
Building Communication System: Takenaka's M2M Platform for Building Management & Application Interface

Yasutomo Matsuoka

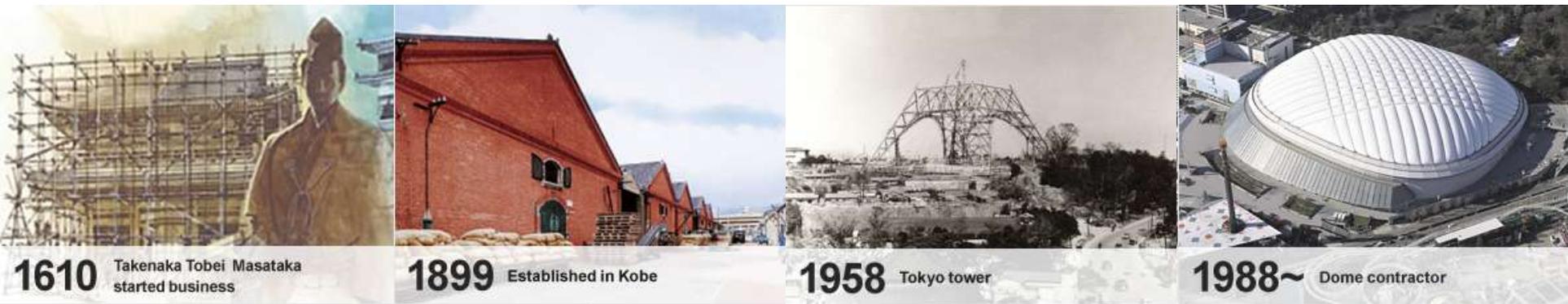
Researcher, Advanced Construction System Department
Takenaka Research & Development Institute

Corporate Profile

With yearly sales of \$9 billion, 20 overseas offices, and over 1,000 architects in our design department.

Takenaka offers comprehensive services worldwide across the entire spectrum of space creation from site location and planning to design and construction as well as post completion services such as building maintenance.

History



Major Works



Takenaka R&D Institute

- About 150 Researchers and 100 staffs.
- World's largest construction R&D laboratory.



Centrifuge Facility



2,000-ton (20MN) Loading testing



Loading equipment



Containment Testing Laboratory



Anechoic Room

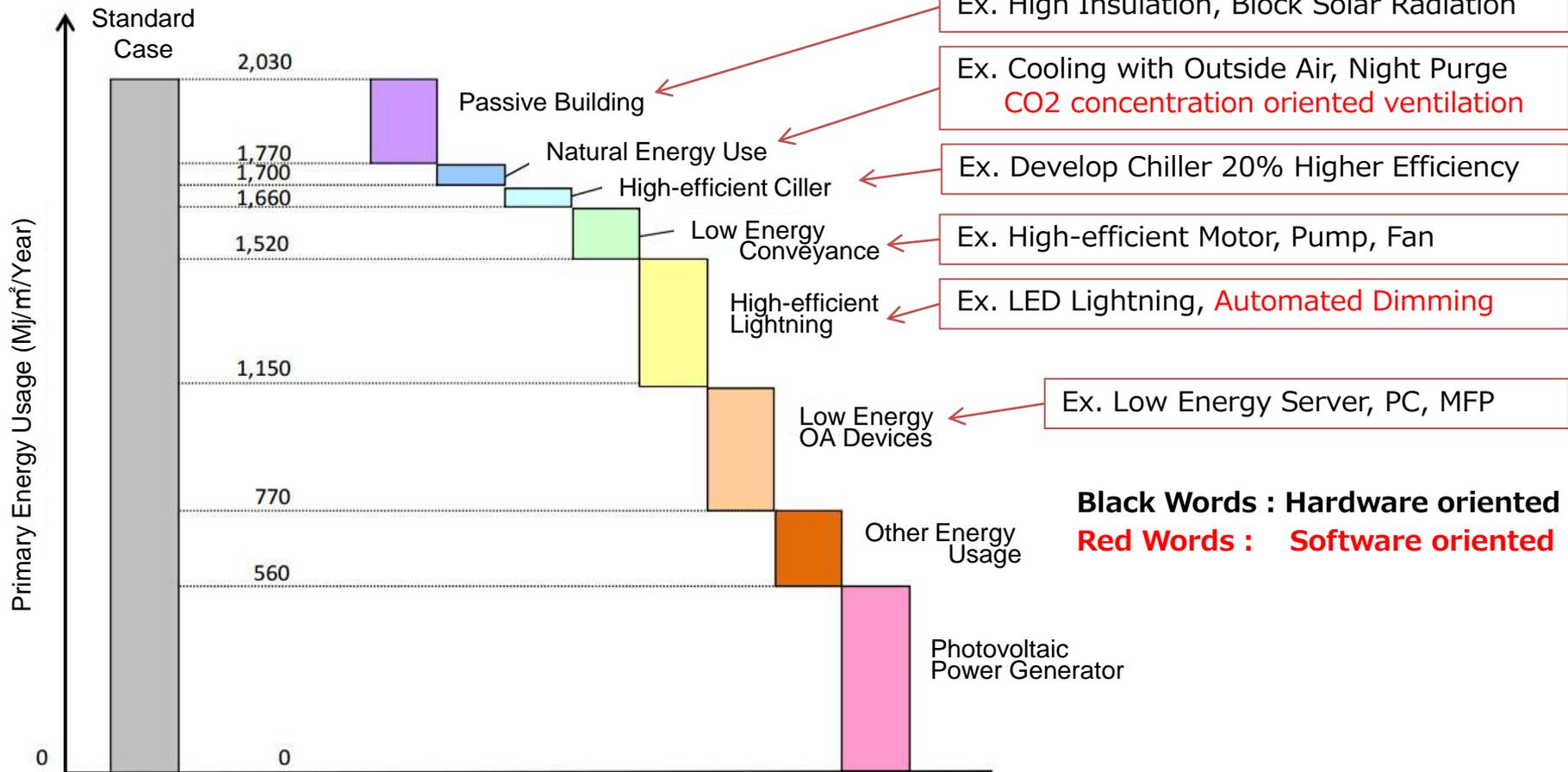
- 1. The Next Step of Building Energy Saving and Management**
- 2. Takenaka's Machine to Machine Platform**
- 3. Case Studies**
- 4. Movement of Demand Response in Japan**

- 1. The Next Step of Building Energy Saving and Management**
2. Takenaka's Machine to Machine Platform
3. Case Studies
4. Movement of Demand Response in Japan

- ◆ Let's get highly insulated building surface!
→ Material and Shape approach. Such as changing wall spec, blocking solar radiation.
- ◆ Let's use latest equipments!
→ High COP Chiller, High lm/W Lighting
- ◆ Let's shut down useless devices!
→ Building manager walks around day and night.
- ◆ Let's be patient, any way!
→ Hot dark weird office.

What can we do any more?
Zero Energy Building,
is it possible?

【ZEBに至る様々な省エネ技術とその省エネ量】



Roadmap of Zero Energy Building in 2030

※Data Source : Nov 2009 METI(Ministry of Economy, Trade and Industry)

Software oriented measure will more important.

Existing Method for Architectural Environment

Supposed workers as equable group.

Homogeneous and Regular Environment

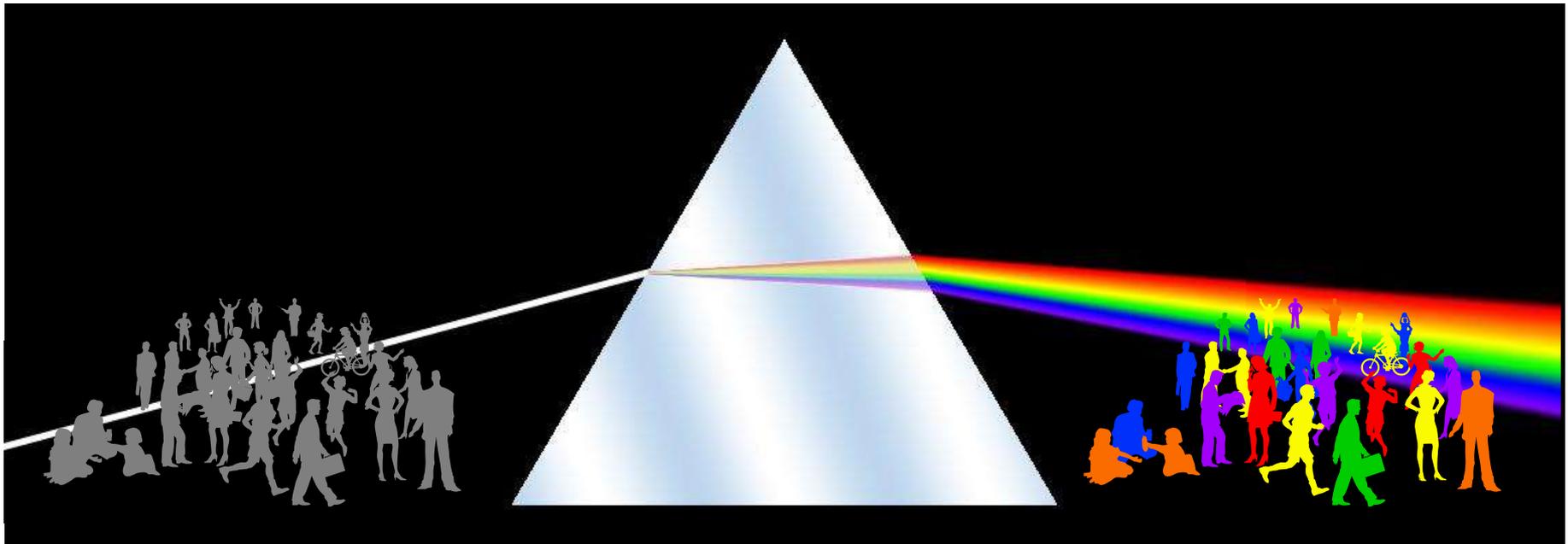
⇒ Not uncomfortable for the most part



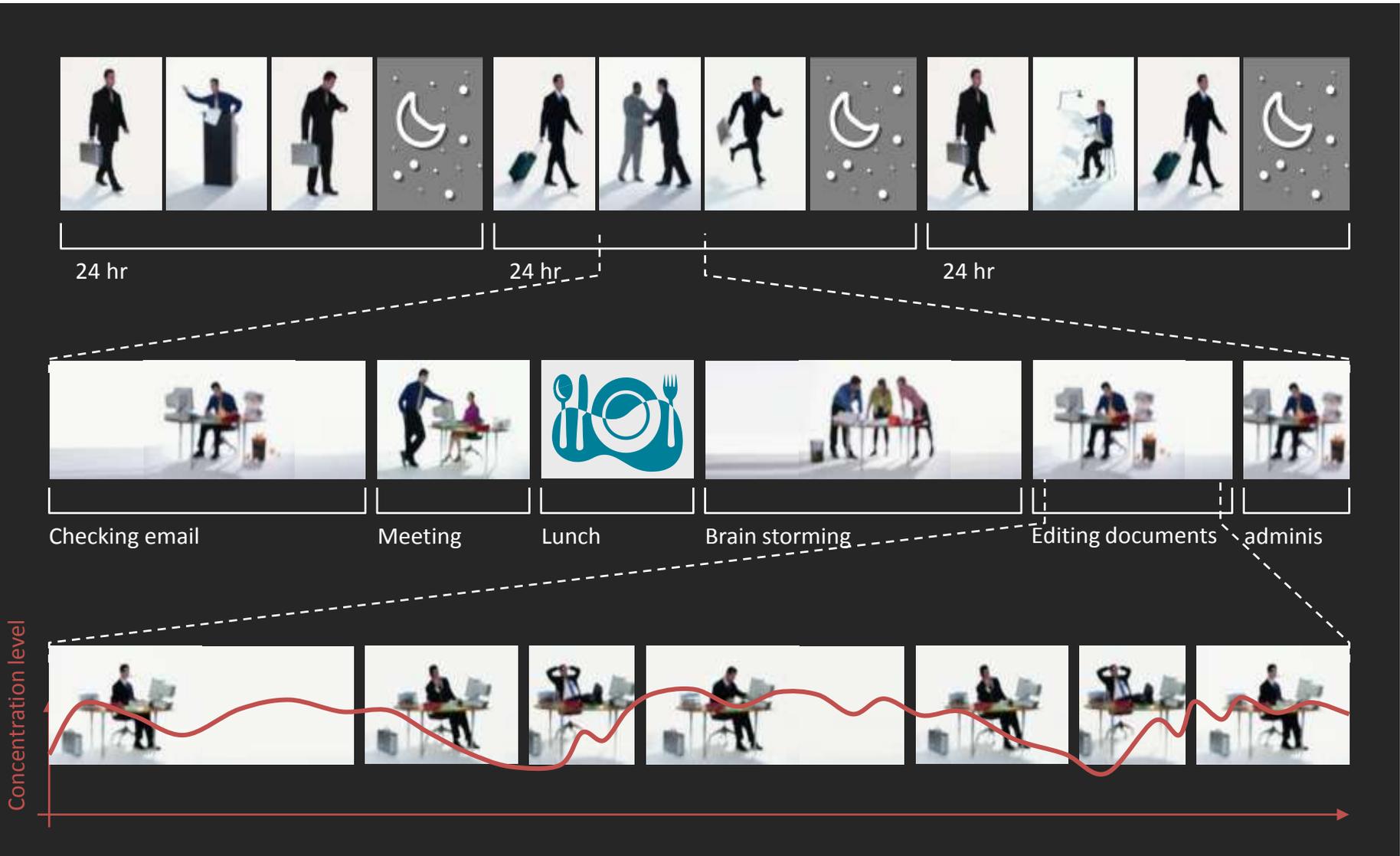
Ideal Method for Architectural Environment

Variety of workers with versatile sensitivity.

Properly changeable Environment
⇒ More aggressive comfort
⇒ Improvement of performance and health



Worker's behavior and state is full of change.





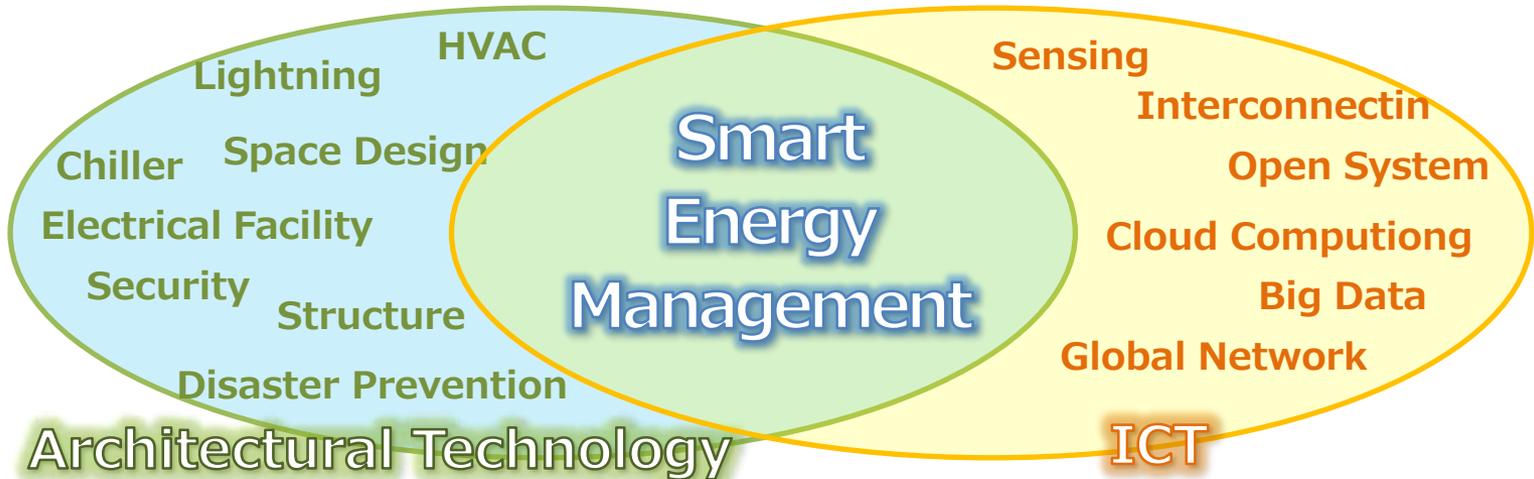
- Energy Saving
- Passive Building
- Renewable Energy
- Demand Control



- BCP / DCP
- Base Isolation
- Vibration Control
- Crime Prevention



- Comfort
- Convenience
- Communication
- Colaboration



(Information and Communication Technology)

1. The Next Step of Building Energy Saving and Management
- 2. Takenaka's Machine to Machine Platform**
3. Case Studies
4. Movement of Demand Response in Japan

Interconnect various systems and users
inside and outside of the building.





Smart Life Office



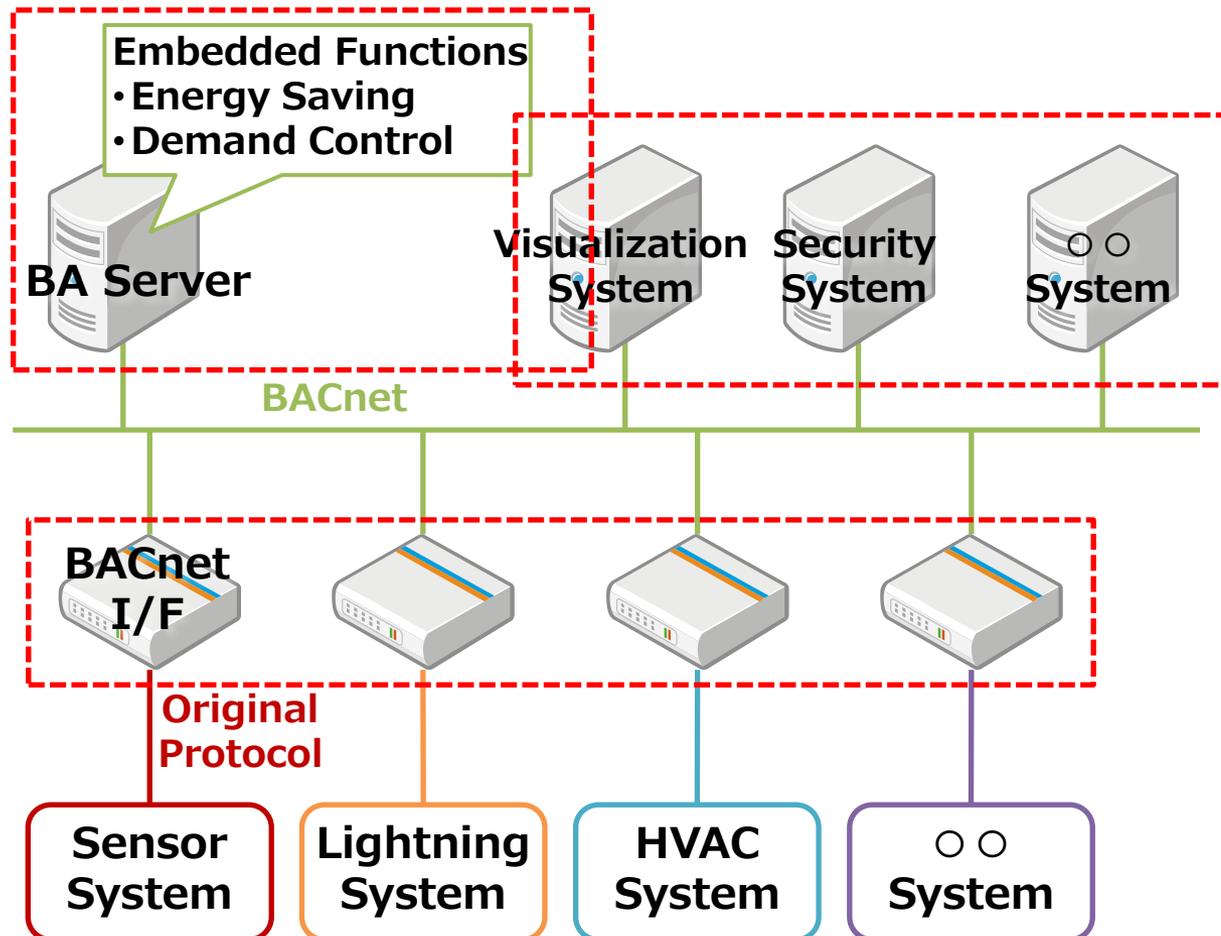
Building Communication System



2. Takenaka's Machine to Machine Platform

Building Communication System

- BACnet I/F device is needed for each sub-system
- Limited connectivity between SCADA and I/F devices
- Customizing or changing functions involves expense
- Application servers are increasing



- BACnet I/F device is needed for each sub-system
- Limited connectivity between SCADA and I/F devices
- Customizing or changing functions involves expense
- Application servers are increasing

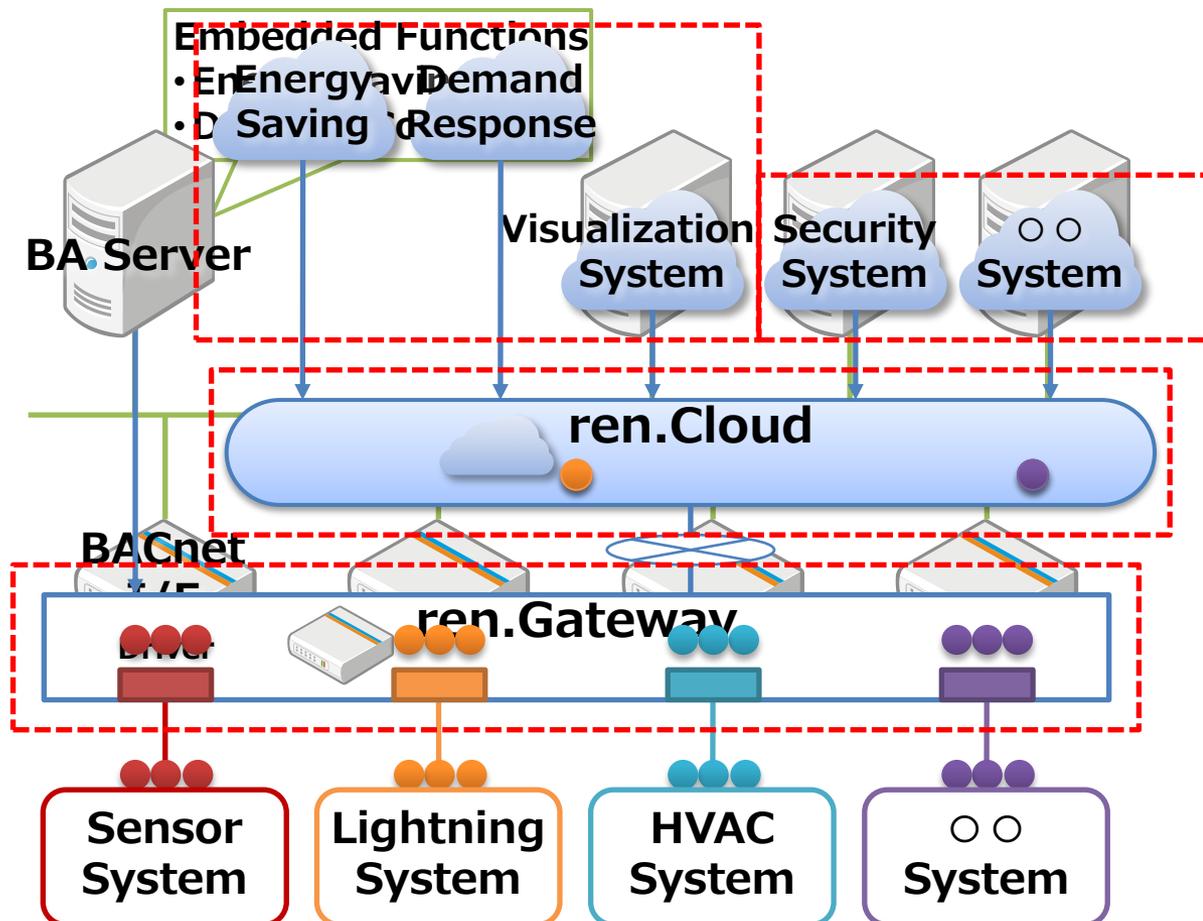
Excessive cost is required for set up and upgrade.

**Impossible to respond to users timely,
while waiting for system reconstruction.**

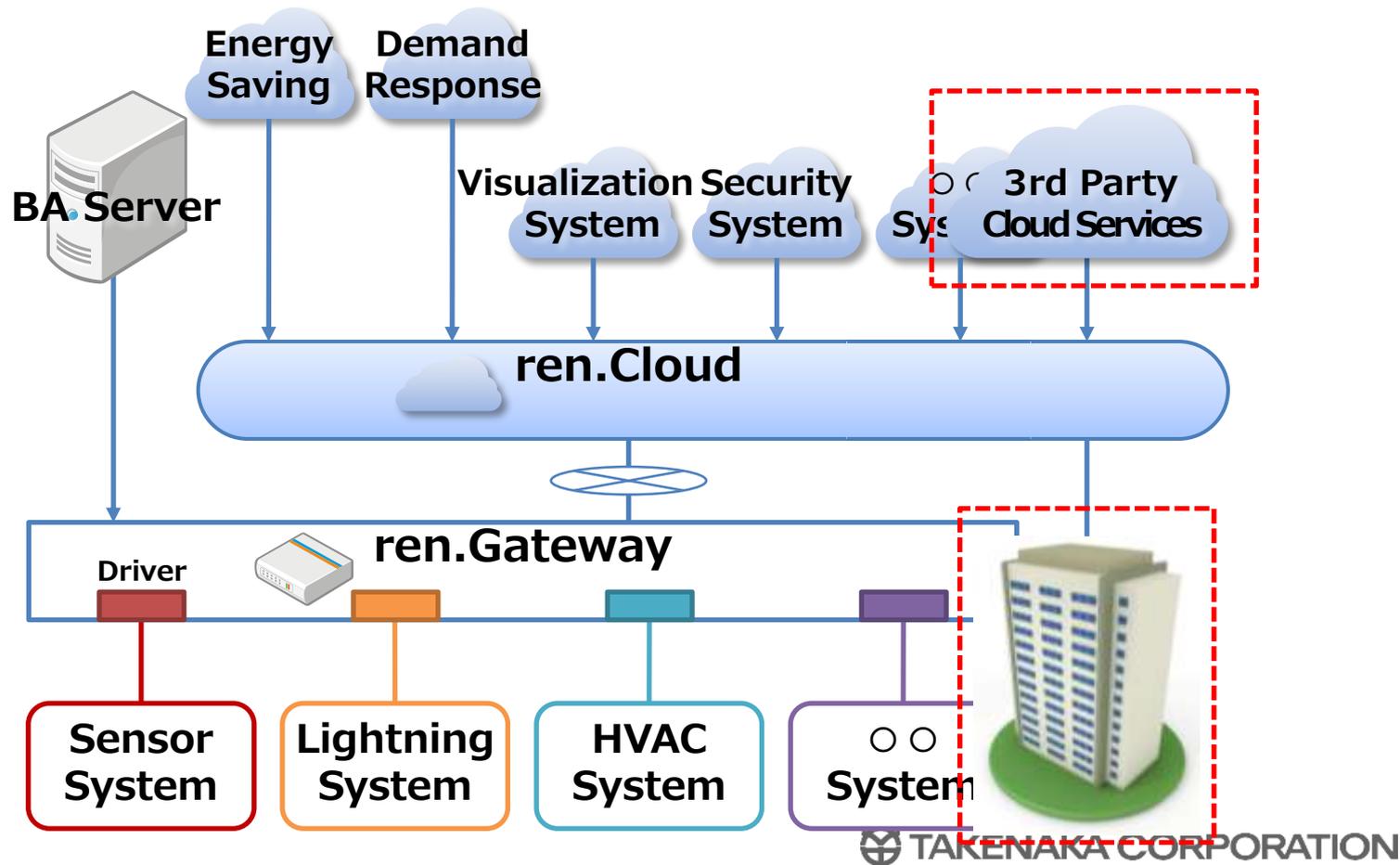
**We have to follow social changes,
but it's too hard to renew BA system.**



- Gateway converts various original protocols
- Functions are provided from cloud services
- Easy to add/remove functions
- Able to be shared local information by every systems



- It does not depends on size and number of the buildings
- Interface for 3rd Party cloud services.



- Gateway converts various original protocols
- Functions are provided from cloud services
- Easy to add/remove functions
- Able to be shared local information by every systems
- It does not depends on size and number of the buildings
- Interface for 3rd Party cloud services.

**Reduction in cost of
system upgrade.**

**Timely response for
users' request.**

**Better building
management service**

Existing System



GALAPAGOS Mobile Phones

- Original System for Each Model
- Factory Installed Applications Only
- Embedded Functions
- Complicated User Interface

Building Communication System



Smart Phones

- Open Platform
- Many Downloadable Applications
- Connected to the Cloud Services
- User Friendly Interface

1. The Next Step of Building Energy Saving and Management
2. Takenaka's Machine to Machine Platform
- 3. Case Studies**
4. Movement of Demand Response in Japan

3. Case Studies

TAK E-HVAC Corp. Shinsuna HQ Building



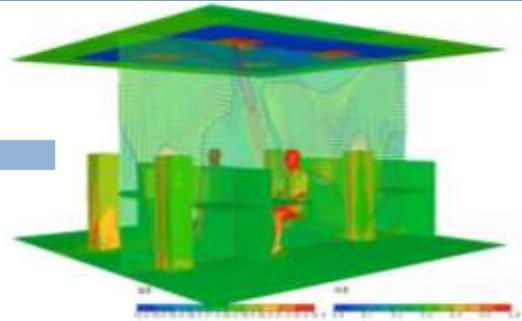
Owner : TAK E-HVAC Corporation
Design : Takenaka Corporation
Construction : Takenaka Corporation
Site : Shinsuna Koutou Tokyo, Japan
Total Floor : 3,918.05m² (※Test Bed Area, 170m²)
Structure : Steel
Floor : 4-story
Completion : Apr. 2010

The first case that Building Communication System is installed.

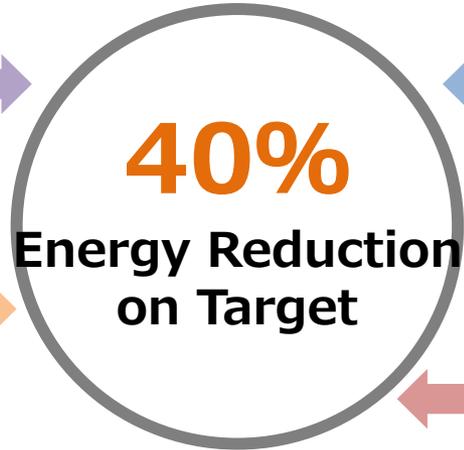


Façade
Vertical Green Façade,
Photovoltaic Generator

HVAC
Air Diffusing Radiation
Panel made of Membrane,
Personal Fan



Lighting
Personal Lighting,
Circadian Rhythm
Scheduler



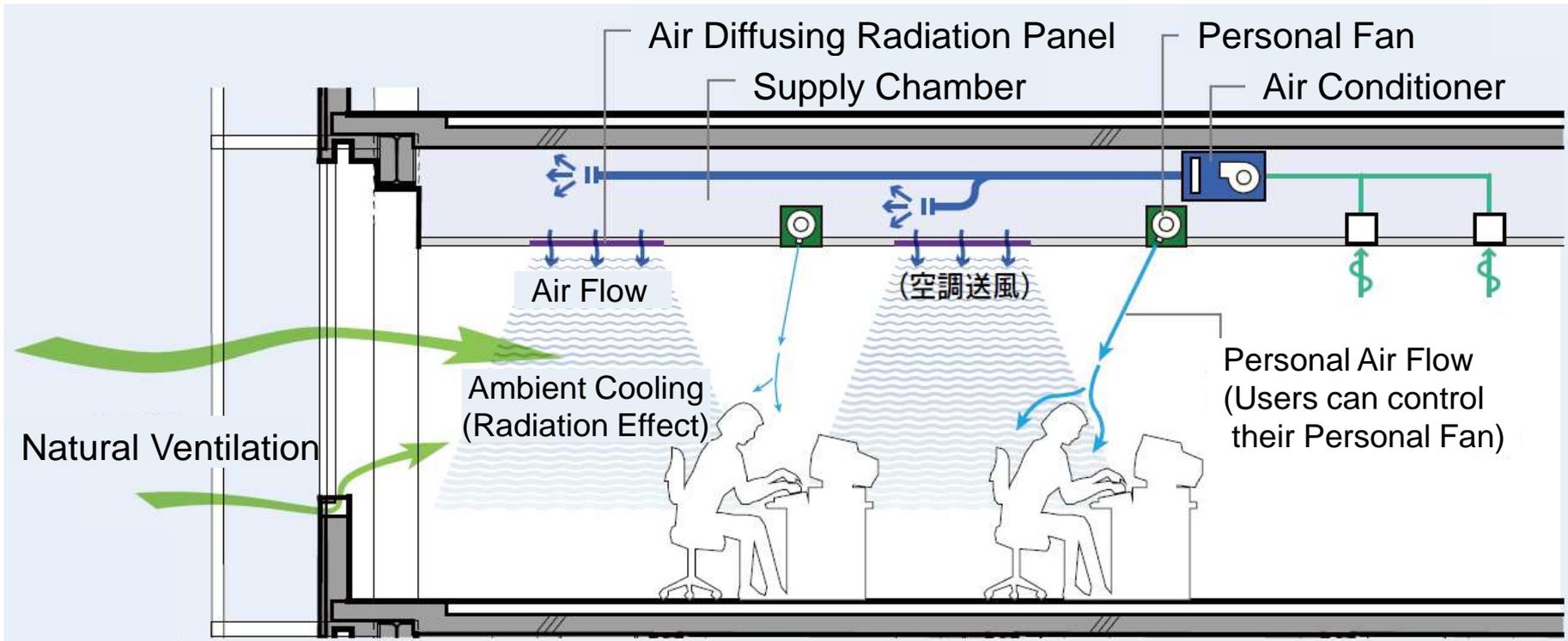
Controller & Network
User Controllable Personal
Environment using the Internet



HVAC

Air Diffusing Radiation Panel made of Membrane, Personal Fan

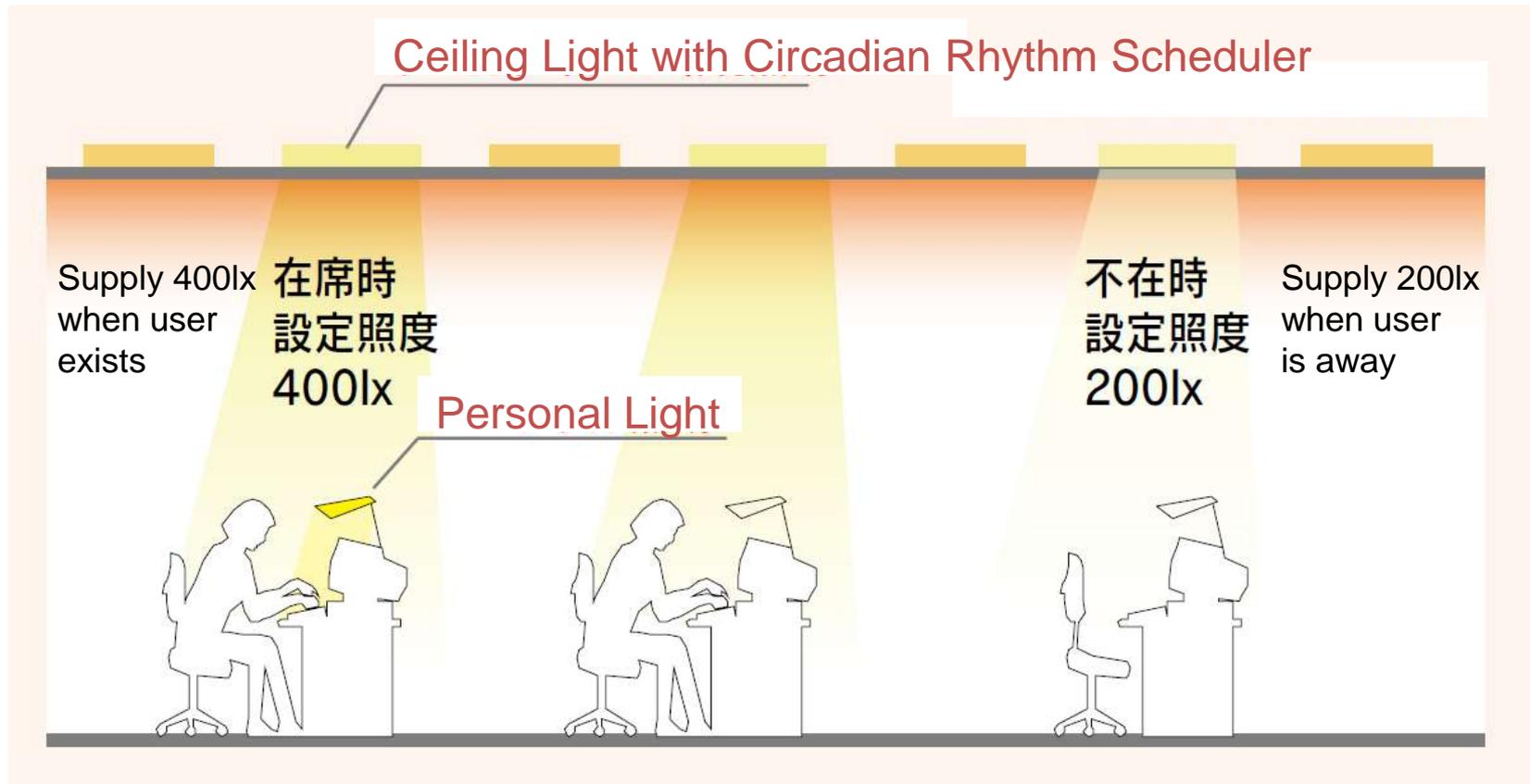
Reduce energy usage while keeping comfort by using “Task and Ambient Cooling”.



Lightning

Personal Light, Circadian Rhythm Scheduler

Reduce energy usage while keeping comfort by using "Task and Ambient Lighting".



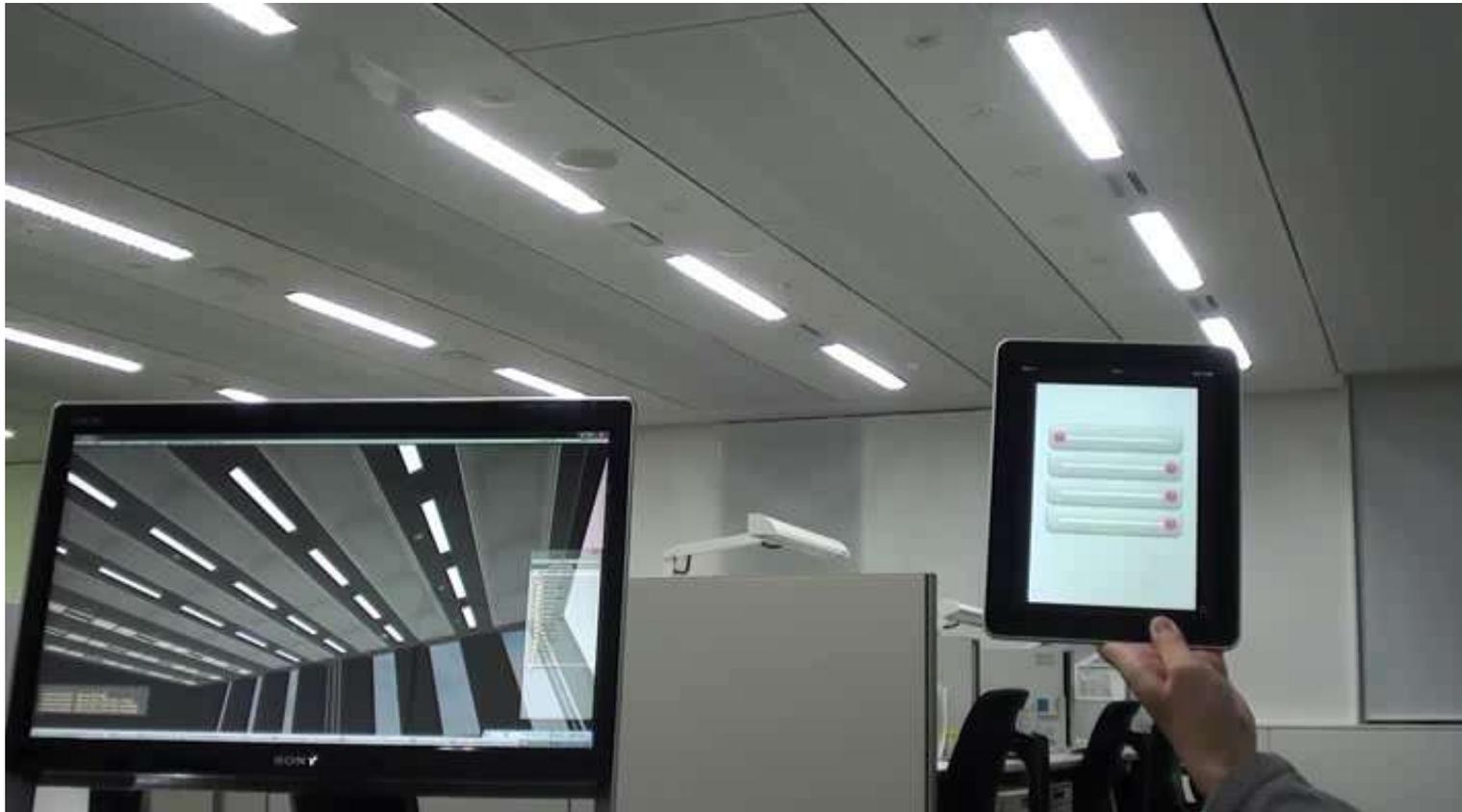
Controller User Controllable Personal Environment using the Internet

Real Space



Virtual Space Viewer

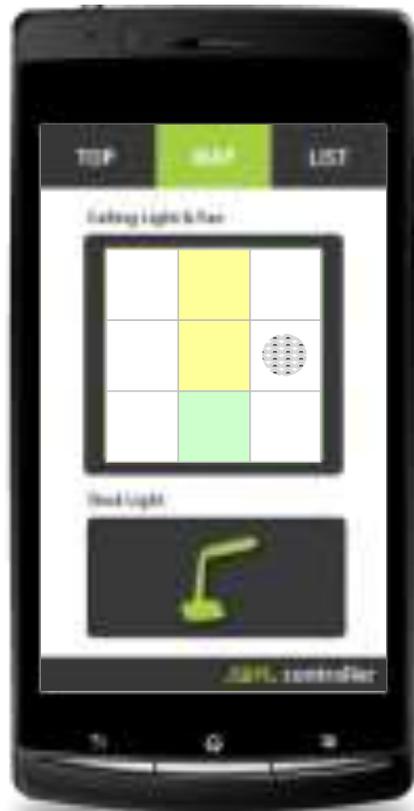
Controller User Controllable Personal Environment using the Internet



iPad controller

Controller User Controllable Personal Environment using the Internet

User friendly interface makes it easy and convenient.



Equipment Selection



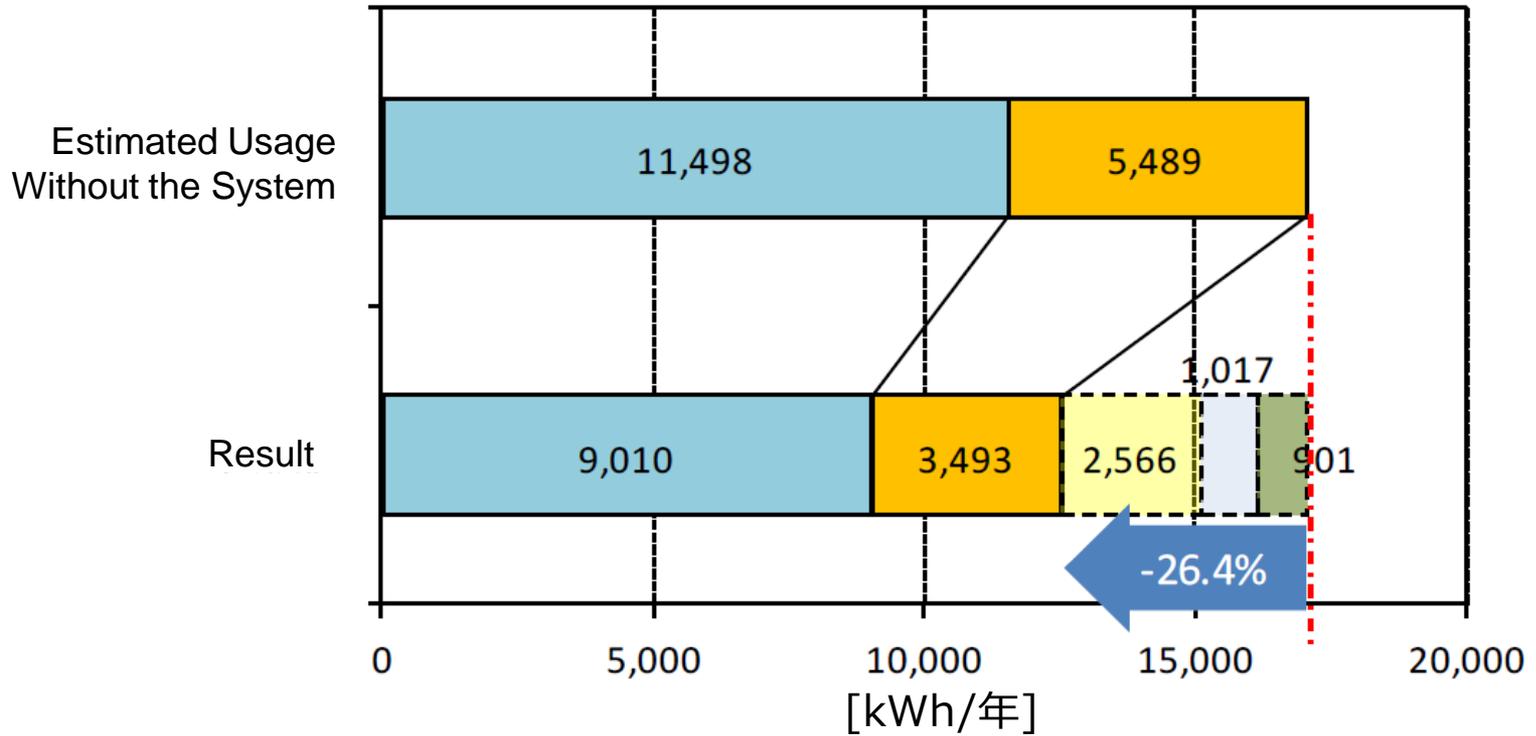
Brightness and
Color Temperature Control



Scene Selection

Annual Energy Usage of the Test Bed Area

- HVAC
- Lightning
- LED調光による削減量
- Effect of Radiation Panel
- Effect of Air Conditioner



3. Case Studies

Iino Building



Owner : Iino-kaiun Corporation
Design : Takenaka Corporation
Construction : Takenaka Corporation
Site : Chiyoda Tokyo, Japan
Total Floor : 103,852 m²
Floor : 27-story
(+5 underground)
Completion : Oct. 2011

Tenant Portal Website



Information from Building Manager



Energy Visualization



Personal Environment Controller



Energy Visualization



Personal Environment Controller

Login Page



Area Selector Map



Equipment Selector



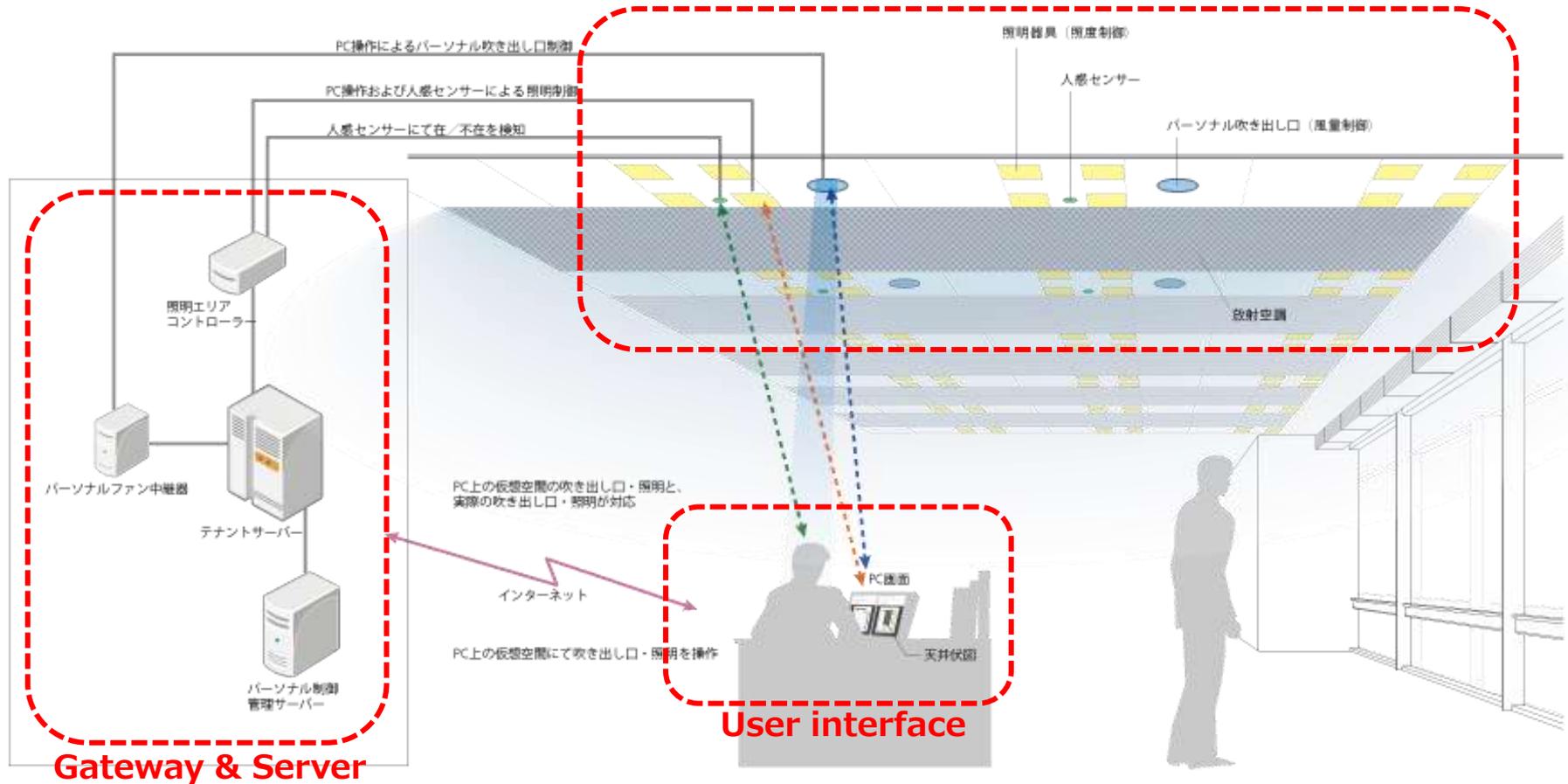
Brightness Controller



Fan Controller

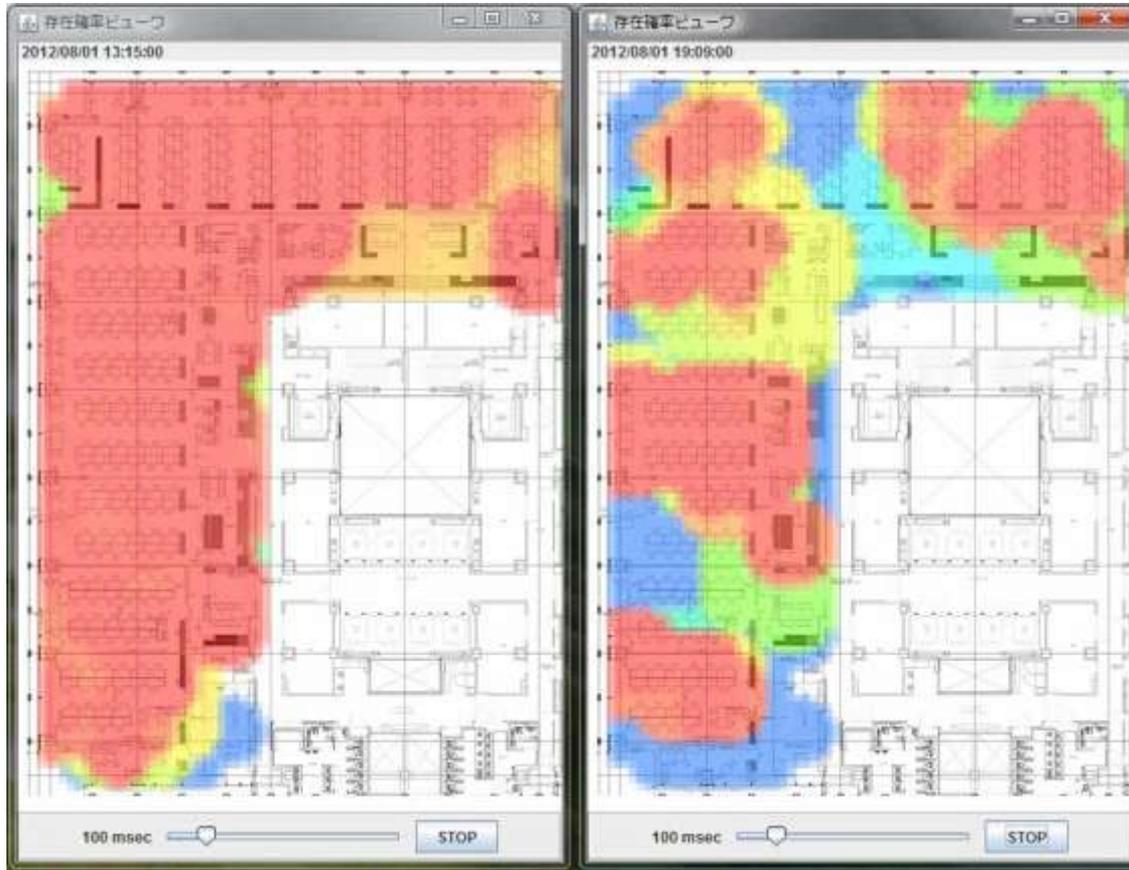


Personal FAN, Personally controllable ceiling Light Motion sensor network, Daylight sensor



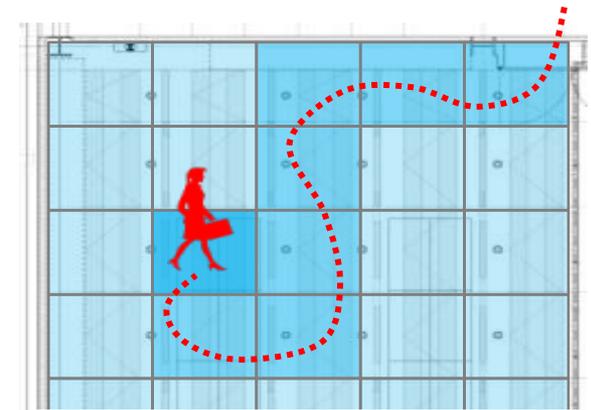
Motion sensor network

Analyzing the human detect events form motion sensors, in order to recognize human existence.

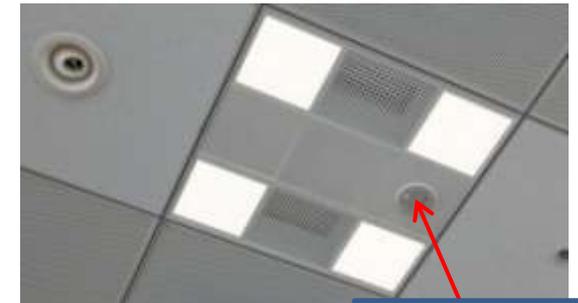


Day time

Overtime



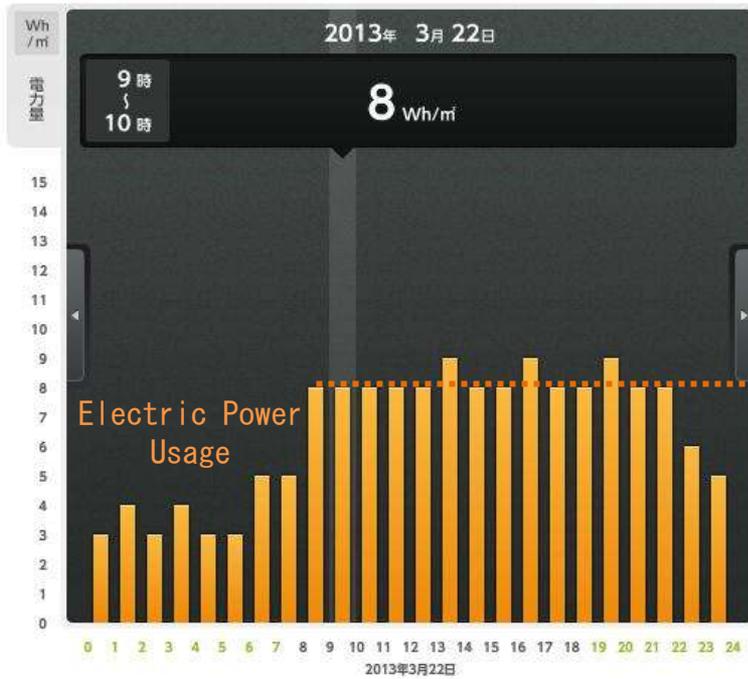
Motion sensors are located on grid



Motin sensor



Energy usage of the installed area



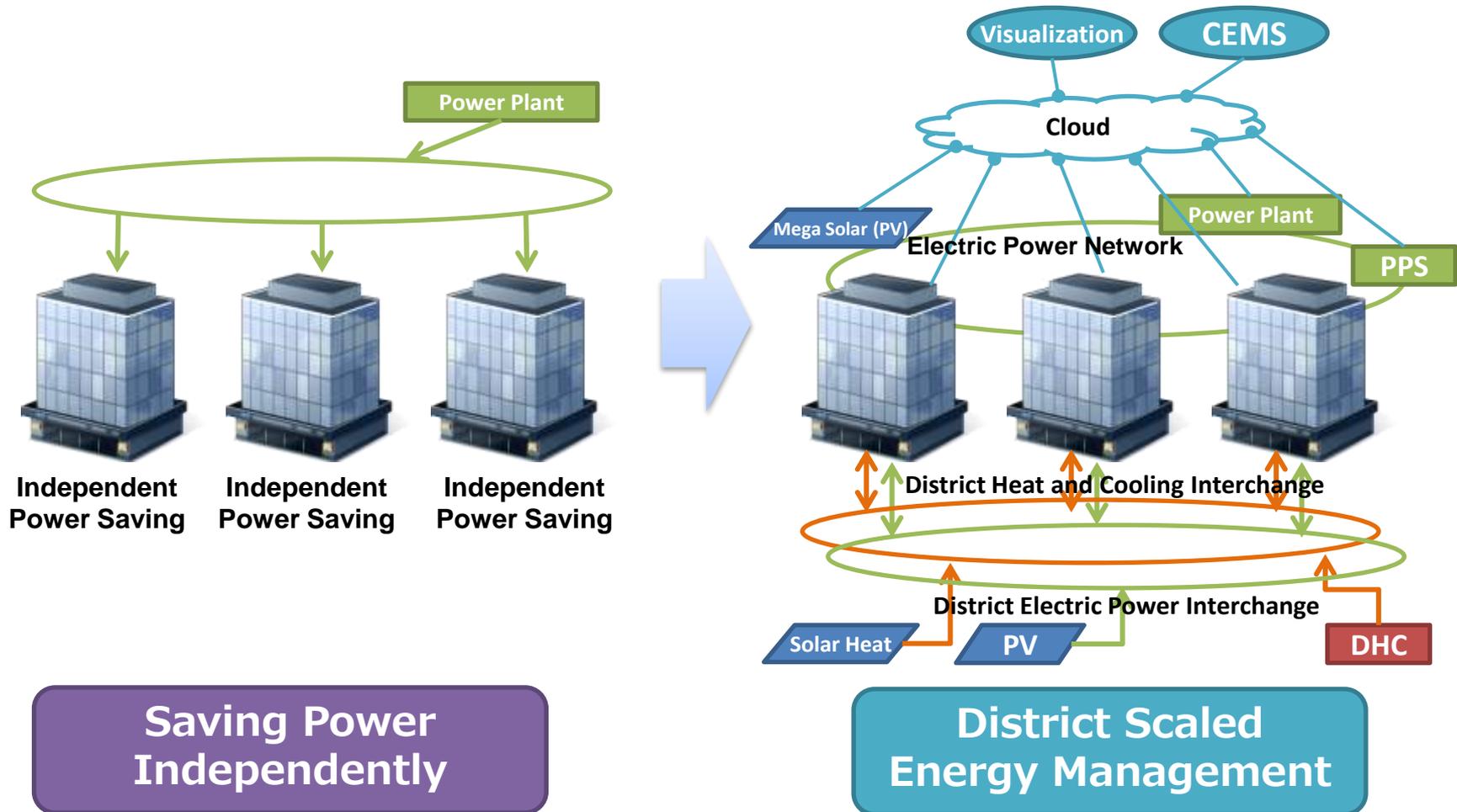
**Without the system
(around 8 W/m²)**



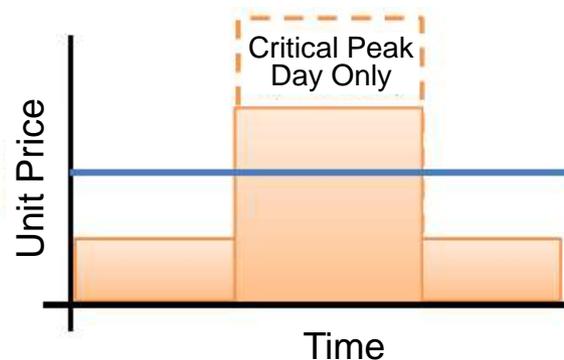
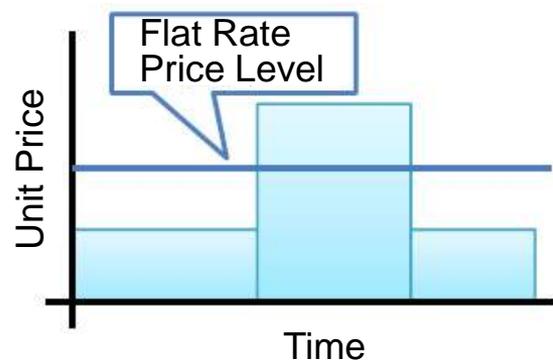
**Result
(3~5 W/m²)**

1. The Next Step of Building Energy Saving and Management
2. Takenaka's Machine to Machine Platform
3. Case Studies
4. Movement of Demand Response in Japan

Independent Building \Rightarrow District Scale

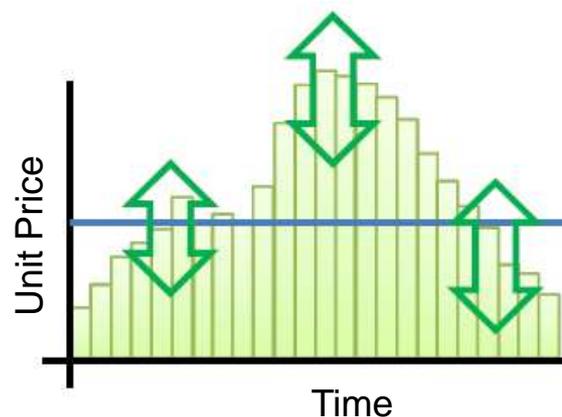
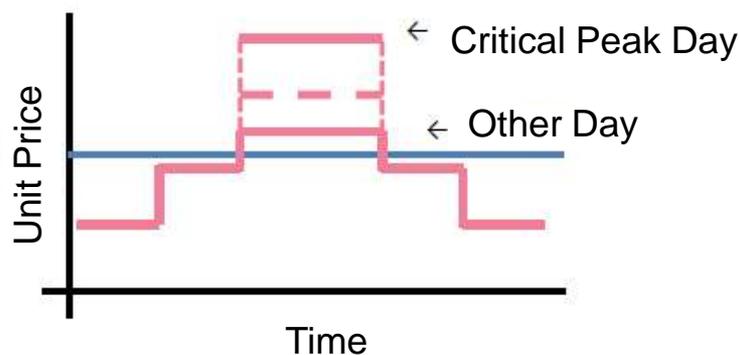


Japanese Government Began to Think About Demand Response, After the Great Earthquake.



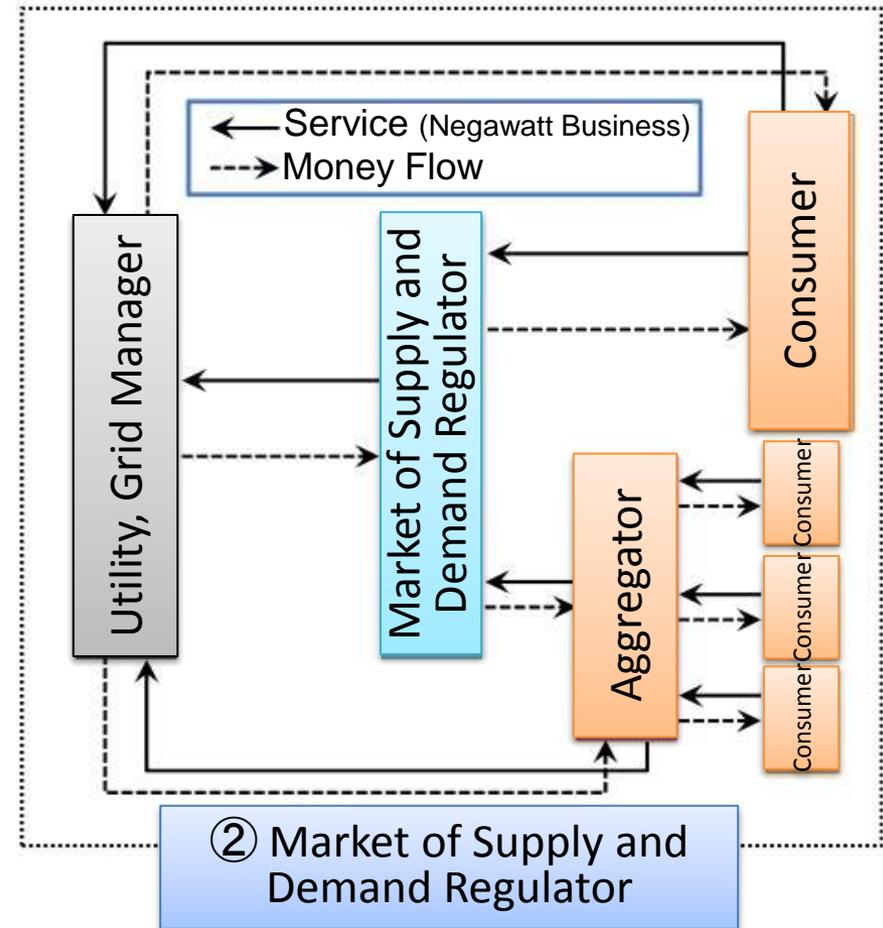
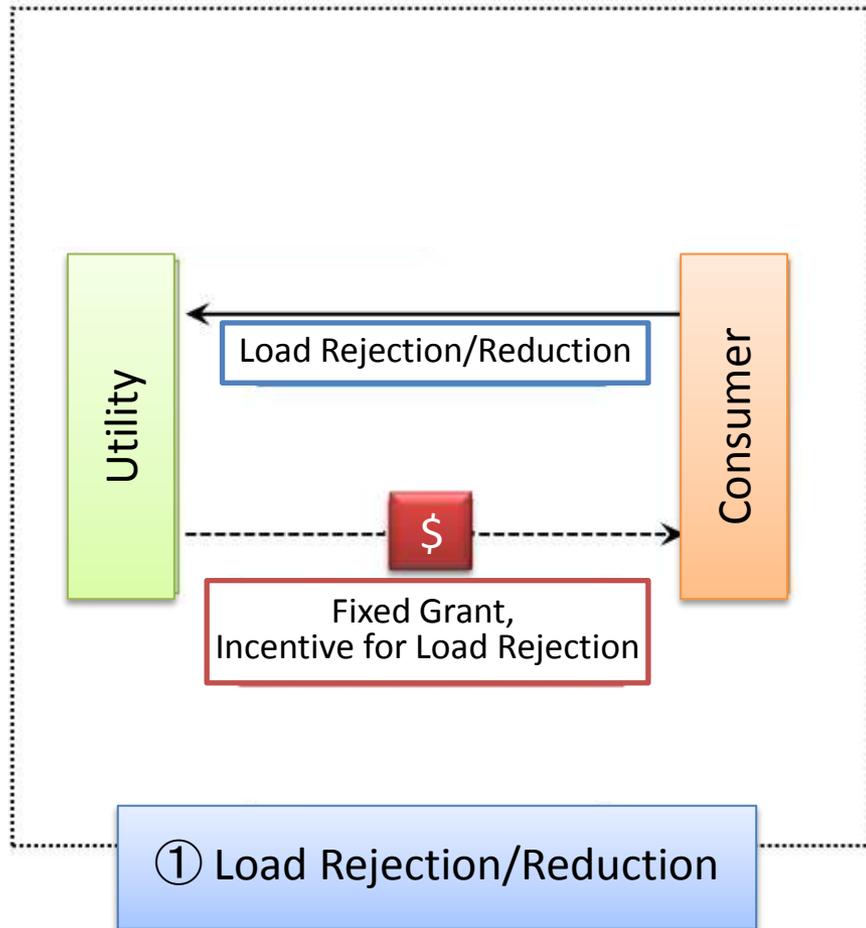
①時間帯別料金(TOU : Time of Use)

②ピーク別料金(CPP : Critical Peak Pricing)



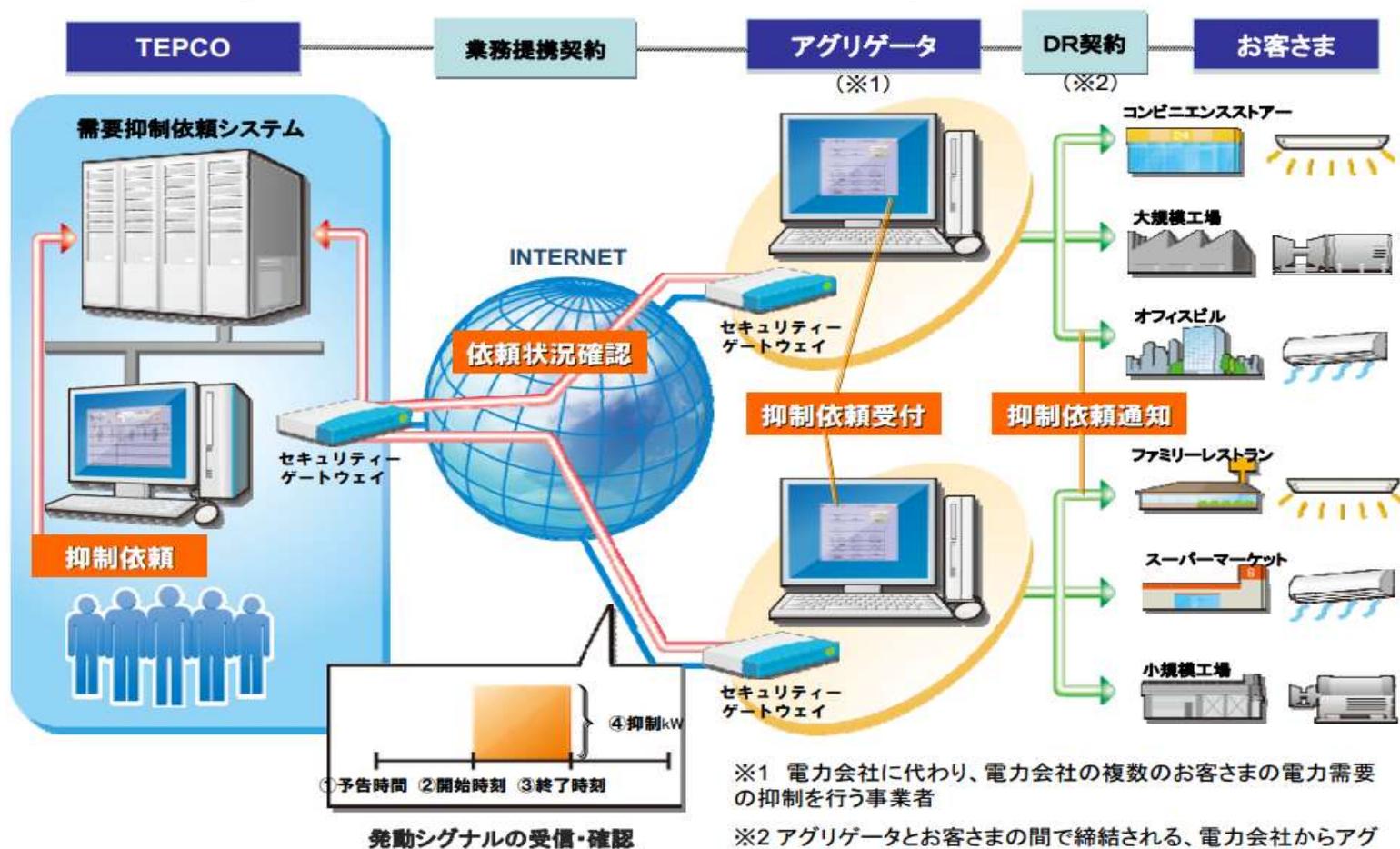
③ピーク日料金(PDP: Peak Day Pricing)

④リアルタイム料金 (RTP : Real Time Pricing)



Tokyo Electric Power Company (TEPCO): Demand Response Business Proposal (2012)

- Recruitment for Business Proposal, which effects peak load reduction
- Planning to reduce about 400,000 kW of peak load



Tokyo Metropolitan Government : Case Study of Demand Response for Multi-tenant Building (2013)

- Incentive based Demand Response. (Partially automated DR)
- Owner of the building will play a role of aggregator.



※Image Source : Mori Building Co. Press Release

- Standardization of nationwide DR communication protocol.
- Funded by METI.go.jp, and implemented by WASEDA University.
- Several DRAS developed individually by private enterprises.

