Lx & Thermal human sensor
Create super energy-saving building

Geothermal pile

Geothermal utilization system

Solar heat panel

Summer

Use for re-heat of desiccant AC in summer

Winter

Use for radiating heating in winter

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
Actual monthly & annual energy consumption and Photovoltaics
(May, 2016 – April, 2017)

Monthly energy consumption

Annual energy consumption

Energy consumption

Photovoltaics

MJ/m²/month

MJ/m²/year

417

403
Comparison before and after renovation - Actual primary energy consumption:

- **Before Renovation**
  - Maximum Utilization & Control of Daylighting
  - Task & ambient Lighting
  - Several Lighting Control

- **After Renovation**
  - Downsizing Building Services Capacity by Thermal Load Reduction
  - Direct Utilization of Geo-thermal & Solar heat
  - Maximum Utilization of Natural Ventilation and Control
  - Environmental Setting for each areas and Control

- **After Renovation (Including PV)**
  - Downsizing PC Devices
  - Sharing of eco-saving copy machines and others

- **Comparison**
  - 71% Reduction
  - 30.3% Reduction

Actual Primary Energy Consumption (MJ/m²-year):

- Others
- Lighting
- Air Conditioning & ventilation
- Power Outlet
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 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.