SEforALL (Sustainable Energy for All)
International Workshop in Japan
on Energy Efficient Building

Best Practices of Energy Conservation in Buildings by way of Energy Management

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  - Tokyo Square Garden
    -ingenuity as a tenant building
  - Mie University
    -strong leadership of the president
- Summary

<reference: key concepts >

- BEMS
- Tuning System
- Energy Conservation Grand Prize Award

<Overview>

- Main focusing points
  - mandatory application of energy conservation standards to buildings
  - the introduction of the benchmark system to buildings in Japan
  - followed by efforts to enhance operational effectiveness of existing facilities with the aim of achieving the target value of the latter.
- Showcases two different Best Practice cases from the Energy Conservation Grand Prize Award and other awards
  - a case of an office building: Tokyo Square Garden
  - a case of an university: Mie University
- The cases clarify the importance of the following aspects
  - the streamlined equipment (hardware)
  - continuous improvements in operation (software)
- Essentials in Best Practice cases.
  - an excellent energy management system
  - autonomous small-group activities or a cross organizational team work
  - promising technologies and know-how

Tokyo Square Garden

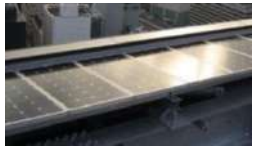
- Use of versatile advanced EE&C technologies
- Measures as a tenant building
  - AEM(Area Energy Network)
  - Building proper measure
    - Pressure to every tenant from outside(ranking)
    - Voluntary action of tenant (pay-as-you-go)

Building Outline

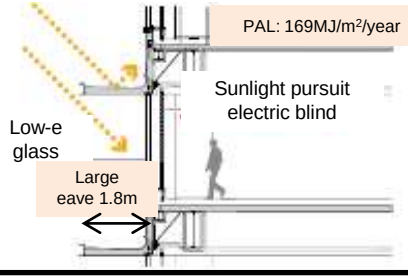
-Name: Tokyo Square Garden
- Location: Kyobashi, Chuo Ward, Tokyo
- Structure: Concrete Filled Steel Tube (CFT), underground Steel Reinforced Concrete (SRC)
- Stories: Above ground 24 stories, underground 4 stories
- Land area: 8,131m^2
- Total floor area: 117,461m^2
- Usage: Office, store, exhibition hall, meeting hall, clinic, parking space
- Completion: March, 2013
- Progress management: Tokyo Tatemono Co., Ltd.
- Basic design: Nikken Sekkei Ltd., Nihon Sekkei, Inc.
- Construction design: Shimizu Corporation, Taisei Corporation Design Division
- Construction: Shimizu Corporation, Taisei Corporation New Building Construction Division

Design Stage—Versatile and advanced energy conservation and environmentally-friendly-oriented technologies

Adoption of a photovoltaic system (50kw)



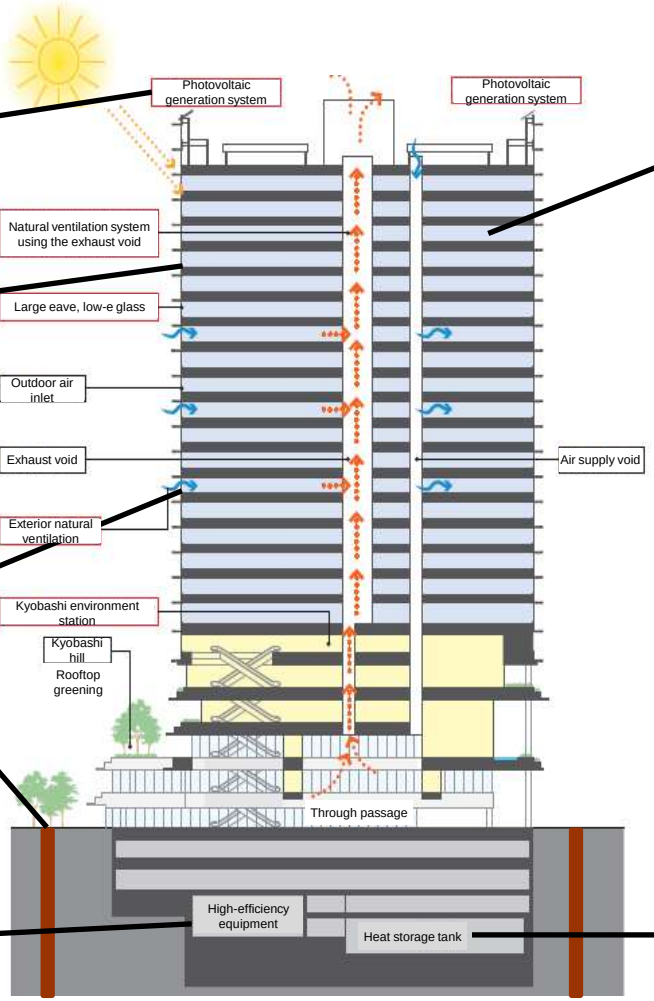
Exterior with high thermal insulation performance



Natural ventilation system

System using underground heat (natural energy) (30RT)

Adoption of a high-efficiency heat source (inverter turbo chiller)



LED lights for both common areas and tenant rooms

Energy conservation technologies for the equipment system

- Inverter control for fans and pumps
- Adoption of high-efficiency IPM motors
- Control of outdoor air intake by CO_2 concentration of offices
- VVVF control, large temperature difference between incoming and outgoing temperatures
- Inverter control of parking space

Introduction of BEMS (building energy management system)

- Awareness nourishing and educational activities by using the tenant service function
- Air conditioning billing system for offices (billing by heat measurement)

Temperature stratification heat storage system

Operation stage – Ingenious measures as a tenant building

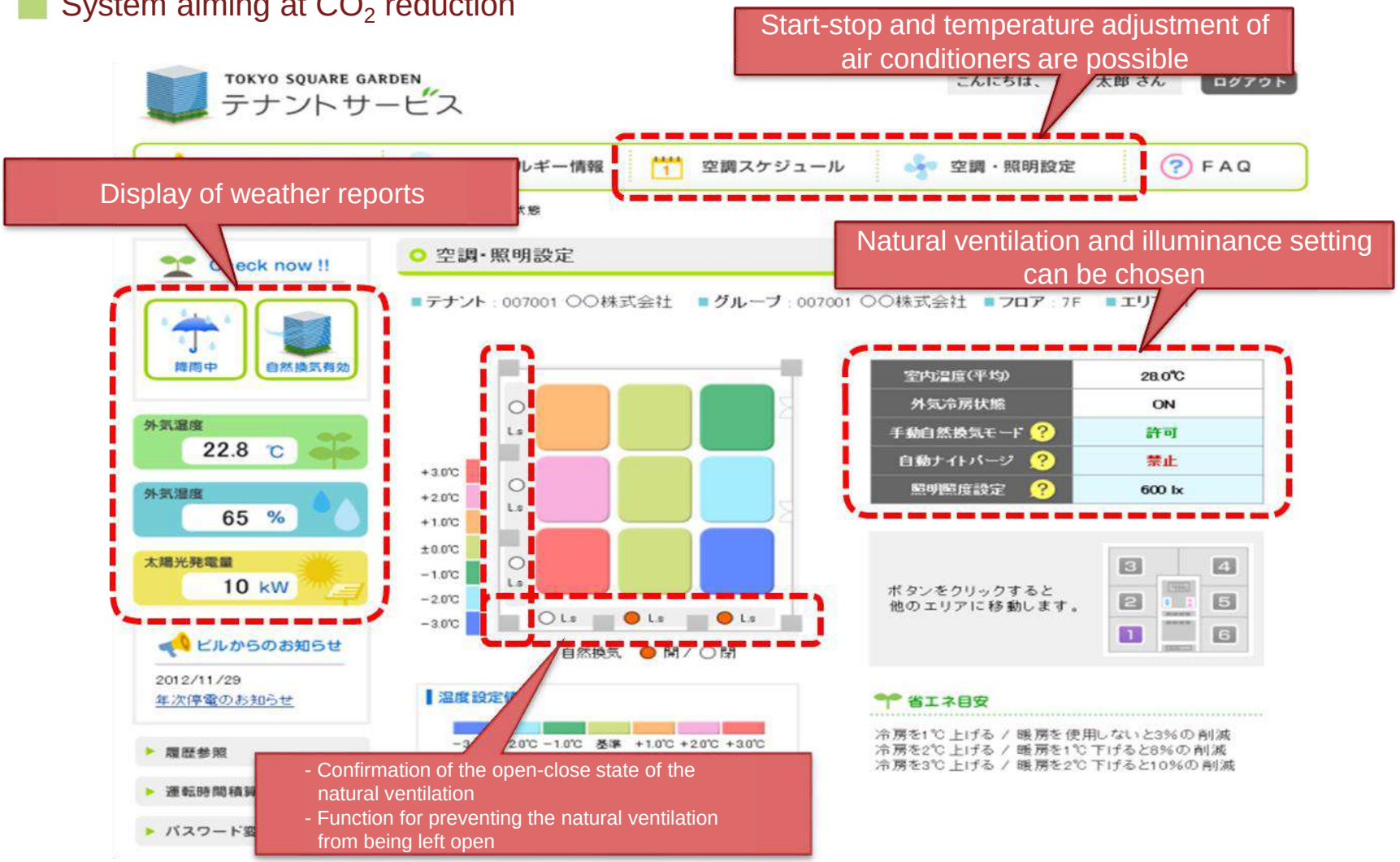
- Area as a whole:
  Introduction of AEM (area energy management)
- Building independently:
  - a system that encourages the owner and tenants to jointly challenge energy conservation not only for the common areas but also for the tenant areas
  - high commodity value as a building and "visualization" means encouraging voluntary efforts such as;
    - System for promoting CO_2 reduction
      - Enrichment of the tenant service system function
      - ranking of each district
    - System that can voluntarily adjust CO_2 reduction
      - Energy conservation trial by tenants themselves is possible (air conditioning, lighting)
      - Tenants themselves can confirm the effect with visualization screens
      - Pay-as-you-go billing system for air conditioning
        (Changed from the flat rate system according to the core time)

Operation stage – Ingenious measures as a tenant building

System for promoting CO_2 reduction

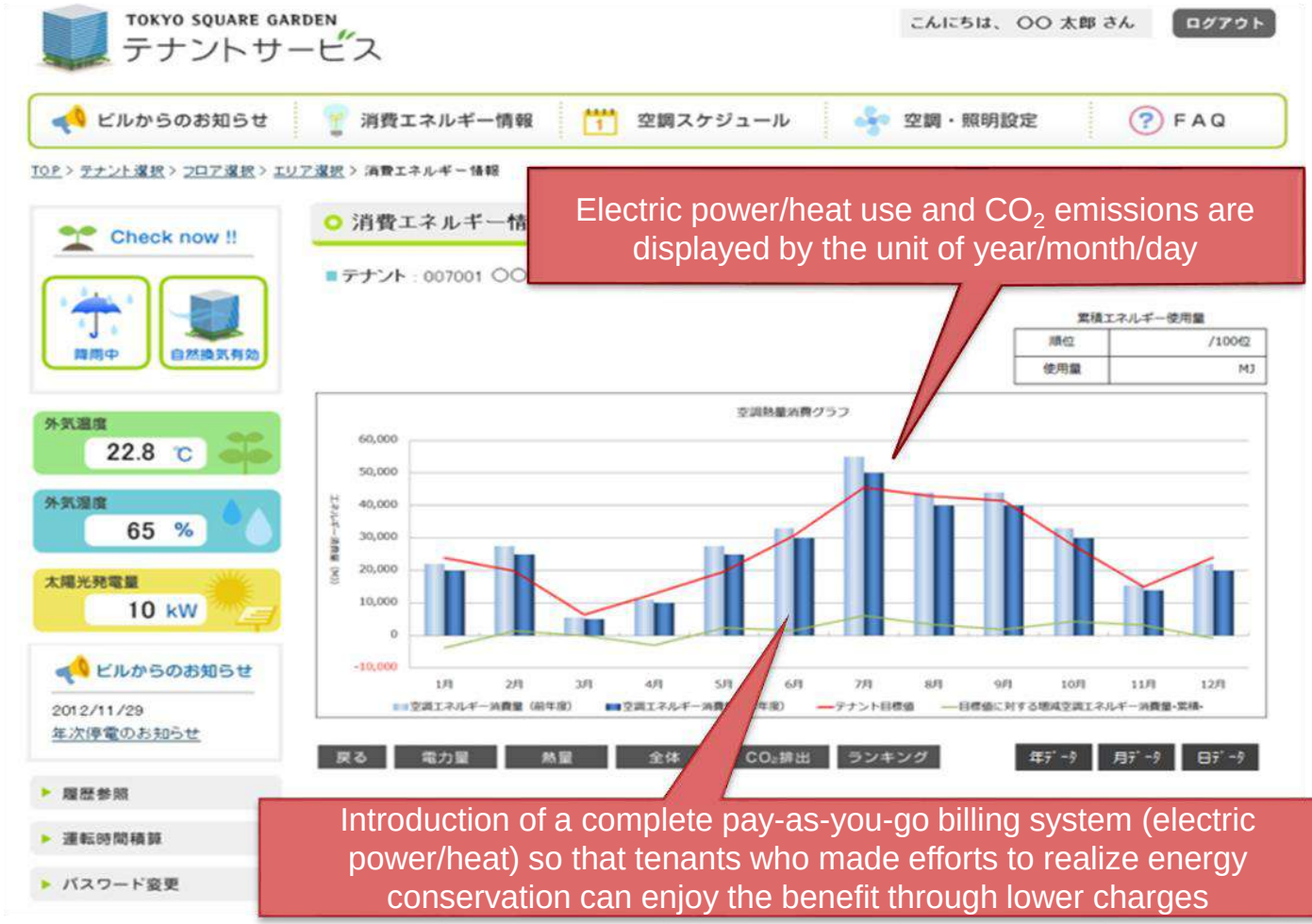
Operation stage – Ingenious measures as a tenant building

- System aiming at CO_2 reduction



Operation stage – Ingenious measures as a tenant building

- System for confirming and enjoying CO_2 reduction effect



Effect of the activities－reduction of energy consumption & CO_2

- Estimation of yearly primary energy consumption
  1,211 (MJ/m^2・year) (office use)
  Energy consumption intensity of general tenant buildings in Tokyo: Approx. 52% reduction against 2,518 (MJ/m^2・year)

- Estimation of CO_2 emission reduction
  Approx. 50% reduction (carbon half) (office use)

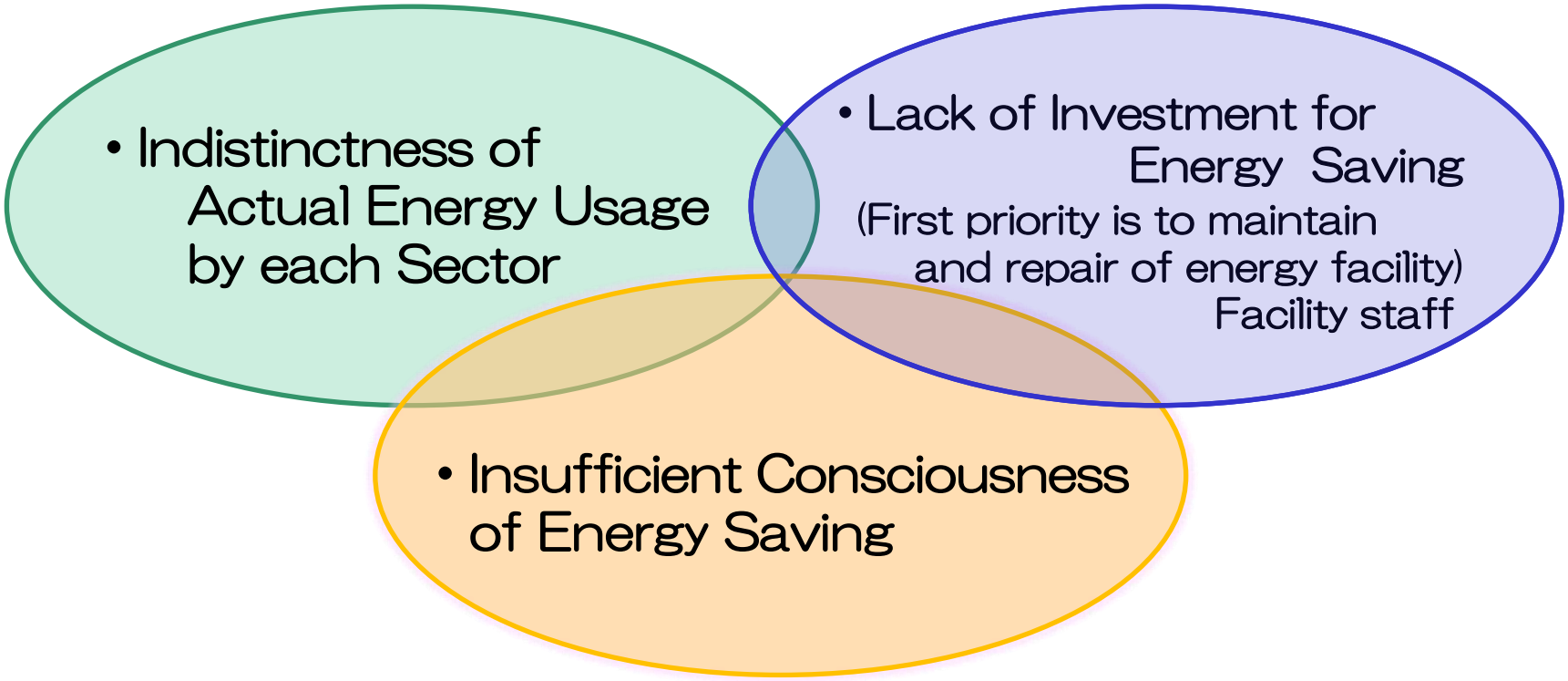
- External assessment
  - CO_2 reduction initiative project for residences and buildings by Ministry of Land, Infrastructure, Transport and Tourism
  - CASBEE highest rank “S rank” (BEE value = 3.8)
  - Certified for the highest rank of Development Bank of Japan's Green Building Certification
  - Assessed as AAA for energy conservation performance by Tokyo Green Building Program

Mie University

- President's leadership helps
  - introduce innovative energy-saving facilities to utilize renewable energy
  - join a technological verification project promoted by the Ministry of Economy, Trade and Industry in 2011.
- Result
  - reduced energy consumption in the campus by 20% from the 2010 level.

Themes on Promoting Energy Saving at University

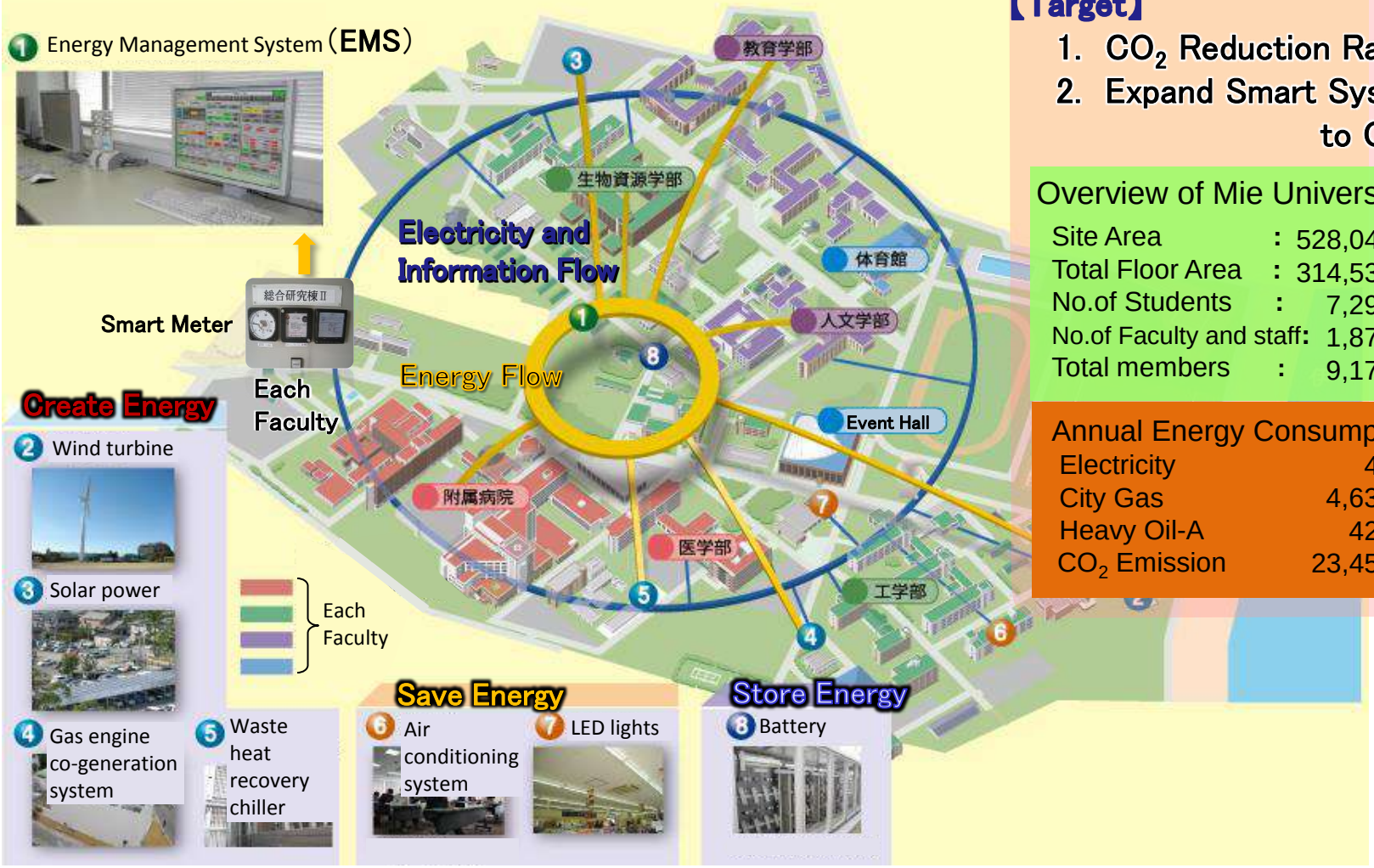
Goal: **Be Proud of Environmentally Advanced University to the World**



Data source : MIE UNIVERSITY

Aiming at an Environmentally Advanced University

Systems Configuration of MIESC



【Target】

1. CO_2 Reduction Rate 24%
2. Expand Smart System to Others

Overview of Mie University (2015)

Site Area	:	528,040	m^2
Total Floor Area	:	314,539	m^2
No.of Students	:	7,297	persons
No.of Faculty and staff	:	1,877	persons
Total members	:	9,174	persons

Annual Energy Consumption (2014)

Electricity	41.0	GWh
City Gas	4,635	km^3
Heavy Oil-A	424	kℓ
CO_2 Emission	23,458	t-CO_2

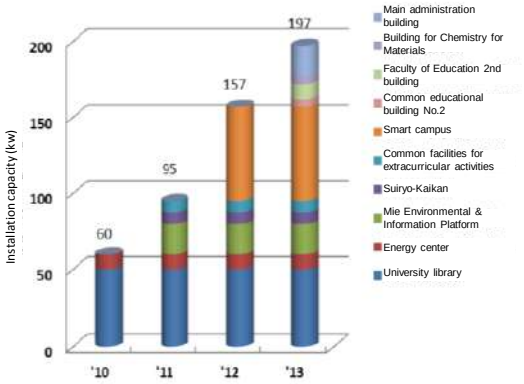
Energy Conservation Effects Obtained

Item	Unit	2013 (Actual result)	2014 (Estimation)
Energy consumption (crude oil equivalent)	Kl/year	▲1,855 (▲ 20.4%)	▲2,630 (▲25.4 %)
CO_2 emissions	t-CO_2/year	▲4,401 (▲27.3 %)	▲5,613 (▲31.5%)

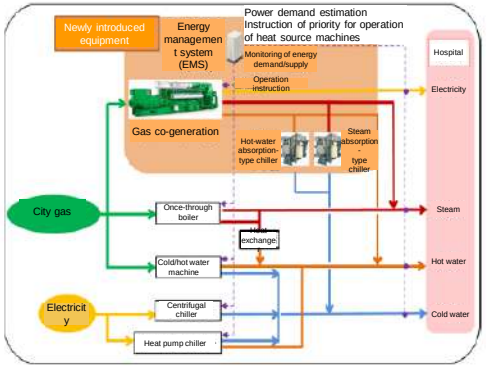
Major initiatives	Energy (crude oil equivalent) kl/year	CO_2 emissions t-CO_2/year	Other achievements
(1) Introduce innovative energy conservation facilities and improve operation			
Energy creation: - Renewable energy facilities	▲124	▲180	Prior evaluation of environmental impact
Energy creation: - Solar power generation	▲1,183	▲1,725	
Energy creation: - Wind power generation	▲466	▲2,322	
Energy creation: - Co-generation using gas and recovering exhaust heat for cooling and heating			
Energy creation: - Conversion of fuel for heat source facilities (from heavy oil to gas)			
Energy storage: - Small capacity battery to maximize the effect of curtaining peak power	---	---	Peak power ▲ 60 kW
Energy storage: - Battery to reduce fluctuation of renewable energy generation	---	---	Reducing instant fluctuation ±50 kW
Energy storage: - Autonomous power supply in case of a disaster or an emergency	---	---	Power supply in case of a disaster
Energy conservation: - Desiccant air-conditioning system that separates dehumidifying function and create a comfortable interior environment	▲82	▲173	
Energy conservation: - Use of DC by solar power generation that will be largely introduced in the future	▲18.1%	▲18.1%	Comparison with A/C
Energy conservation: - Improvement of operation by integrating new and existing facilities (optimization of operation)	} (▲776)	} (▲1,212)	Improved in the end of 2013 (Effects will be acquired in 2014)
Energy conservation: - Introduction of an operation method in which exhaust heat is used with priority			
Energy conservation: - Selection of the most appropriate operation devices by using estimation of electricity demand			The amount of saved energy is maximized
(2) Power-saving efforts of all students and faculty members in the university	▲2,770 kWh	▲1.03	
- Visualizing energy conservation activities and give incentives to start such activities	---	---	
- Demand response to lower peak power during summer (power-saving activities)	Solar insolation shielding effect ▲65 to ▲90%		Peak power: an average 4.5% reduction in nine days (430 kW)
- Green walls to combat global warming			

Improvements of Equipment in the Building

[Energy creation]

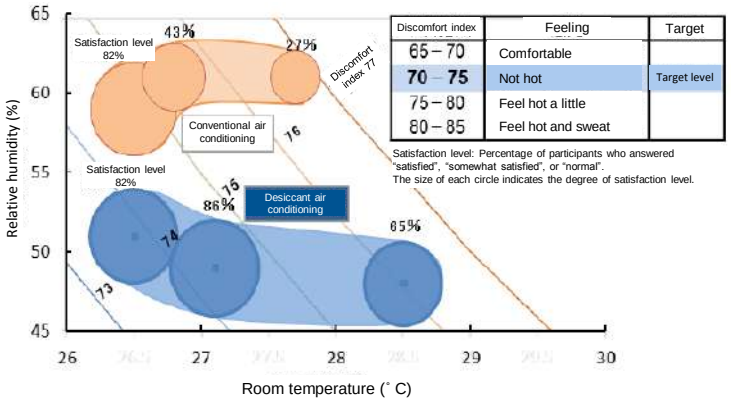


Promote the introduction of solar power generation



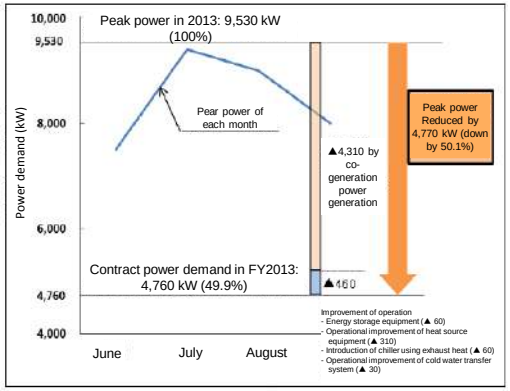
Gas co-generation using exhaust heat

[Energy conservation]

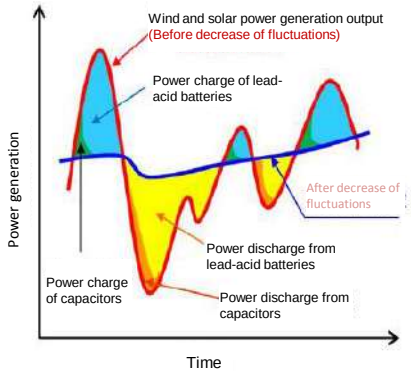


Introduction of desiccant air-conditioning system (dehumidification in summer)

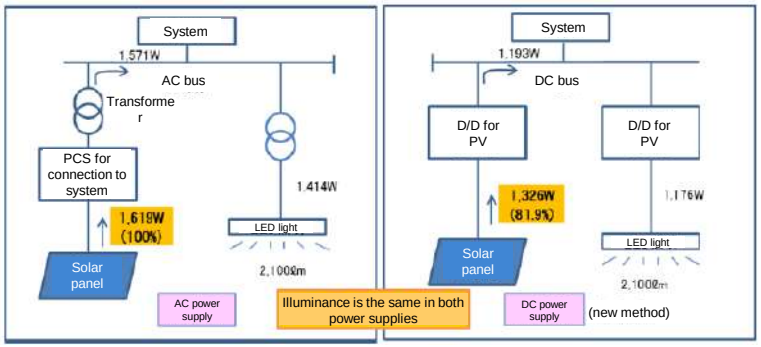
[Energy storage]



Curtaining peak power and reduce fluctuation of power



Battery to reduce fluctuation of renewable energy generation



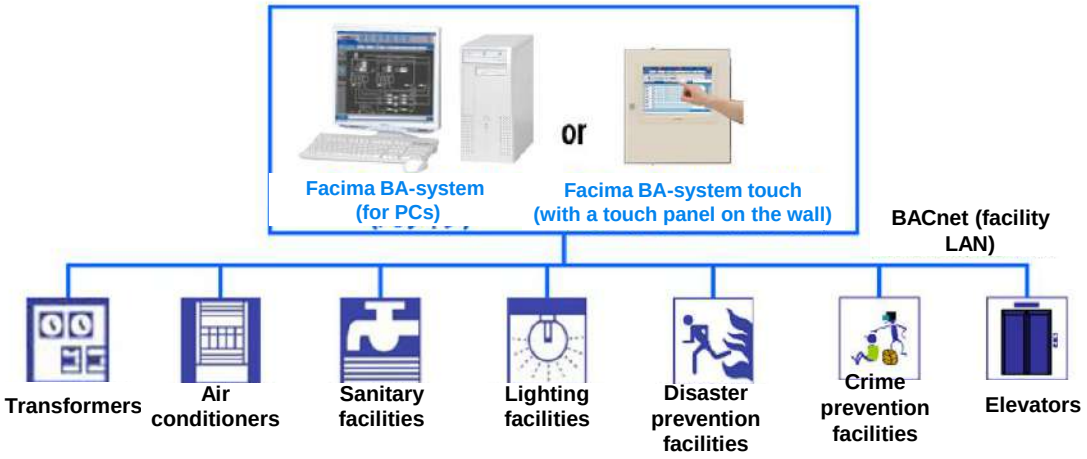
Direct DC power supply to lighting by solar power generation system

Summary

- Tokyo Square Garden
  - Combination of advanced technologies and tenant-oriented measures for seeking autonomous energy management structure
    - individually and collectively energy-conscious bodies
    - ingenious measures as a tenant building
  - achieved result 50 % vs average level(Energy Consumption & CO2)
- Mie University
  - President' leadership & proactive stance
    - in improving building equipment
    - in promoting eco-friendly operation.
  - Achieved result, significant energy conservation.

Reference 1: Overview of BEMS (Building Energy Management System)

【Monitoring and control system】



- **Visualize power consumption and compare predicted values and actual values to reconsider operation**
- **Peak shaving of power consumption**

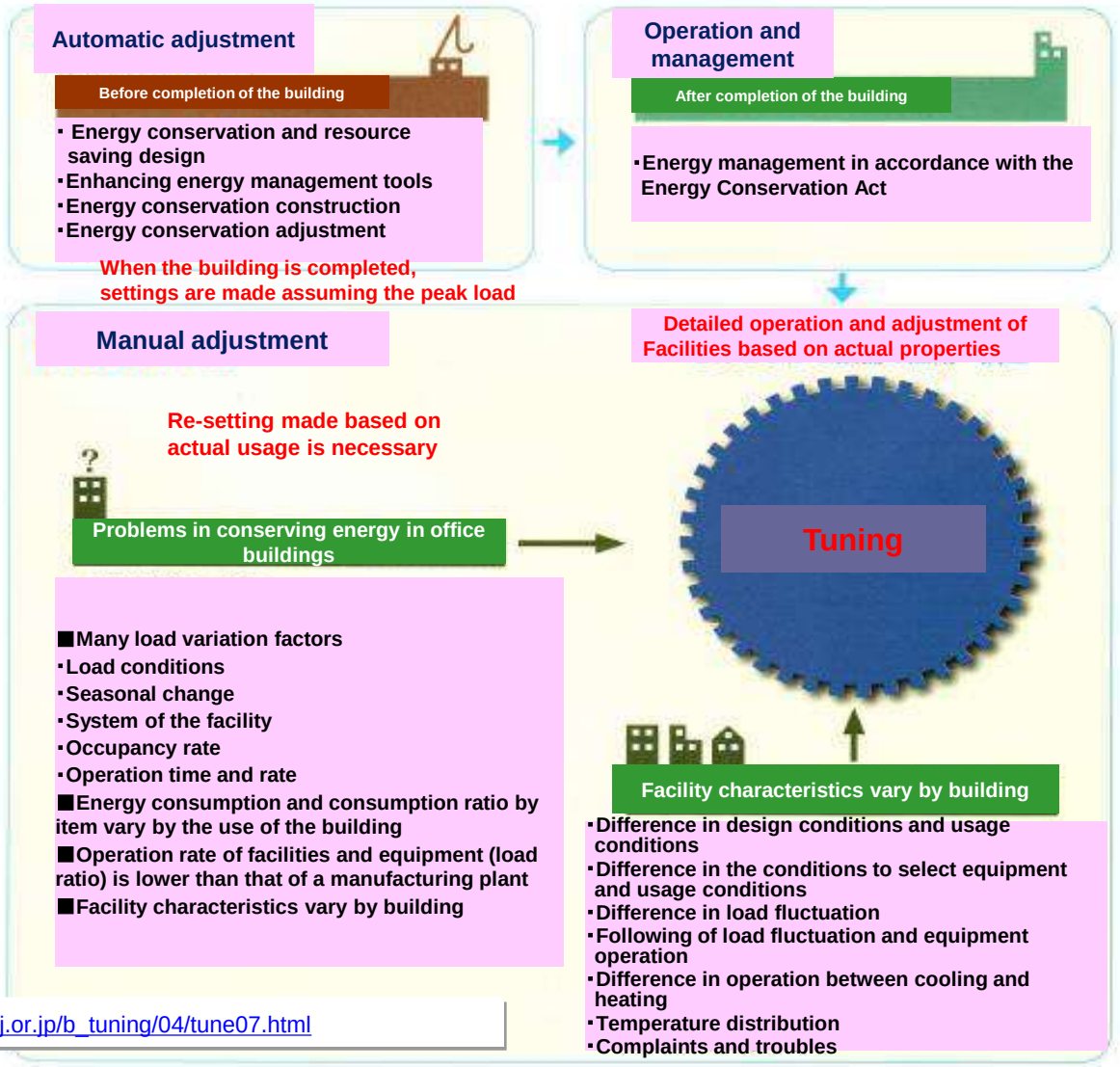
【Energy management function】

- **Analysis of facility data by using various charts**

http://www.eccj.or.jp/bems/manual/index.html

Reference 2-①: Overview of Energy Conservation Tuning

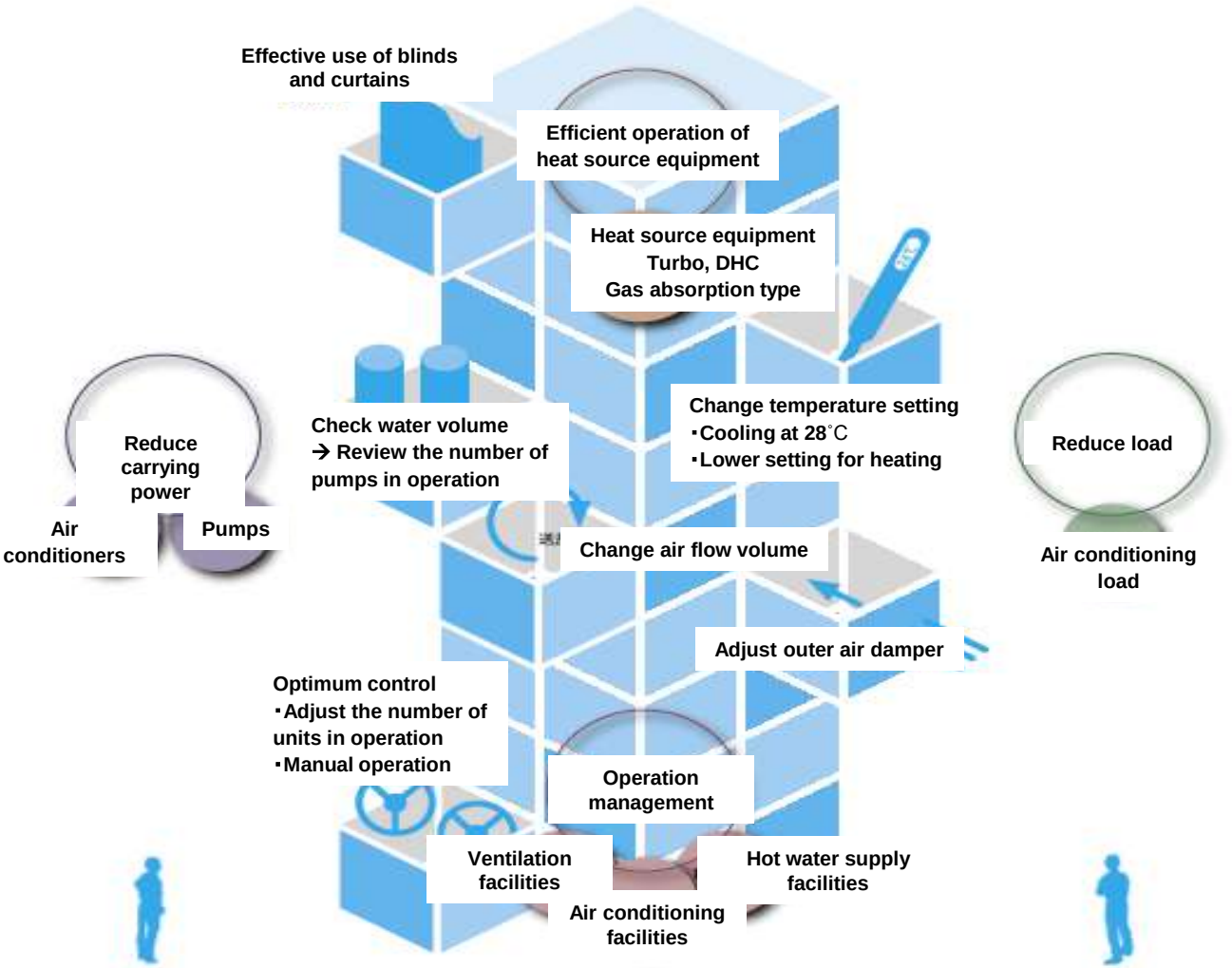
[What is energy conservation tuning?]



http://www.eccj.or.jp/b_tuning/04/tune07.html

Reference 2-②: Overview of Energy Conservation Tuning

[Tuning items]



Reference-3:Energy Conservation Grand Prize Award

ECCJ has been implementing the award system for the first time in Japan since 1975.Then system was introduced and developed to ASEAN countries and the world .

Purpose

- Disseminate Energy Conservation Awareness
- Promote Energy Efficient Products
- Develop Energy Conservation related Industry
- Construct Energy Conservation Oriented Society

History

- ECCJ started in 1975 as a government funded award program
- From 2011 restarted as ECCJ's independent award program

Category

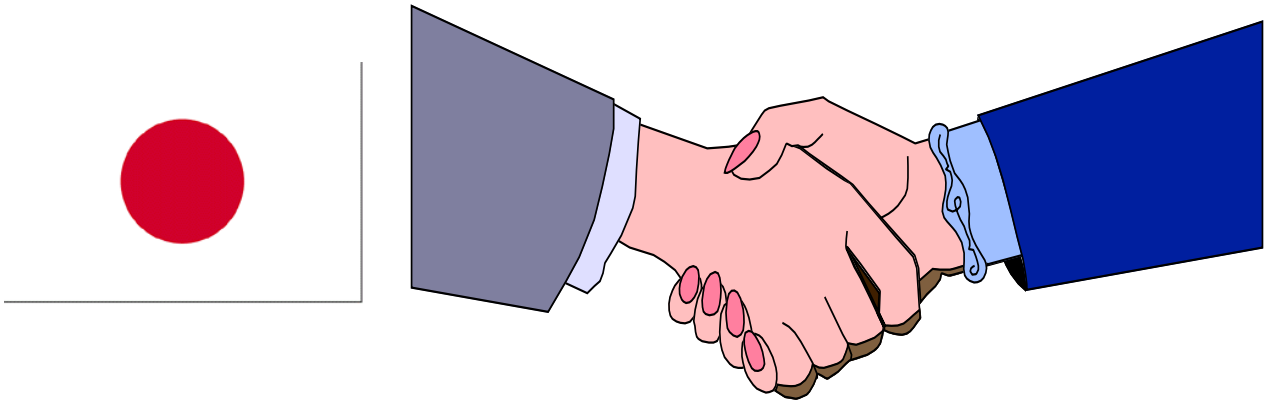
- Best Practice — 1975 ～ (awarded case 1500 pcs)
- Products / Business Models — 1990～ (awarded case 500 pcs)

Evaluation

- Innovative?
- Energy efficient?
- Resource saving / Recyclable?
- Marketable?
- Environmentally friendly / safe?

Schedule

Thank You Very Much



省エネのシンボルです
SMART CLOVER

For More Information;
The Energy Conservation Center, Japan
http://www.eccj.or.jp <from 1996>
Asia Energy Efficiency and Conservation Collaboration Center
(Established in April 2007)
http://www.asiaeec-col.eccj.or.jp
Japanese Business alliance for Smart Energy-Worldwide
(Established in October 2008)
http://www.jase-w.eccj.or.jp

The Energy Conservation Center, Japan
Since 1978

The Symbol of Energy Conservation
Since 2005
ECCJ has been spread the symbol mark with the visual image of a flour-leaf clover which is thought to bring happiness named as "SMART CLOVER", representing everyone's energy conservation activities.