Lighting retrofit in office building for better lighting quality and energy efficiency

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1. Energy saving solution for Kyudenko main office
   （九電工本社ビルにおける省エネルギー化への取組）
2. Lighting retrofit
   （照明設備改修計画内容について）
3. Energy efficiency
   （省エネルギーの実績について）
4. Example of subsidize retrofit project
   （補助金を利用した照明改修工事の事例）
5. LED lighting for lighting retrofit
   （照明改修とLED照明器具について）
# Energy saving solution for Kyudenko main office

## Building outline of Kyudenko main office (2014)

<table>
<thead>
<tr>
<th>Construction completion</th>
<th>December 1974 (39-years-old building)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floors</td>
<td>10 floors</td>
</tr>
<tr>
<td>Basement 1</td>
<td>Parking area, cafeteria, machine room</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Entrance hall, offices</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt;-8&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Offices</td>
</tr>
<tr>
<td>9&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Hall, conference rooms</td>
</tr>
<tr>
<td>10&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Switch room and machine room</td>
</tr>
<tr>
<td>Total floor area</td>
<td>12,531 m²</td>
</tr>
<tr>
<td>Electrical services</td>
<td>Receiving voltage : 6.6kV</td>
</tr>
<tr>
<td></td>
<td>Contract demand : 550kW (43.9W/m²)</td>
</tr>
<tr>
<td>Heat-source equipment</td>
<td>Air-cooling heat pump chiller: 30HP×9</td>
</tr>
<tr>
<td></td>
<td>heat storage tank: 600m³</td>
</tr>
<tr>
<td></td>
<td>Sub heat storage tank : 30m³×2</td>
</tr>
<tr>
<td>Air conditioning equipment</td>
<td>Air-conditioning unit: 19 units</td>
</tr>
<tr>
<td></td>
<td>Fan-coil units: 144 units</td>
</tr>
<tr>
<td></td>
<td>Air-conditioning system: 27 units</td>
</tr>
<tr>
<td>Plumbing equipment</td>
<td>Electrical water heater: 10 units</td>
</tr>
</tbody>
</table>
Energy saving solution for Kyudenko main office

◆ Target for energy use (set in 2008)

- Standard office building
  - 2007 (base)
    - 1,047t-CO₂ (2,800MWh)
  - 2014 (target)
    - 702t-CO₂ (1,876MWh)

33% (924MWh) Cut

Solar power and others
A/C system retrofit
Lighting retrofit
Energy saving measures
Three main energy saving solutions

**Lighting**
Replace existing lighting with LED lighting

**Energy management system**
Installation of Q-BEMS
(Kyudenko Building Energy Management system)

**A/C system**
Replace existing A/C system with cocktail A/C system
(self developed A/C system)
Lighting retrofit

1) Replace existing lighting with LED lighting
   2009: 1st 8th 9th 10th floor
   2010: 3rd 6th 7th floor
   2011: 2nd 4th 5th floor

2) Replace existing emergency light with LED lighting (2009)

3) Installation of intelligent lighting system on 3rd floor (2010)

Prior to retrofit 20.1 W/m²
After retrofit 4.8 W/m²
Lighting retrofit

Lighting retrofit on 4th floor (E&M design department office area)

Window with Venetian blind

Lighting plan
Lighting retrofit

-**Lighting retrofit on 4th floor (E&M design department office area)**

Prior to retrofit: 28W/m²

After retrofit: 9.6W/m² (-66%)
(Dimming to setting the right light level)

**Average horizontal illuminance**: 1000lx
**Color temperature**: 3500K
**General color rendering index**: Ra=84
**Type of Lamp**: Fluorescent lamp
**Life time**: 12000 hours
**Rated power consumption**: 94W each
**Luminous flux**: 5000lm

Average horizontal illuminance: 1000lx
Color temperature: 4000K
General color rendering index: Ra=80
Type of Lamp: LED
Life time: 40000 hours
Rated power consumption: 48W each
Luminous flux: 3340lm
Lighting retrofit

◆ Lighting retrofit on 4th floor (E&M design department office area)

Monitor of Building Energy Management System
(showing dimmer load factor ratio)
**Lighting retrofit**

- **Lighting retrofit on 4th floor (E&M design department office area)**

![Energy usage comparison graph](image)

Energy usage comparison vs. Brightness

![Energy usage comparison graph](image)

Energy usage comparison vs. Efficiency

<table>
<thead>
<tr>
<th></th>
<th>Type of Lamp</th>
<th>Energy use (W)</th>
<th>Number</th>
<th>Total Energy use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to retrofit</td>
<td>Fluorescent 40W-2</td>
<td>94</td>
<td>214</td>
<td>20.1kW</td>
</tr>
<tr>
<td>After retrofit</td>
<td>LED</td>
<td>48 × 57%</td>
<td>74</td>
<td>6.9kW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>48 × 72%</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>Energy saving</td>
<td></td>
<td></td>
<td></td>
<td>13.2kW (66%)</td>
</tr>
</tbody>
</table>
Lighting retrofit

◆ Lighting retrofit on 4th floor (E&M design department office area)

Prior to retrofit  39 switching divisions

After retrofit  50 switching divisions

Improve lighting practices
• Switch off light in lunch time
• Effective use of daylight or task light
Energy efficiency

◆ Reduction of single-phase energy usage

Usually in old office buildings, measurement is not able to separate usage by lighting and usage by outlet and others because of electrical main line.
Example of subsidize retrofit project

◆ A subsidized retrofit project in Japan

建築物省エネ改修等推進事業（国土交通省）
Subsidy to promote retrofit for energy saving of architecture (Ministry of Land, Infrastructure, Transport and Tourism)

This subsidy is provided for retrofit for energy saving, barrier-free and energy measurement retrofits.

Project requirement example
・Retrofit building envelope system (insulation, eaves, louver, glazing etc)
・Estimate more than 15% energy saving
・Measure energy usage, continuous energy management, energy saving measures

Percentage in construction cost
Percentage: a third of construction cost
Thank you!

We are waiting for you on 1st Oct