Lecture No.4

Workshop on Energy Conservation for Kyrgyz and Tajikistan

Energy Efficiency in Buildings
(Case Studies of EE&C in Buildings)

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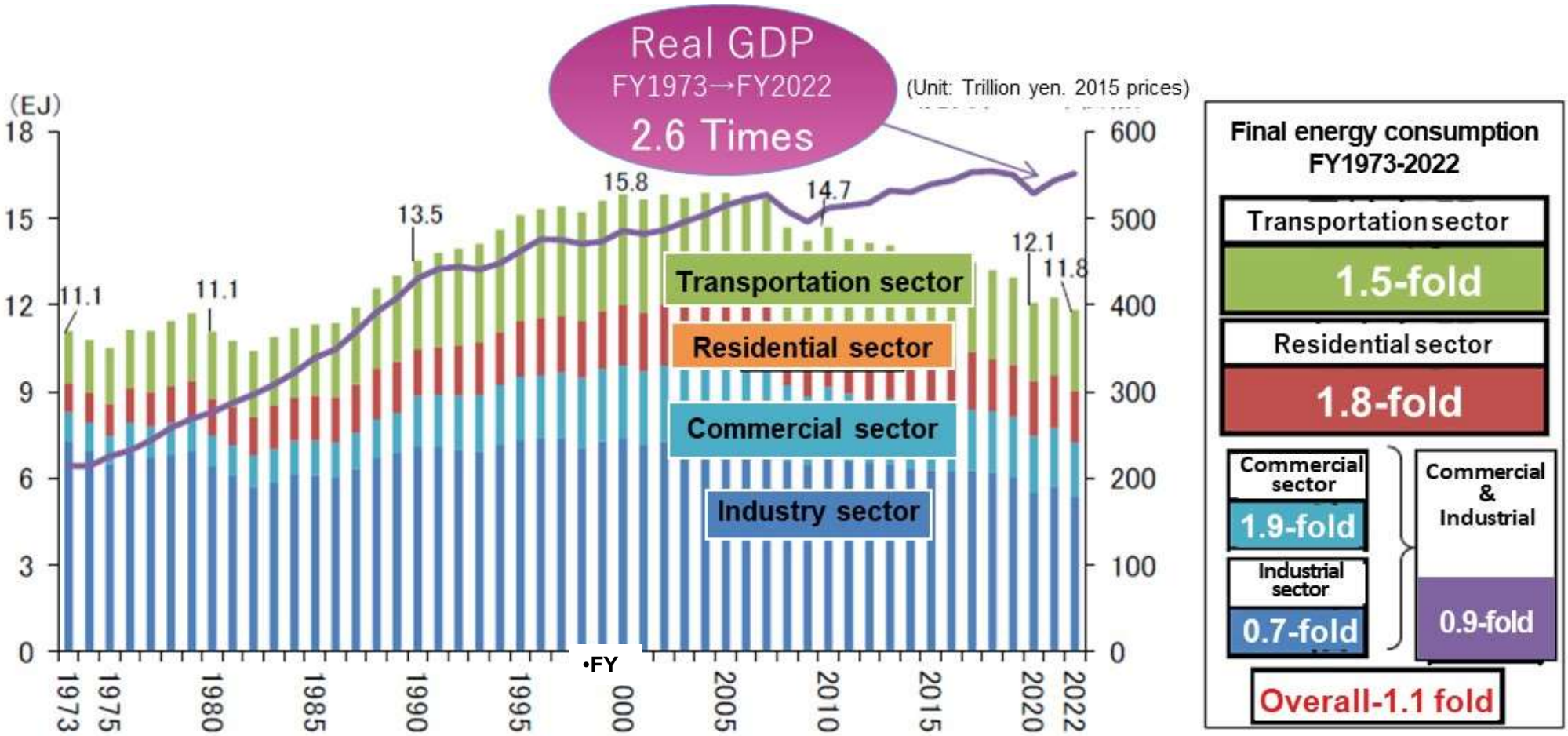
Contents

1.1 Trends in the Final Energy Consumption in Japan



1.2 Developments of Green Buildings in Japan

1980 Establishment of building energy conservation standards (Second oil shock)
Initially, PAL, CEC/AC, and office applications were subject to the notification requirements.

1993 CEC/V, L, HW, and EV were added. Hospitals and schools also became subject to the notification requirements.

1998 Introduced Type 2 designated factories (buildings) in the EC Act.

2002 Notification of energy conservation measures (for new construction and extension and reconstruction) was made compulsory.
All buildings (2,000m^2 or greater), with the exception of residences, became subject to the regulations. (For large-scale renovations in 2006 and for buildings 300m^2 or larger in 2010)

The standards achievement rate was improved to 90% by making notification compulsory.

2002 Obligatory submission of periodical report for Type-2 Designated factories &buildings

2005 CASBEE for Buildings completed (CASBEE tools have been developed and revised until now)

2015 New Building Energy Code for design (Introduced primary energy standards)

2015 ZEB Family concept and the project started

2016 Benchmarking system for buildings (convenient stores)

2017 Mandatory requirement standard for design

2019 Revision of the scale of the buildings to be covered by the law

2021 Revision was enforced

2022 Further revision proposed to promote energy efficient buildings

1.3 Policy and Measures for Green Buildings in Japan

Energy	**RE**	CASBEE	EC law	ZEB Family ●Net ZEB ●Nearly ZEB ●ZEB Ready
	EE&C			
Environment Indoor/Outdoor Water treatment Service quality				
Measures to promote and disseminate		Design and evaluation tool By MLIT	Mandatory Requirements By METI (operation) & MLIT (design)	Design and evaluation tool By METI (Non-Residence), MLIT(Residences)

CASBEE: Comprehensive Assessment System for Built Environment Efficiency
MLIT: Ministry of Land, Infrastructure, Transport and Tourism
METI: ministry of Economy, Trade and Industry

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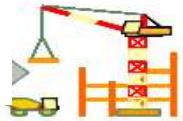
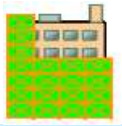
2.1 Overview of the Energy Conservation Law on Buildings

Obligation of the Building Owners under the Energy Conservation Law

Design | Construction | Operation | Renovation



For design and retrofit (MLIT)

Before construction (new design)
- Obligation to comply EC standard specified in EC law (300m² and more)
- Obligation of effort(less than 300m²

Renovation
- Compliance to EC standard specified in EC law (300m² and more)
- Obligation of effort(less than 300m²

For operation (METI)

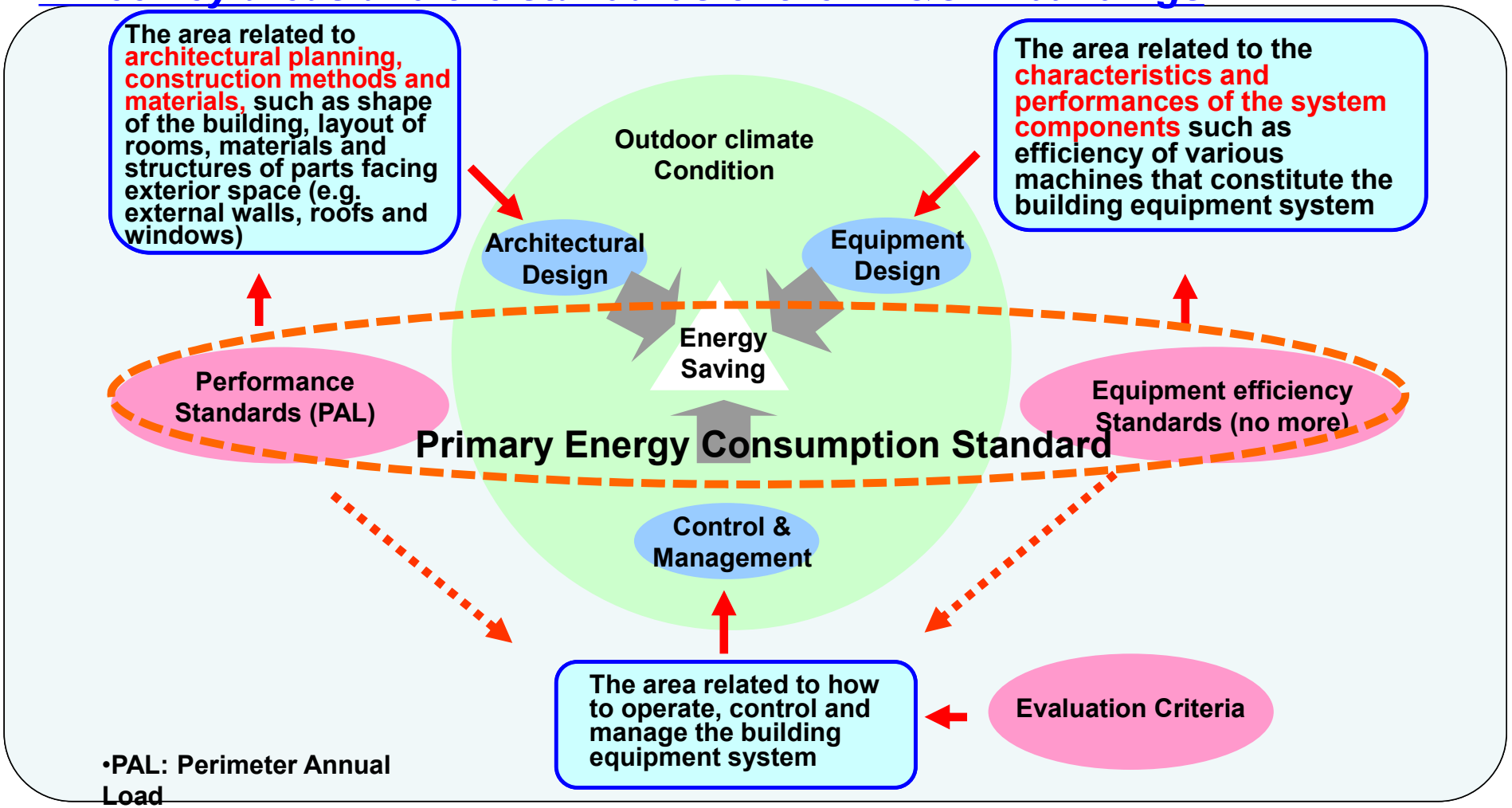
Specified Business Operator classified by annual energy consumption:
1500kL(oe) or more

Designated EM factory /building
Type 1: 3000kL(oe) or more
Type 2: 1500kL to 3000kL(oe)

- Energy management control officer & Energy management planning promoter to be selected.
- Energy managers(Type 1 or Type 2) to be selected for each designated energy management factory/building.
- Submission of medium and long-term plan and periodical report by each company.
- Compliace to EC Standard

2.2 The Related Regulations on Buildings

Three key areas and the standards of the EE&C in buildings

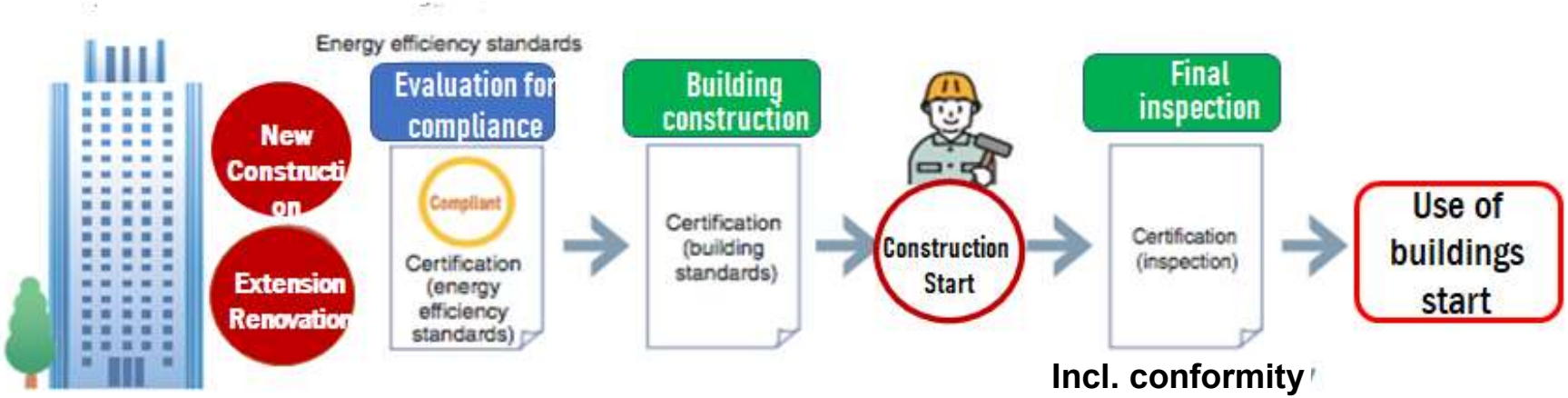


Fixed an architecture for a sustainable future (IBEC)

2.3 Mandatory Compliance to The Design Standard

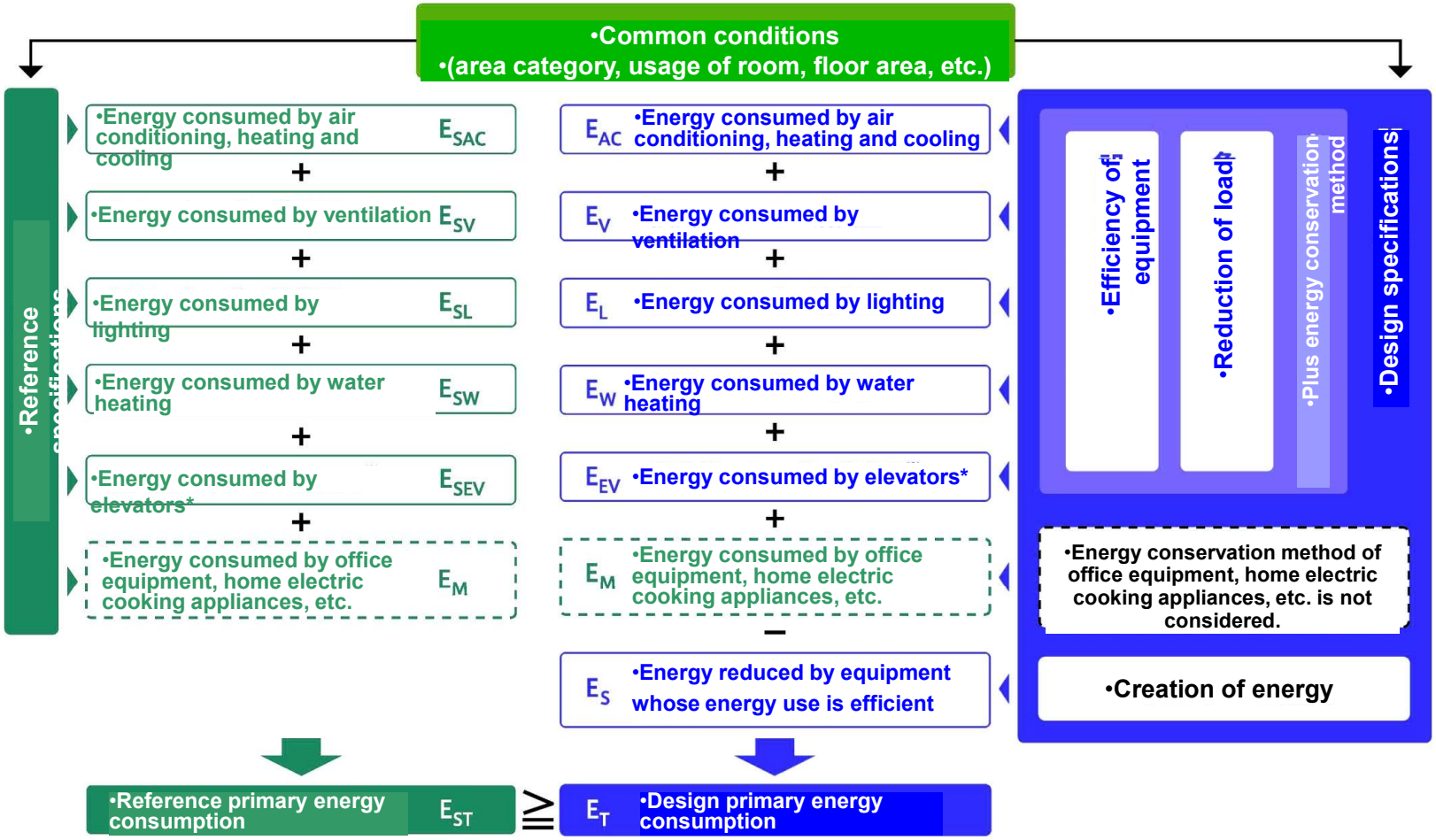
When construction clients plan to undertake new construction/ extensions/ renovations of buildings at or over a certain size, they must acquire certification of conformity with energy efficiency.

After the implementation of the regulatory measures, such non-residential buildings that are not compliant with energy efficiency standards become ineligible for construction under the law.



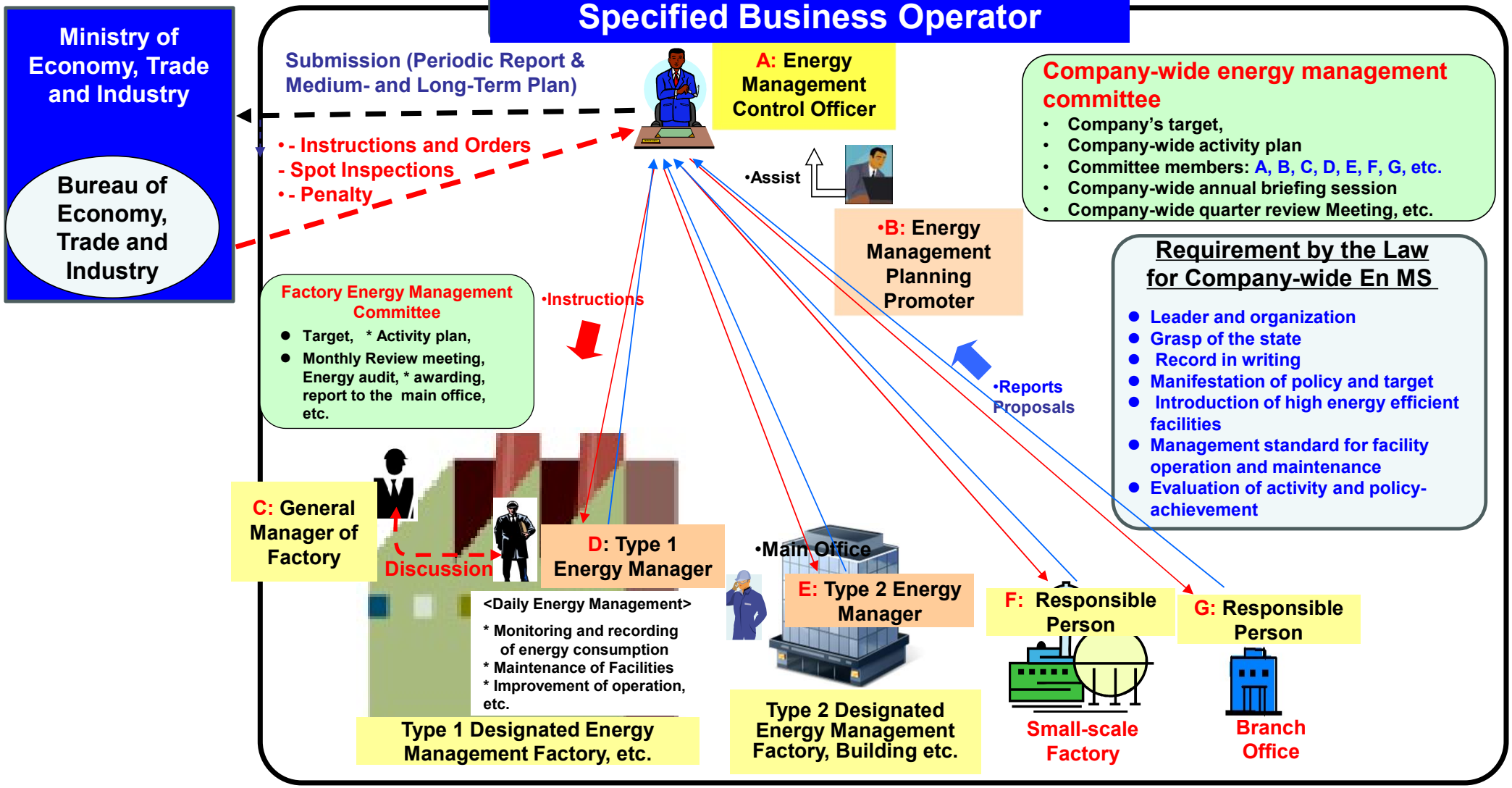
2.4 Evaluation Method of EE&C of Non-Residential Buildings

•Based on the following calculation methods, the design building primary energy consumption should be less than the standard values.



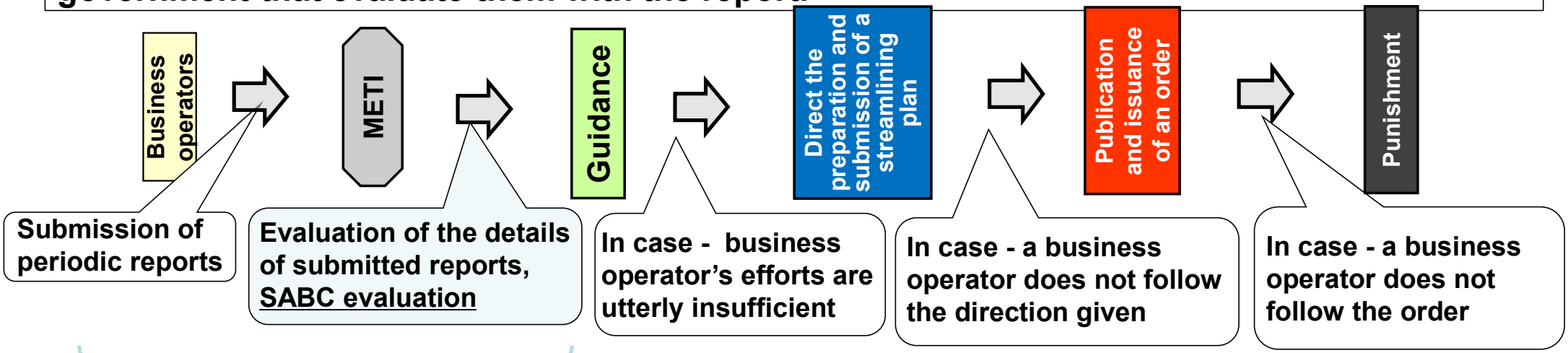
•* The target is non-residential buildings and apartment residences.

2.5 Company-Wide Energy Management System required the AC Act



2.6 Report to METI on Energy Efficiency Activities and Evaluation

The Act requires business operators to report their activities on energy efficiency to the government that evaluate them with the report.



< Matters to be stated in periodic reports >

- Implementation status of energy conservation measures
- Changes in energy intensity
- Status of the benchmark indices (for only applicable types of business)

○EC Guideline for energy efficiency measures (Matters to be observed concerning business operators' management systems and management methods of individual devices

○Non-binding target (Reduction by 1% or more on an annual average basis)

○Benchmark index/target levels (for several business sectors (e.g. manufacture of steel, power supply, manufacture of cement, manufacture of paper, petroleum refinery, and manufacture of chemicals))

•Source: METI Website

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3.1 ZEB Family Concept

(1) Necessity of ZEB dissemination in Japan

1. The current energy efficiency measures cannot achieve COP21 requirements for reduction of greenhouse gas (GHG) in Japan.
2. The current Japanese E. E. Law for buildings does not have enough power to achieve the target for reduction of GHG in building sector.
3. Therefore, the following target has been set in order to promote and disseminate high level energy efficient buildings, "ZEB Ready" first and realize (net)ZEB by step-by-step approach though the continuous efforts. → ZEB Family Concept (ISO TS23764)

•Target

To realize ZEBs in average for newly constructed public and private buildings by 2030

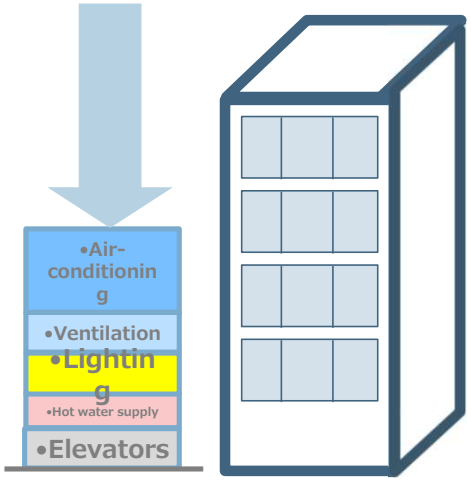
3.1 ZEB Family Concept

(2) Step by step approach toward ZEB

•The concept of ZEB has been expanded to “ZEB series” according to actual conditions. First step is to aim for super energy efficient buildings which are defined as “ZEB ready”, and then aim for “ Nearly ZEB” and “(net) ZEB” which is a step-by-step approach.→ ZEB family Concept

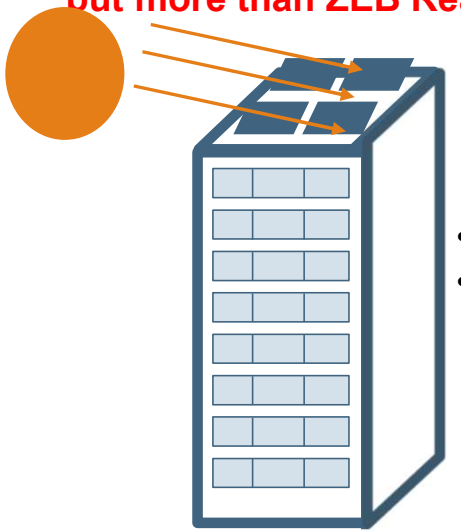
ZEB Ready

(Significant energy saving more than 50% from reference point)



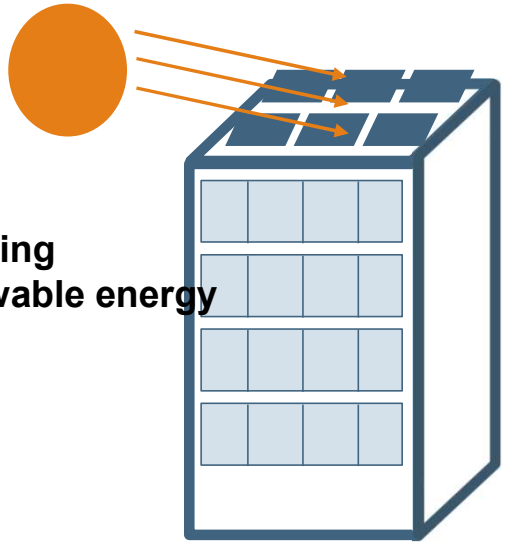
Nearly ZEB

(Net energy saving (RE) not reach 100% incl. but more than ZEB Ready)



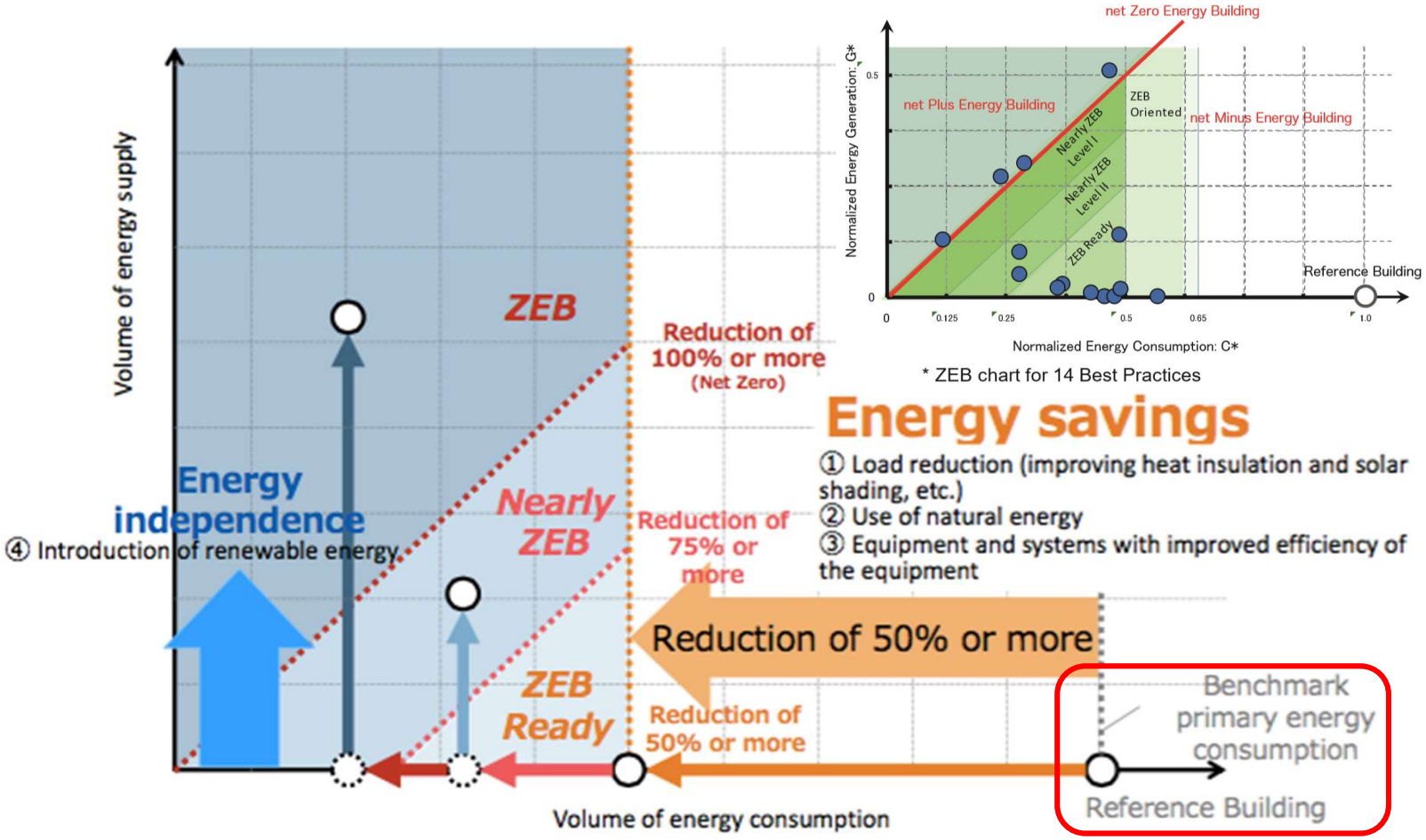
(net)ZEB

(Net energy saving (including RE) of 100% or more)



•Including
•Renewable energy

3.1 ZEB Family Concept
(3) Definition and evaluation methods of ZEBs



3.2 ZEB Ready Example – Office

Outline of the building

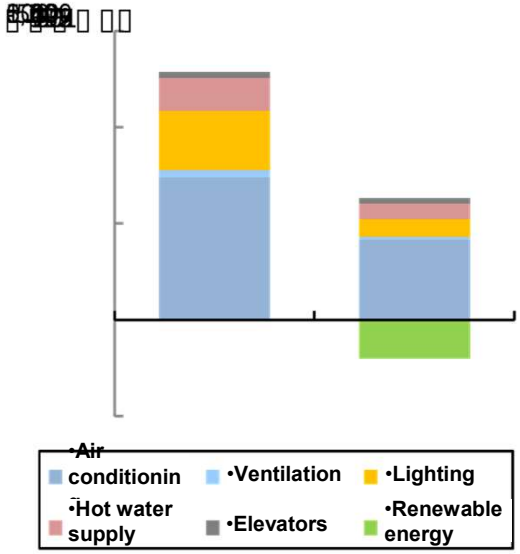
•Concept for ZEB realization	To realize a ZEB for this headquarters building, it was planned to reduce the building's overall energy load by primarily using a passive building design that enhanced the building envelop insulation performance and utilized daylight and natural ventilation as far as possible. Secondly, regarding the parts of the load that could not be reduced using the above measures, it was planned to implement thorough energy conservation using high efficiency air conditioning, lighting, and hot water supply. Additionally, the introduction of BEMS to understand and evaluate the actual energy consumption was to lead to further reductions in energy consumption with the operations management.

Project location	Hamamatsu, Shizuoka		Region 6
Building use	Office (Part used as a warehouse)		Newly constructed
Structure	S construction	No. of stories	4 stories above ground
Total floor area	3,704.10 m^2		

(Source: Sustainable open Innovation Initiative)

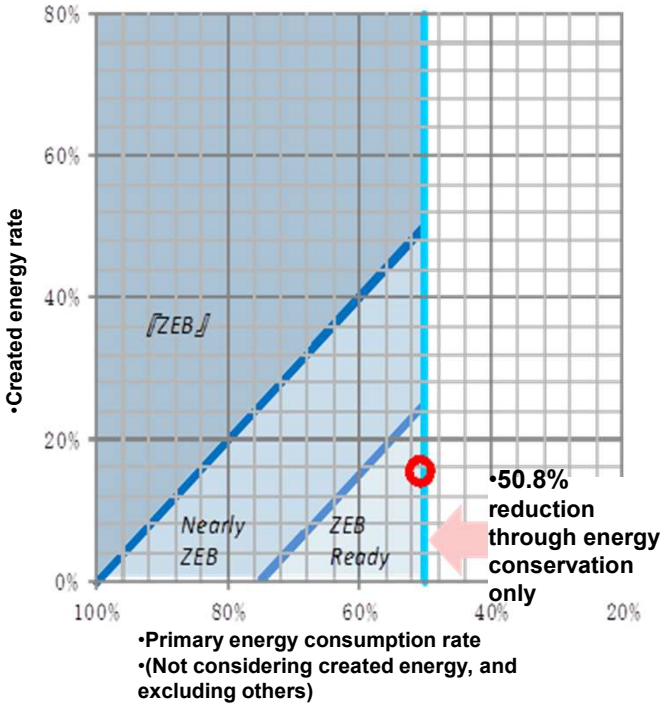
3.2 ZEB Example – Office

Energy saving and renewable energy supply



•Units: MJ/m² year

	Standards	Design	BPI/ BEI
Exterior	470	304	0.65
Air conditioning	738	415	0.56
Ventilation	38	14	0.38
Lighting	307	93	0.30
Hot water supply	173	81	0.47
Elevators	29	29	1.00
Total	1,286	632	0.49
Renewable energy	0	−201	-
Total	1,286	431	0.34



[Energy performance evaluation]

The design primary energy consumption of this building is 632 MJ/m² year (431 MJ/m² year when including the renewable energy), which realizes energy conservation of approximately 51% compared to the reference .

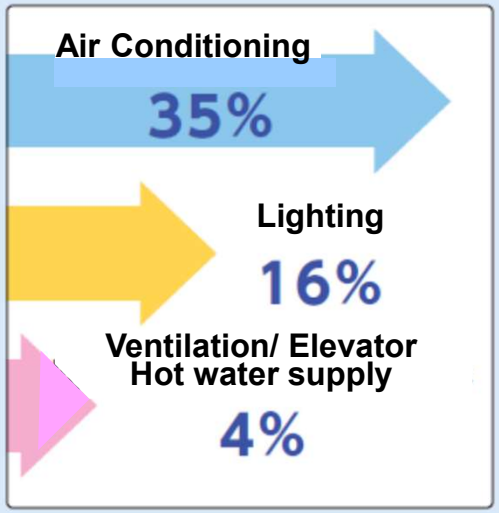
•(Source: Sustainable open Innovation Initiative)

3.2 ZEB Ready Example – Office

Cost for ZEB Ready

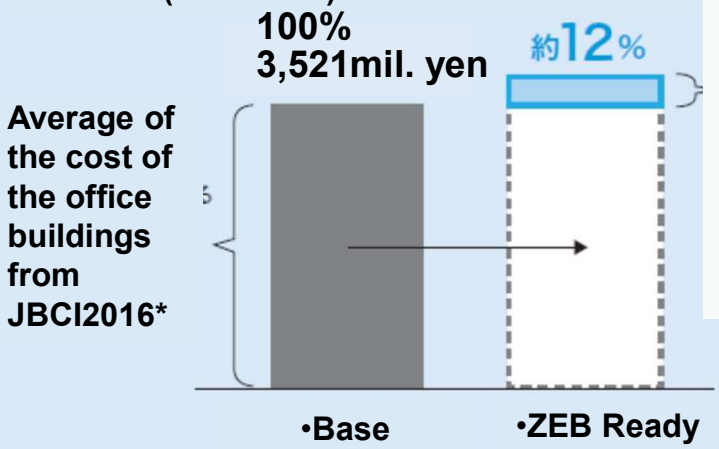
"ZEB Ready" is not difficult to be realized. It is officially announced that "ZEB Ready" can be realized by the application of versatile high-efficient technologies with approximately 12% of buildings costs increase in comparison with the building designed in compliance with the energy efficiency standard.

Office buildings



* JBCI: Japanese Building Cost Information

「ZEB Ready」
The amount of building construction cost Increase (estimated)



All the cost for the work of temporary, finishing, M&E, envelope, structures, etc.

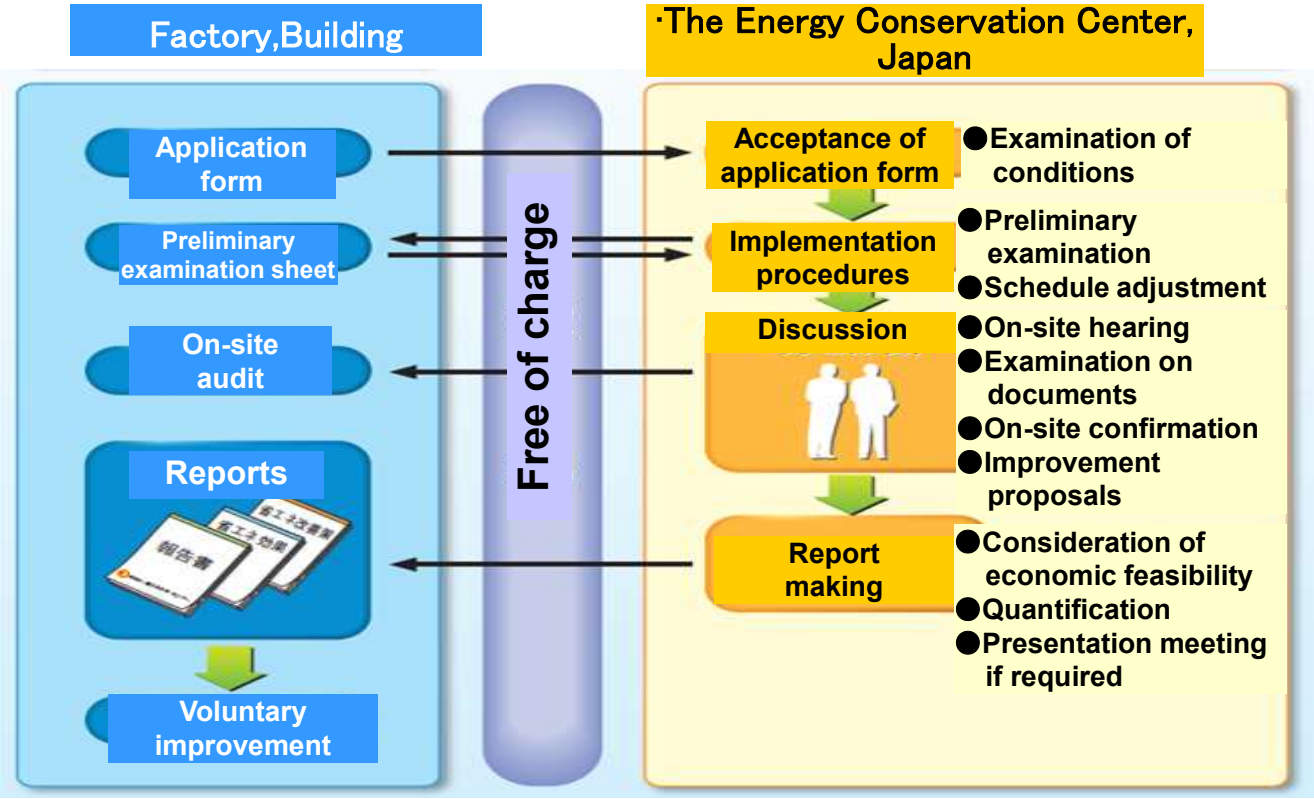
The cost for the whole building construction becomes 112% of the standard building.

Source: METI Website

Contents

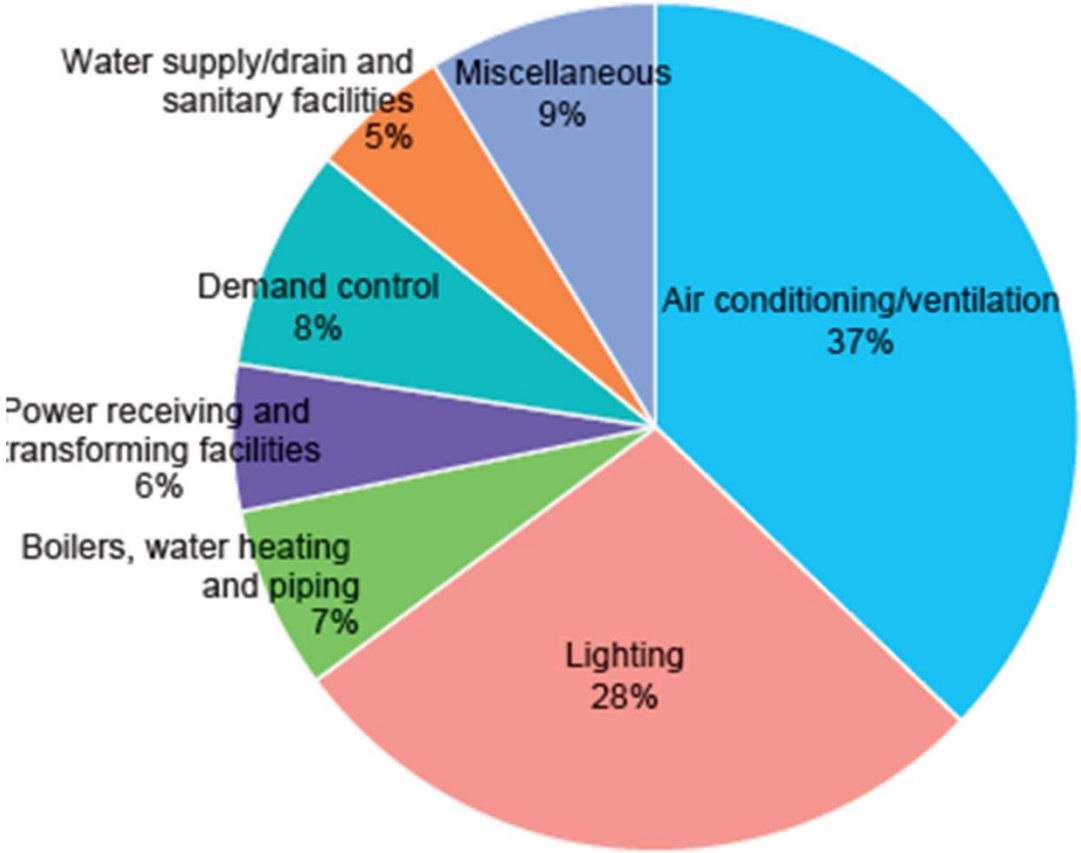
4.1 One-day Energy Diagnosis by ECCJ

- ✓ ECCJ sends two experts of energy conservation to the factory for diagnosis.
- ✓ Experts submit an audit report and presents specific improvement, proposals, expected effects and economic feasibility of the proposals.



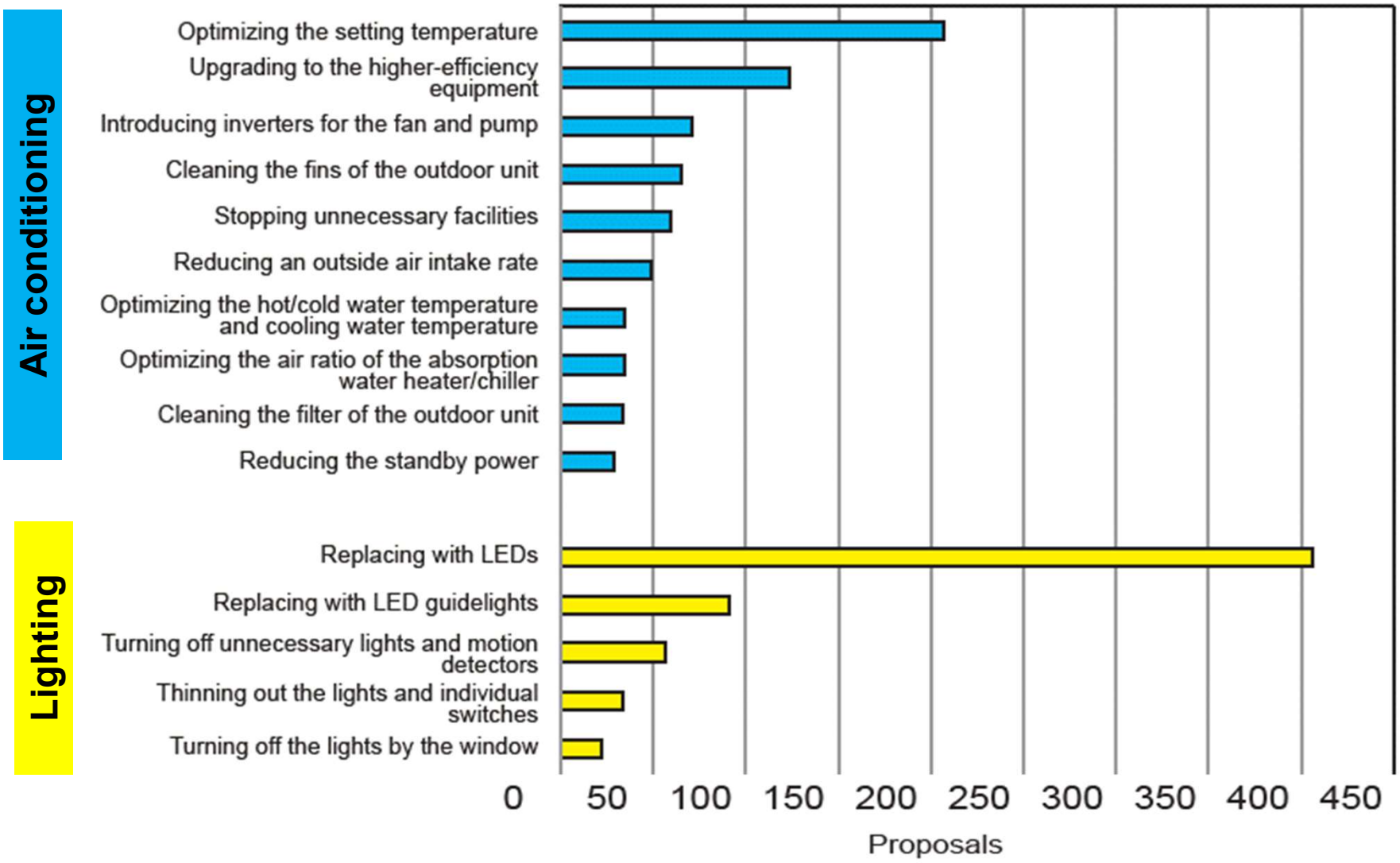
3.1 One-day Energy Diagnosis by ECCJ

After investigating the status quo of the building, the energy audit presents an improvement proposal. The right pie chart shows the ratio of the recent improvement proposals for each facility. There are many proposals for the air conditioning and lighting facilities, basically reflecting the ratio of energy consumption of the buildings.
The following figure itemizes the proposals for each classification of target facility.
For the air conditioning/ventilation facilities, optimization of the setting temperature is proposed much more than the others. For lighting, renewal to LEDs is proposed very much.

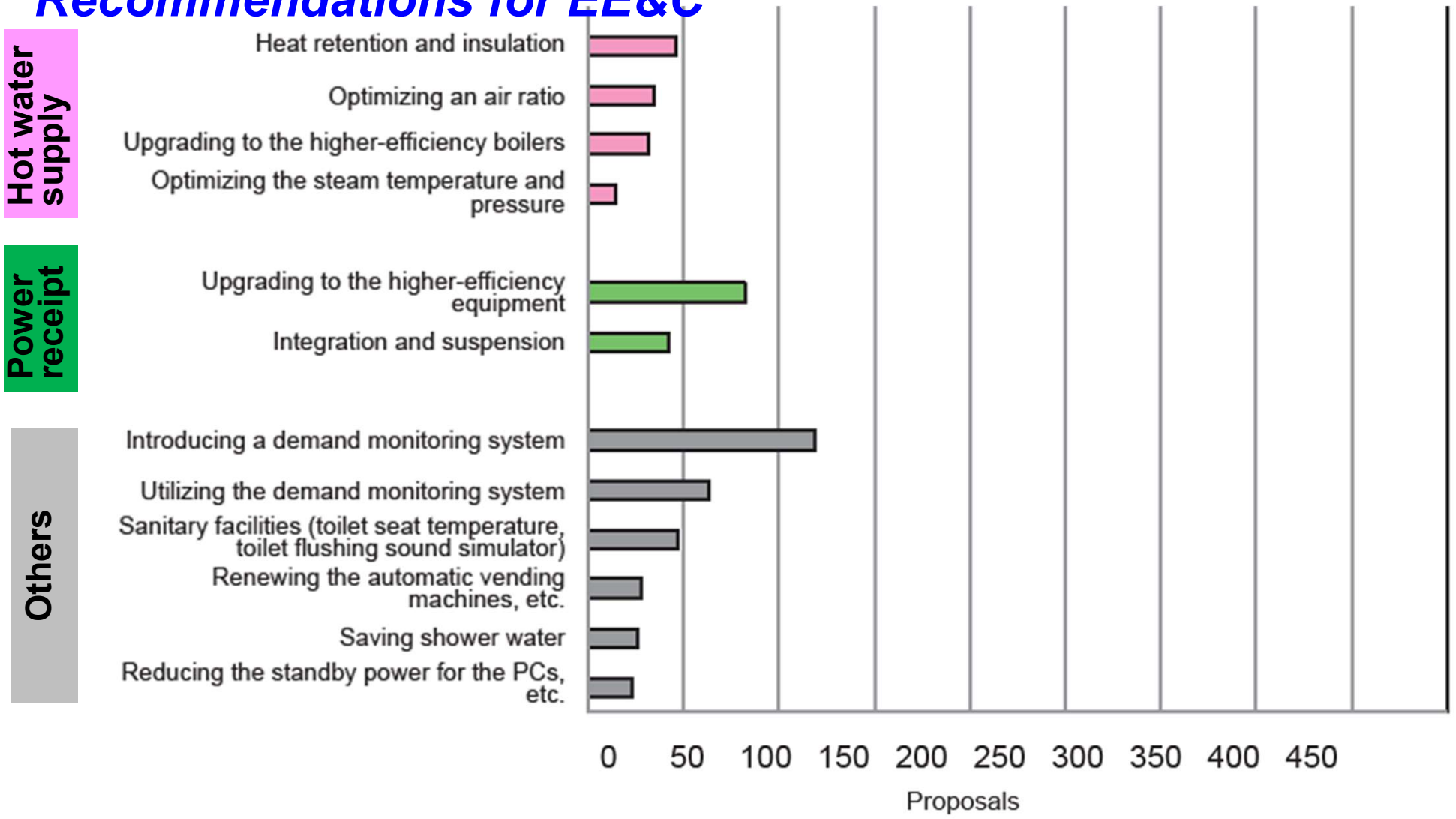


Improvement proposals by energy audits of buildings

Recommendations foe EE&C



Recommendations for EE&C



4.2 Check Points for Energy Conservation Measures

1 Energy conservation measures by users

These actions to minimize load are the first step towards energy conservation measures.

Classification	Major energy conservation measures
Management	Maintain organizations for promoting energy conservation.
Air conditioning	Adjust the indoor temperature appropriately.
Lighting/ Outlet	Turn off the lights in unused rooms.
	Turn off the lights during lunch break.
	Turn off the vending machines at night time.
Architecture	Manage the blinds of the east side of the building to reduce cooling load in the morning.
Elevating machine	Adjust the number of elevators in operation on Saturdays, holidays, and night time.

2 Energy conservation measures by operations

Tuning of equipment/system (basic of the energy management) without imposing a burden to users

Classification	Major energy conservation measures
Air conditioning	Manage the setting of the chiller's outlet temperature and the efficiency of heat source including auxiliary machines.
	Adjust the number of distribution pumps, according to the load.
	Manage the cooling water temperature to enhance chiller efficiency.
	Manage CO2 concentration to enable minimum outside air intake.
	Stop outside air intake at the time of starting cooling/heating.
	Turn off the heat source equipment before the end of operation time to use the heat inside the equipment and the piping effectively
	Shorten the warm-up time of the air conditioning.
Lighting/ Outlet	Manage the load ratio of the transformers and adjust the balance of three-phase loads.
	Review the temperature setting of the electric room to reduce cooling load and ventilation power.
Hot water supply	Adjust the air ratio of the boiler and combustion equipment.

3 Energy conservation measures by investments (shorter payback year)

Classification	Major energy conservation measures
Air conditioning	Install inverters to fans to adjust air volume.
	Install inverters to pumps to realize operation according to pressure or flow.
	Exchange filling materials of cooling towers depending on the clogging status.
Air conditioning/ hot water supply	Enhance thermal insulation of the steam valve, piping, etc.
Ventilation	Install sensors to the ventilation equipment of the parking area to control start-stop or air volume.
Water supply/ Hot water supply	Employ water-saving top and equipment.
	Install imitation sound generation devices to ladies restrooms.
Lighting/ Outlet	Subdivide the lighting circuits.
	Exchange magnetic stabilizers of lighting fixtures to inverter stabilizers.

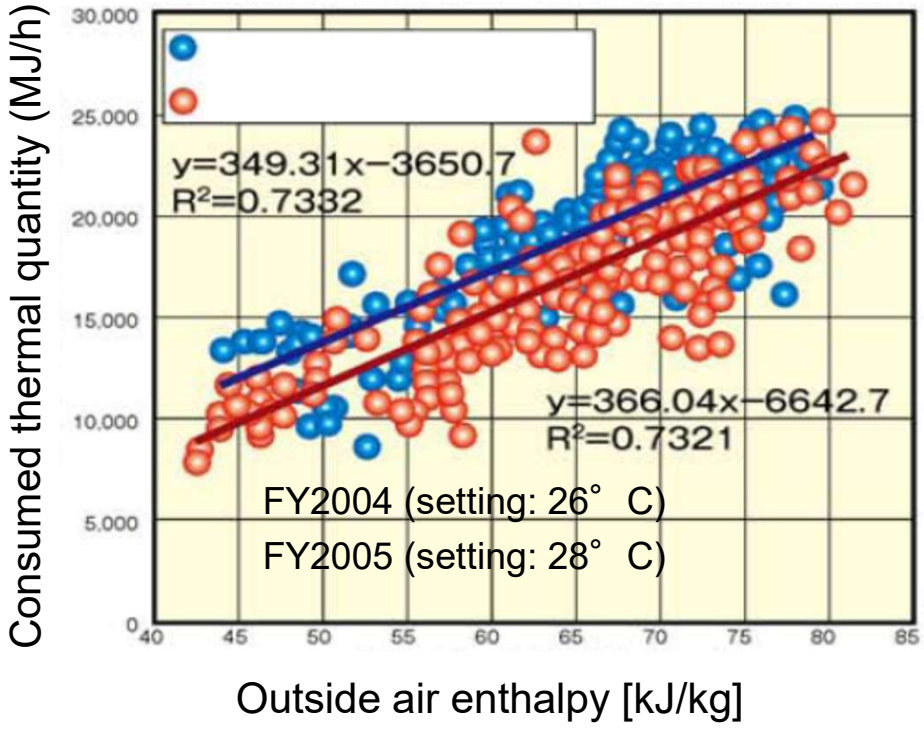
4 Energy conservation measures by investments (on an occasion of renewal)

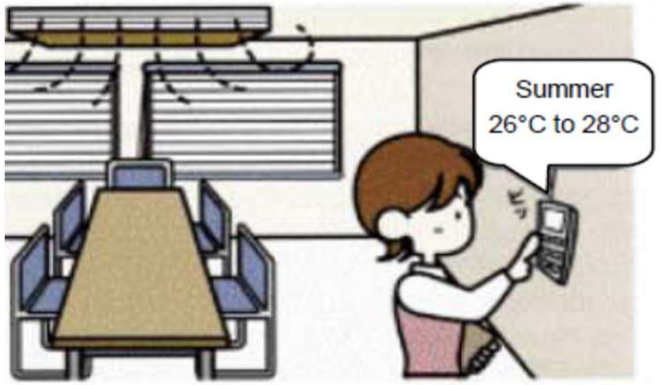
Classification	Major energy conservation measures
Air conditioning	Enhance the efficiency at a partial load by appropriate adjustment of the heat source capacity and the number of units.
	Introduce variable air volume system and variable water volume system. (VAV, VWV)
	Employ CO_2 sensor system for outside air intake.
	Employ total heat exchanger.
	Introduce BEMS to enhance overall efficiency of air conditioning equipment.
Hot water supply	Consider introducing a local type hot water supply.
Lighting/ Outlet	Renew to high-efficiency lighting fixtures.
Substation	Employ high-efficiency transformers and optimize their allocation.
	Employ power factor correction capacitor units.

4.3 Successful Cases of Energy Conservation measures

Case 1

The indoor temperature setting change from 26°C to 28°C





Effect:
Chilled water thermal quantity
11% reduction

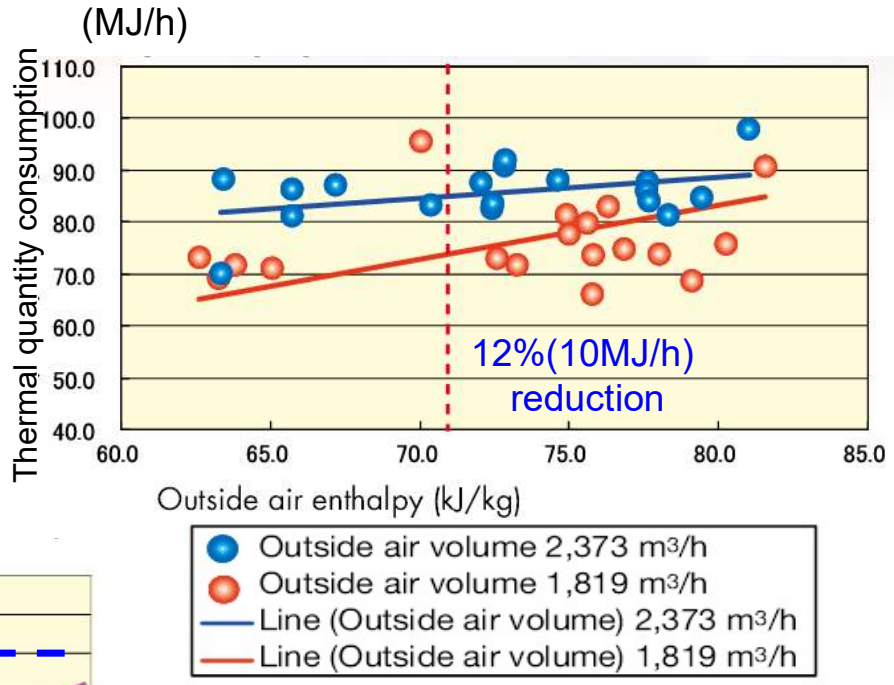
From the "TuBE Guidebook"
(Created in March, 2006)

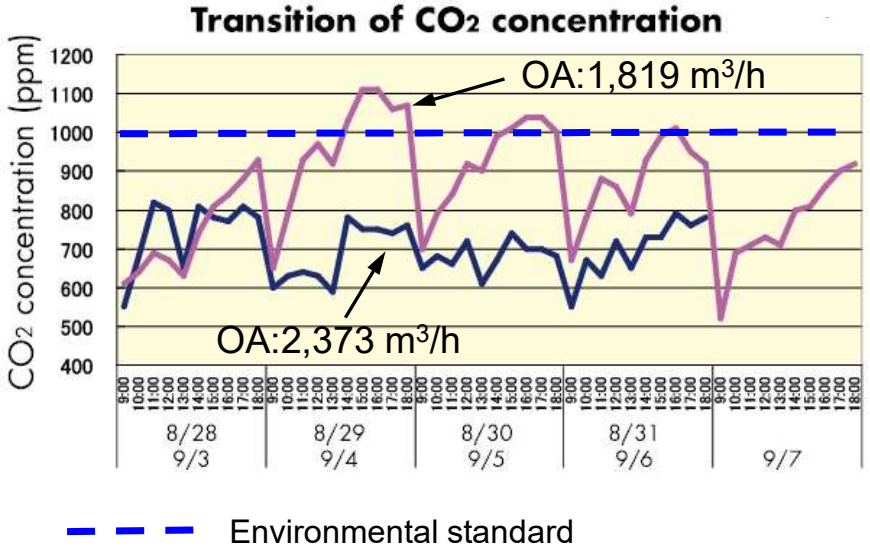
Case 2

Reduction of outdoor air volume

Outside air volume

2,373 m^3/h ⇨ 1,819 m^3/h





But, CO_2 exceeded 1000ppm.

Air volume was adjusted to 2,130 m3/h to maintain CO_2 under 1000ppm.

Final Effect:

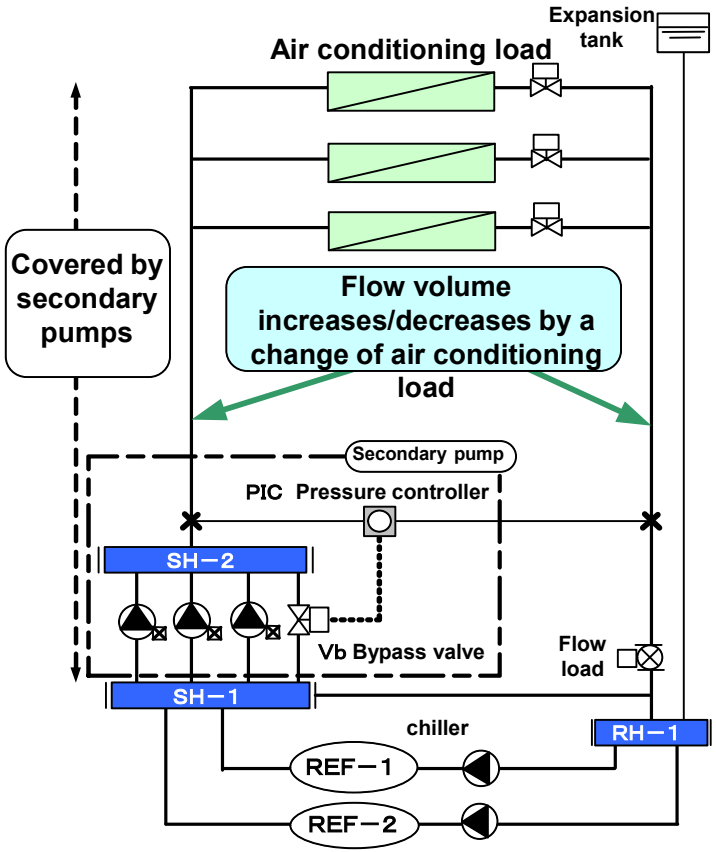
Chilled water thermal quantity 8.5 MJ/h (10%) reduction

Case 3

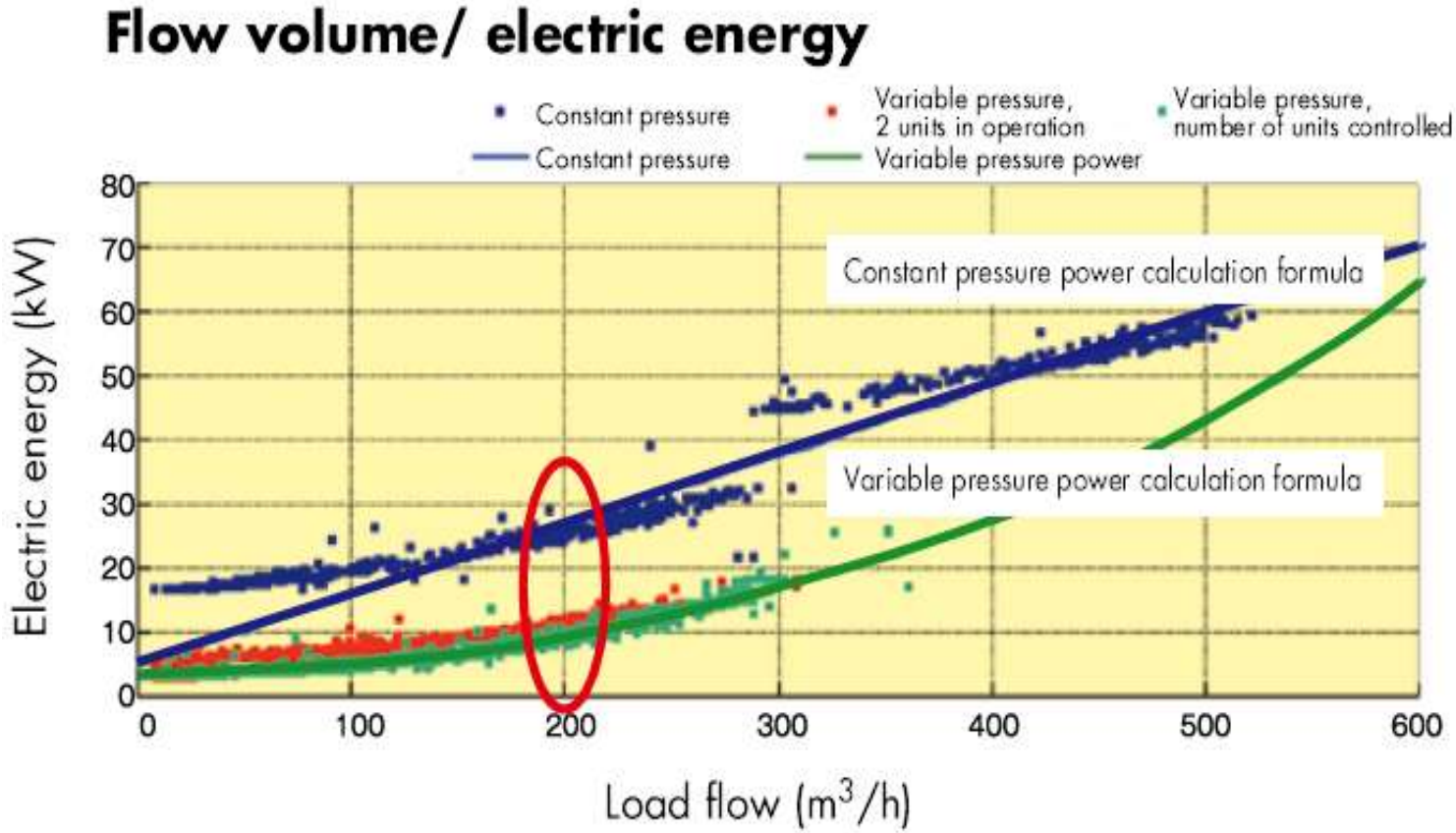
Power reduction by variable pressure control in secondary chilled water pumps

In some cases, unit control of secondary pumps of air conditioning system is not implemented appropriately due to improper setting of values and a change in the operation method.

→ Optimum unit control of secondary pumps will reduce power consumption of pumps



Power reduction by variable pressure control in secondary chilled water pumps



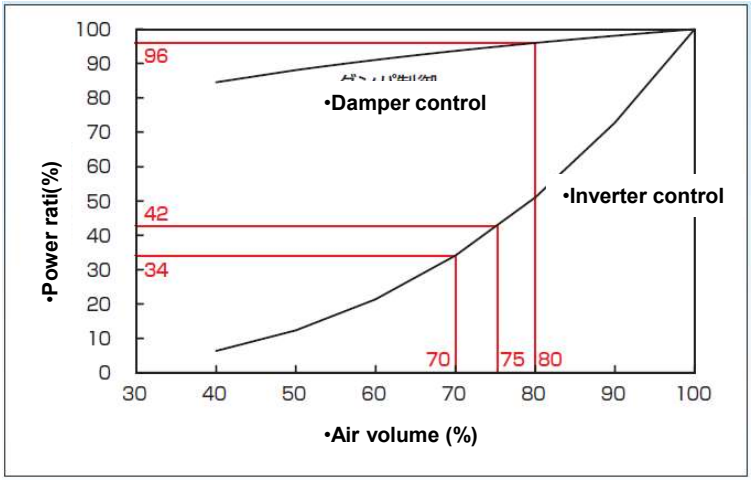
The annual power consumption of secondary pumps of the variable pressure control was 50% of that of the constant pressure control.

Case 4

Variable air volume of air-conditioning fans

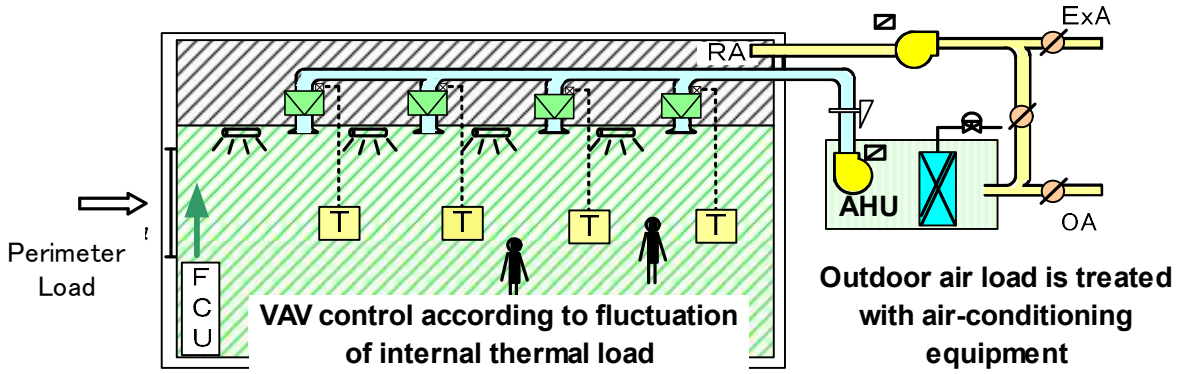
·Current problems

Eight air handling units are running and they all are controlling air volume by damper. Air conditioners are running at a fixed level of air volume throughout the year, regardless of the number of visitors, and consume a lot of conveyance power.



·Improve measures

The conveyance power was reduced by installing an inverter in the air handling unit, and decreasing the air volume using a timer for each AHU during off-peak hours.



VAV control according to fluctuation of internal thermal load (human, lighting, etc.)

Outdoor air load is treated with air-conditioning equipment

·Effect

Save: - 52%

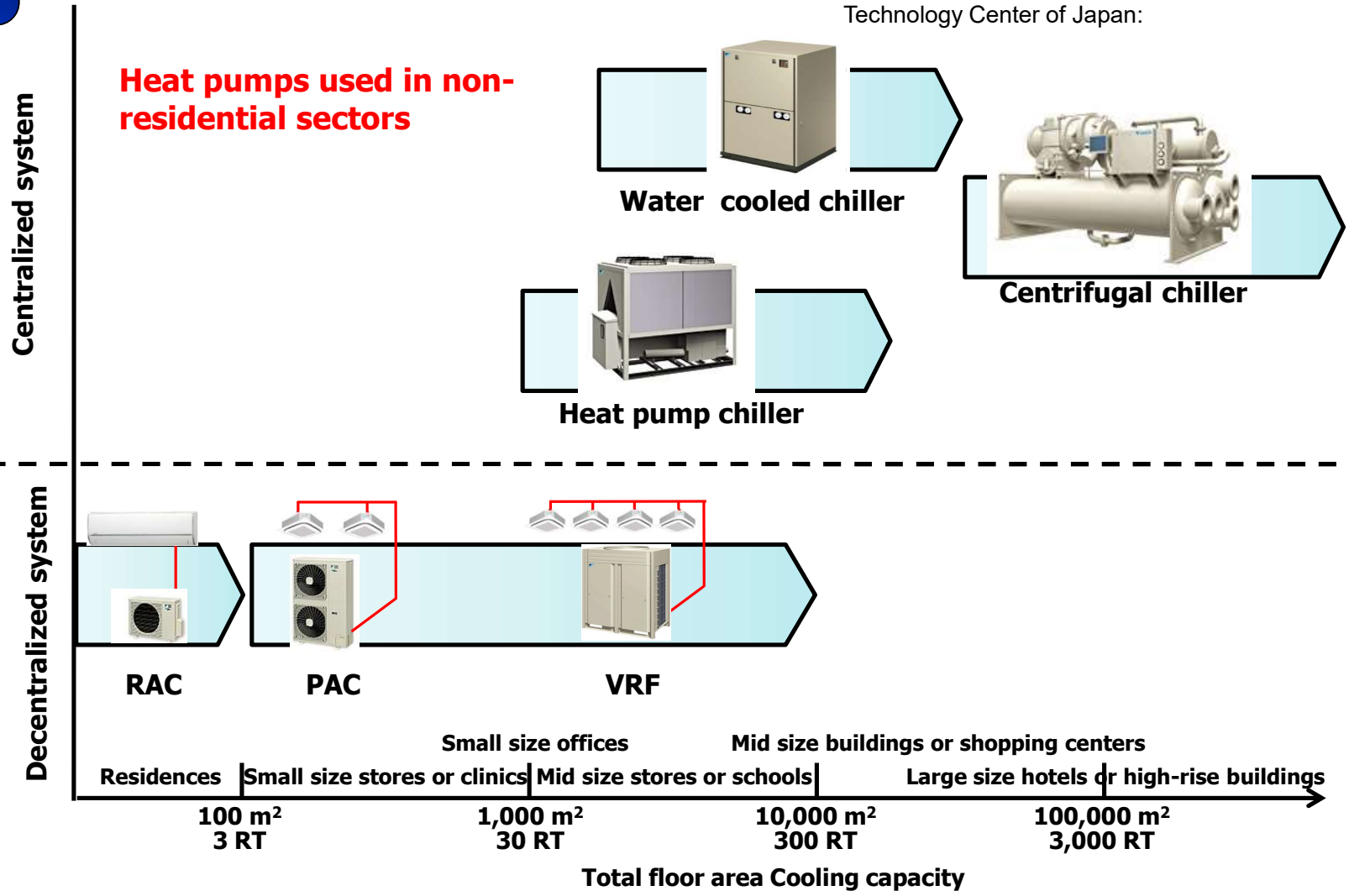
·Source：EC Guidebook for Building (ECCJ, 2011–2012)

Case 5

Replacement to new heat source

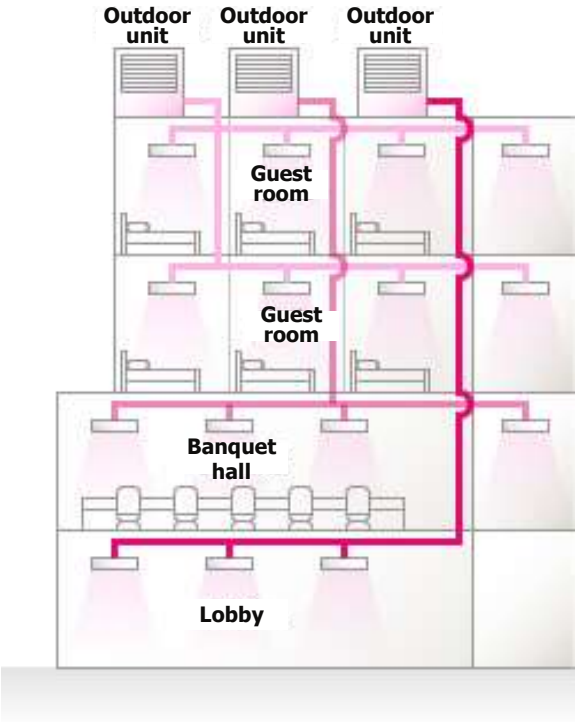
Source: Heat Pump & Thermal Storage Technology Center of Japan:

Heat pumps used in non-residential sectors



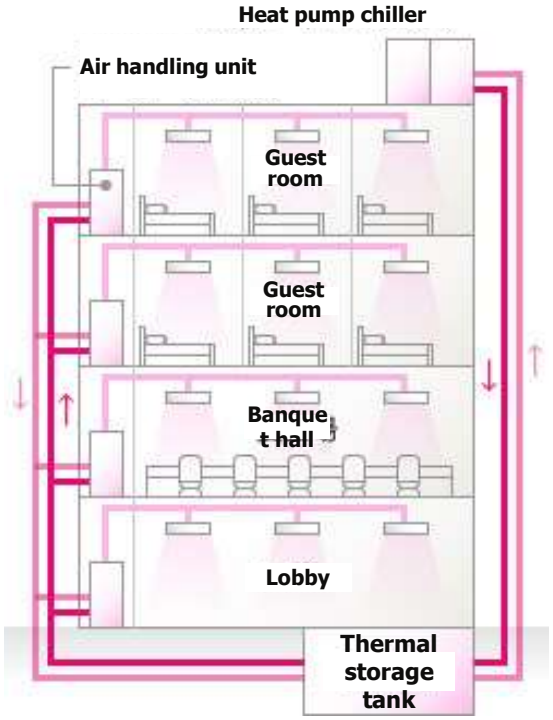
Heat pumps used in non-residential sectors

Air conditioning systems can be categorized broadly into decentralized systems used in small and medium size facilities and centralized systems used in large size facilities.



Decentralized system

This system is suitable for complex buildings, buildings leased to offices or shops, where the times of use vary, since outdoor units can be installed separately by air-conditioned room.



Centralized system

This system is an air conditioning system that uses ducts/pipes to distribute cooled air/water to to an entire building. Heat source is located on top of the roof or in a machine room.

Source: Heat Pump & Thermal Storage Technology Center of Japan:

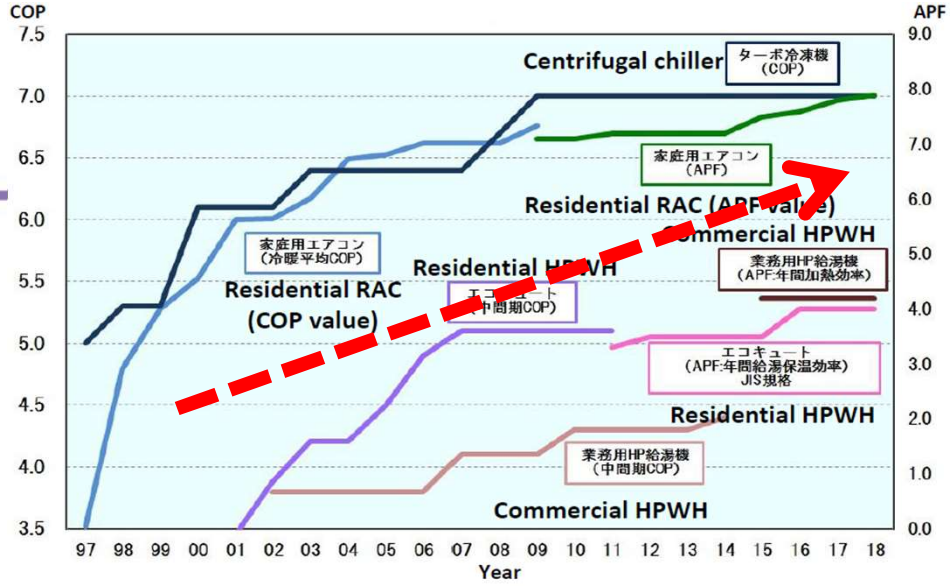
Performance improvement of the refrigeration machinery in Japan

Energy conservation can be realized by simply renewing the air-conditioning heat source devices.

Top Runner system
Revised Act on the Rational Use of Energy
Enforced in April, 1999

* Top Runner system

This system sets the target values above the highest energy conservation performance of the products of all the manufacturers currently marketed at the time of formulating the energy conservation standards.



Numerical values are those of the top-runner devices. Home air-conditioners are those of 2.2 kW with free dimensions.

- COP: Cooling/heating capability (kW) ÷ Power consumption (kW)
- Cooling and heating average COP:
  (COP at cooling + COP at heating) ÷2

* At cooling: Outer temperature 35 ˚C, Room temperature 27 ˚C;
At heating: Outer temperature 7 ˚C, Room temperature 20 ˚C
(JIS C 9612 rated conditions)

- Interphase COP: COP under the operating conditions of Outer temperature (DB/WB ˚C) = 16/12, Water temperature = 17 ˚C and Heating temperature = 65 ˚C.
- APF: Annual hot water supply efficiency. It is the hot water supply calorific value per unit power consumption when the device is operated under certain constant conditions through the year.

■ **Source: Excerpted from the manufacturers catalog and energy conservation type product information site (Energy Conservation Center)**

Case 6 Total Heat Exchangers

1. Current problem

In an assembly hall (total floor area: 5,200 m^2), a total heat exchanger in a hall air conditioning line is not functioning. A heat load due to the outside air accounts for 20 to 30%, there is a high ratio of an air conditioning load in general office buildings. Furthermore, more outside air is required in a room with many people such as an assembly hall, with the heat load accounting for higher percentage of the air conditioning load.

2. Improvement measure

Recover the function of the total heat exchanger and enable heat recovery from air conditioning exhaust to reduce an outside air load.
The total heat exchanger is an effective measure to achieve both precautions for COVID-19 and reduction of the air conditioning load through ventilation. Recently, some total heat exchanger models with higher flexibility in installation are commercialized. They include a model having a humidifying function with low energy consumption and a model consuming less power during partial load operation by controlling air volume using a high efficiency motor.

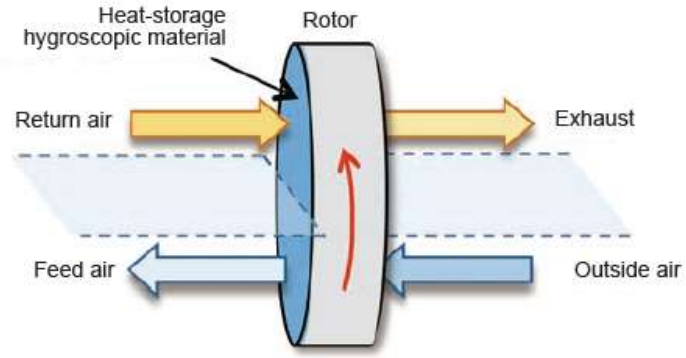


Fig. 1 Rotary total heat exchanger

Source: Heat Pump & Thermal Storage Technology Center of Japan:

Total Heat Exchangers

One of the Recommendation in the audits implemented last year

4.5 Introduction of total heat exchanger

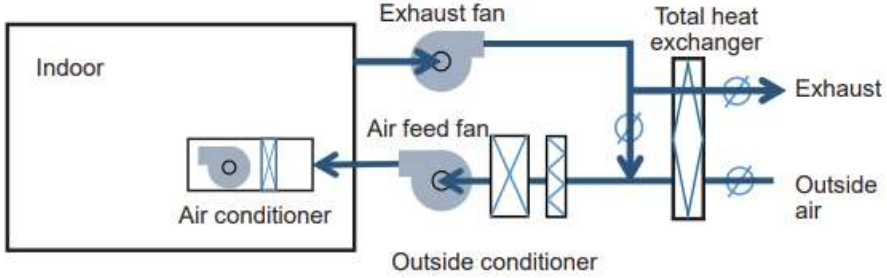


Fig. 2 Example of total heat exchanger system

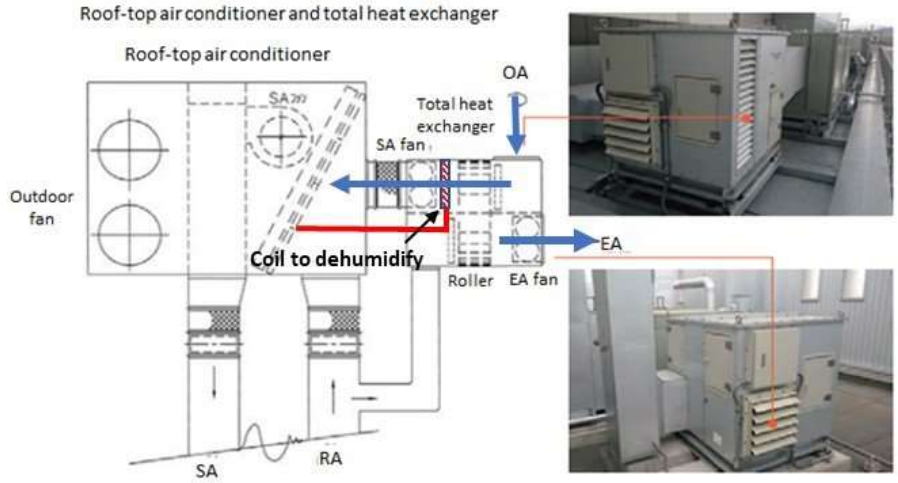


Fig. 15 Total heat exchangers for the roof-top air conditioners

Current conditions:

Now 15% of indoor air is exhausted to outdoor. This exhaust air is less than 20℃ and causes energy loss for air conditioning without heat recovery.

Recommendation

Installing a total heat exchanger in a roof-top air conditioner provides comfortable space, lower running costs, and energy savings. In addition, the heat exchange between RA and OA reduces the outdoor air load, which allows for downsizing of the air conditioner.

Case 7

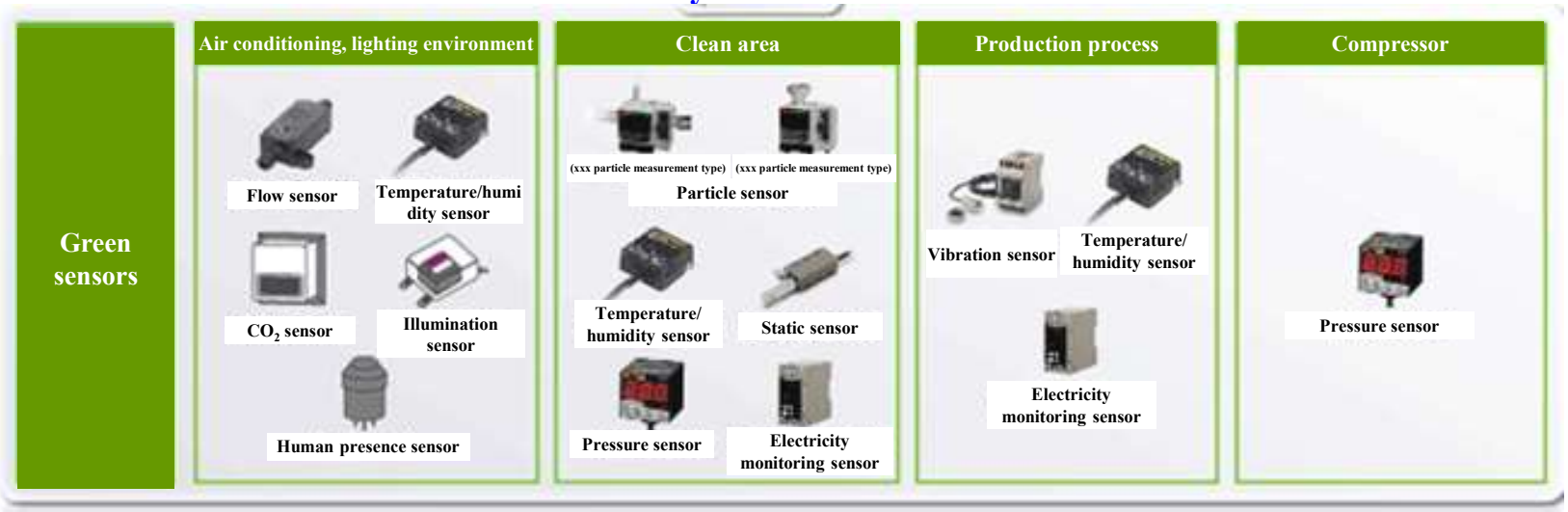
Application of Sensor Technologies

- Being developed with the initiative of NEDO* and National Institute of Advanced Industrial Science and Technology
- Use of MEMS** technology

Wireless communication function
Independent power source function
Electricity ultra-low consumption function

} These functions are incorporated.

*NEDO : New Energy and Industrial Technology Development Organization
MEMS : **Micro Electro Mechanical Systems



Source: Website of OMRON Corporation
http://www.omron.co.jp/green-automation/automation/factory/

28degree, 40% RH + Variable fine wind air conditioning system

- Air conditioning operated when necessary, where necessary and for amount necessary
-Easing of indoor temperature by variable fine wind air conditioning
- (from 25℃, 50% to 28℃, 40% + intermittent fine wind)

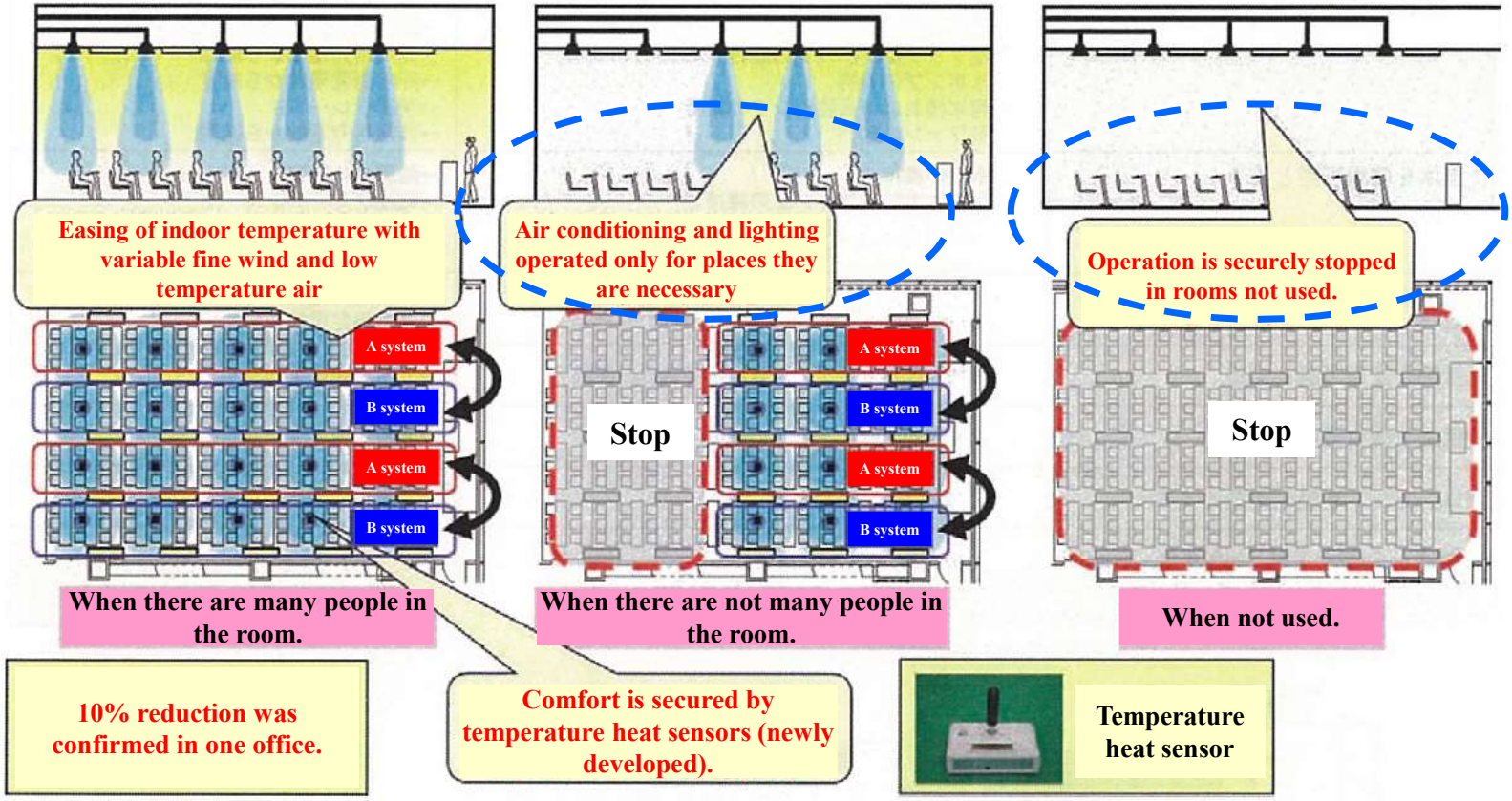
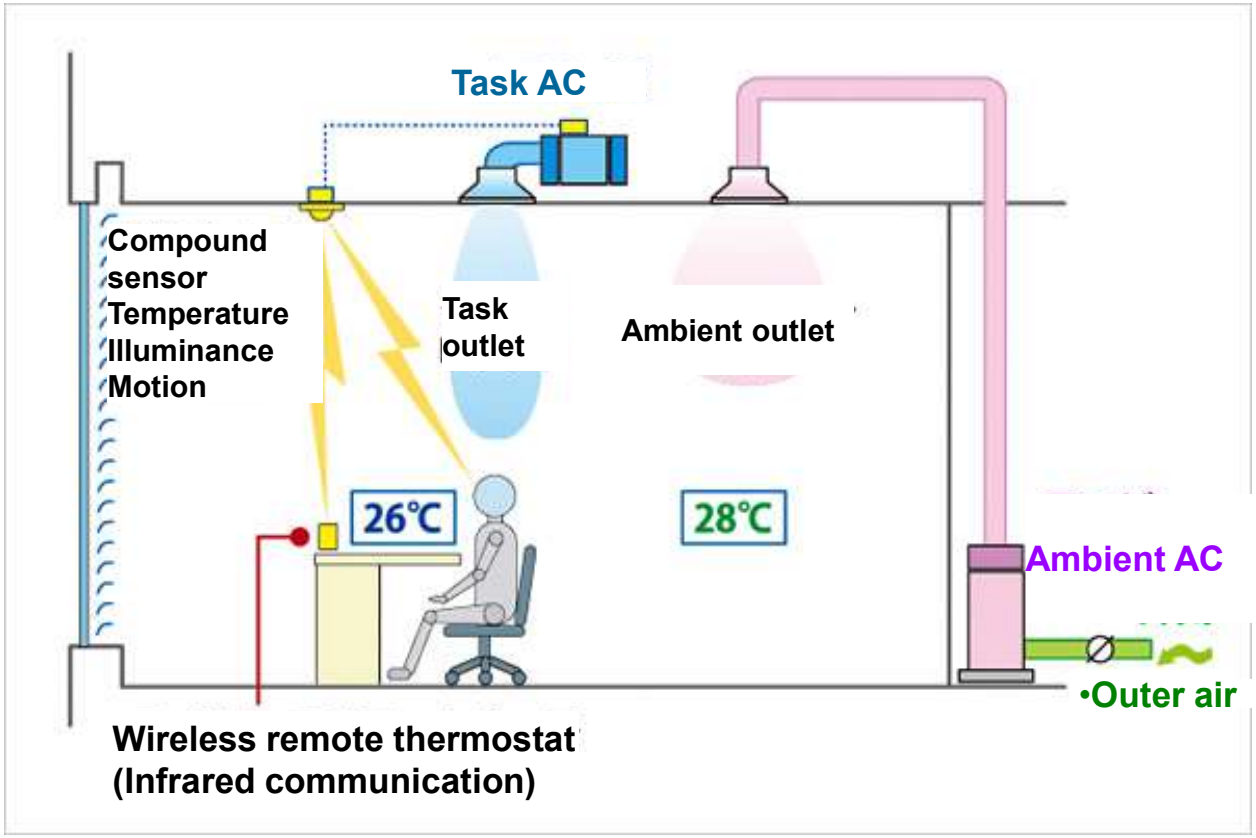


Figure 10 Variable fine wind air conditioning system

Source: Data for visitors of Tokyo Denki University, Senju Campus

Task and ambient air-conditioning

Compatibility of comfort and energy conservation is sought after by separating air-conditioning into two types; base air-conditioning “ambient air-conditioning” to take care of outer air load and lighting heat generation, and “task air-conditioning” to take care of frequently fluctuating and uniformly distributed internal heat generation and human body heat generation.

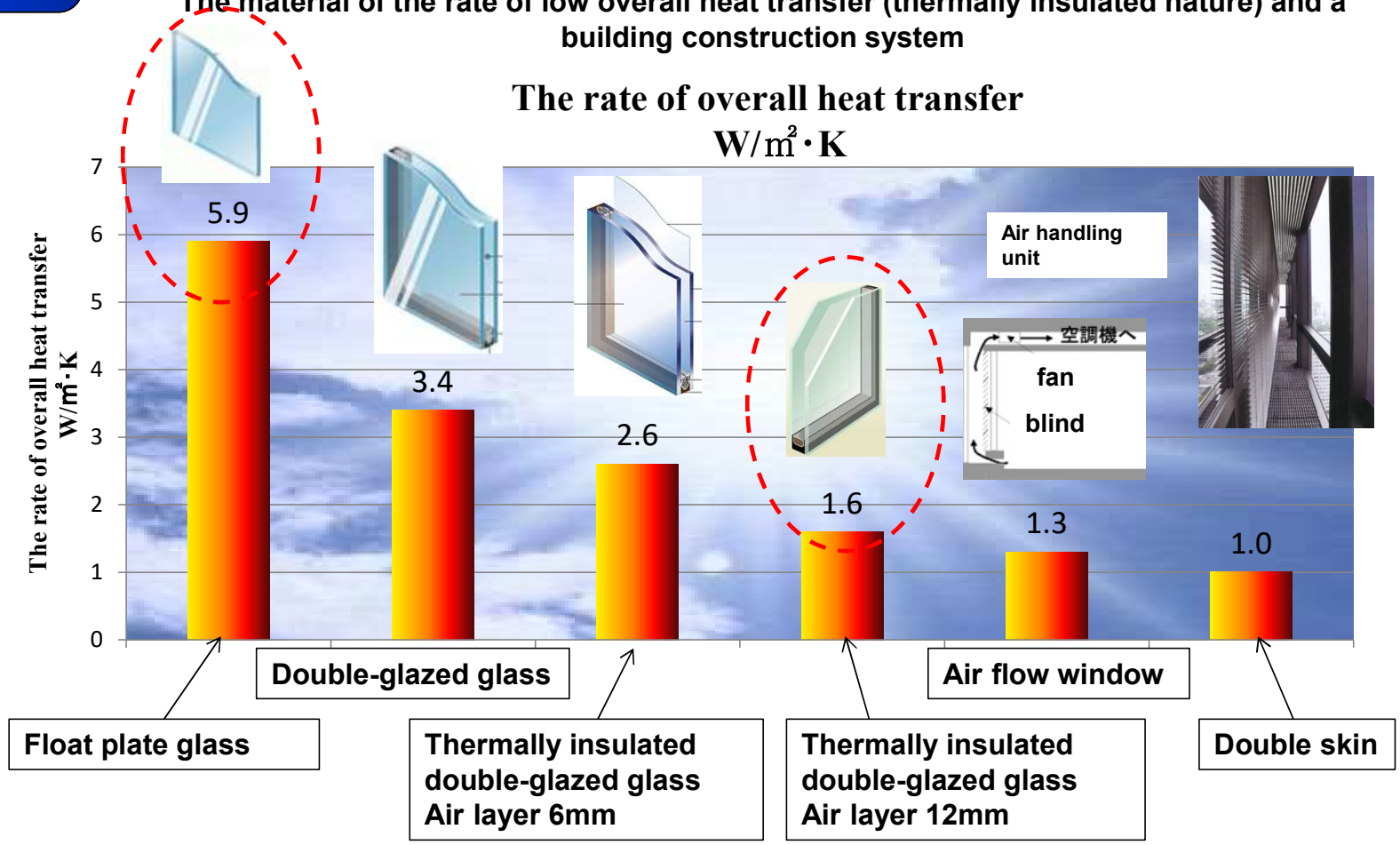


Case 8

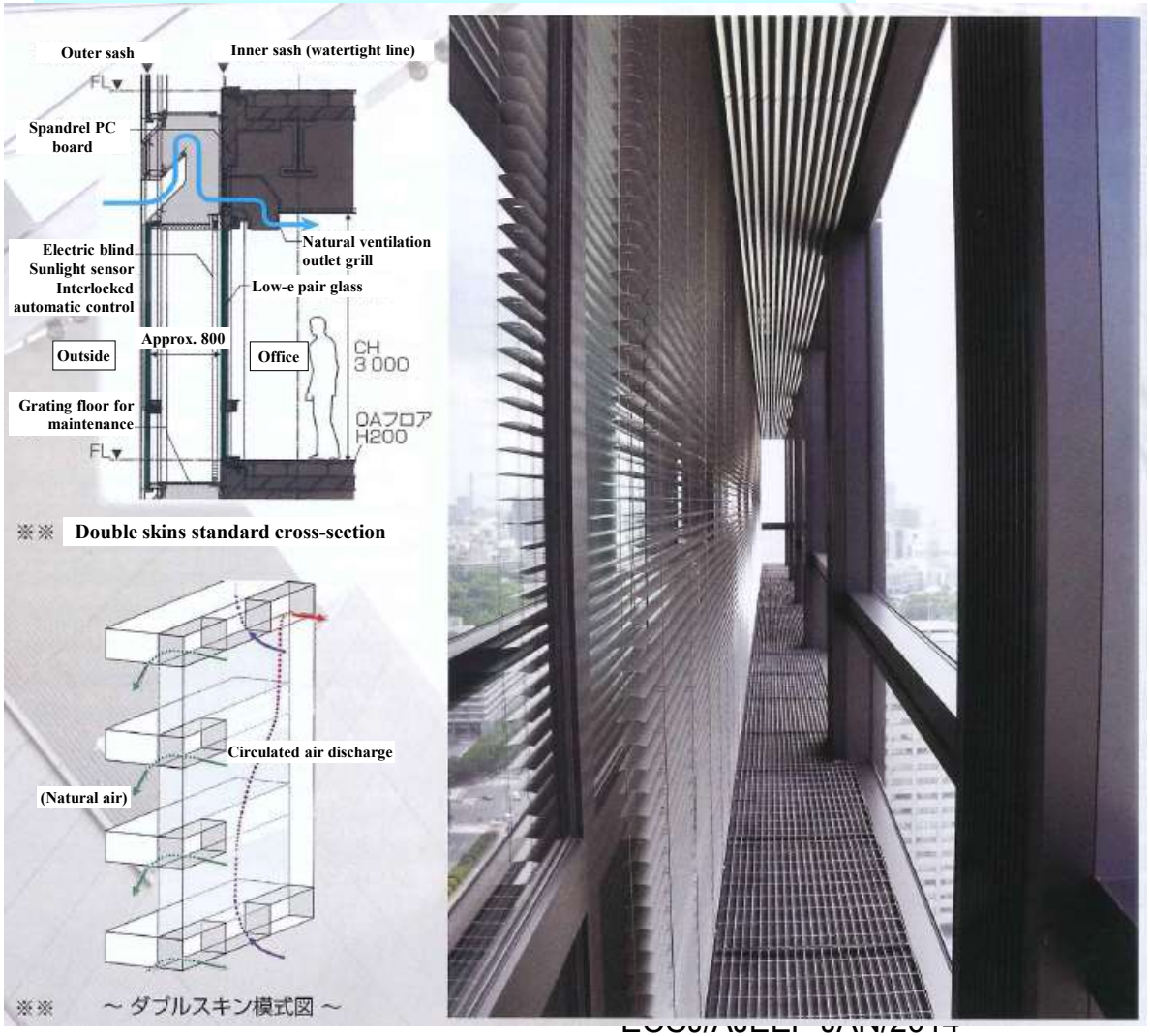
Enhance Insulation Efficiency of Windows

Low-E glass, air-flow window and double skin system

The material of the rate of low overall heat transfer (thermally insulated nature) and a building construction system



The feature of double skin

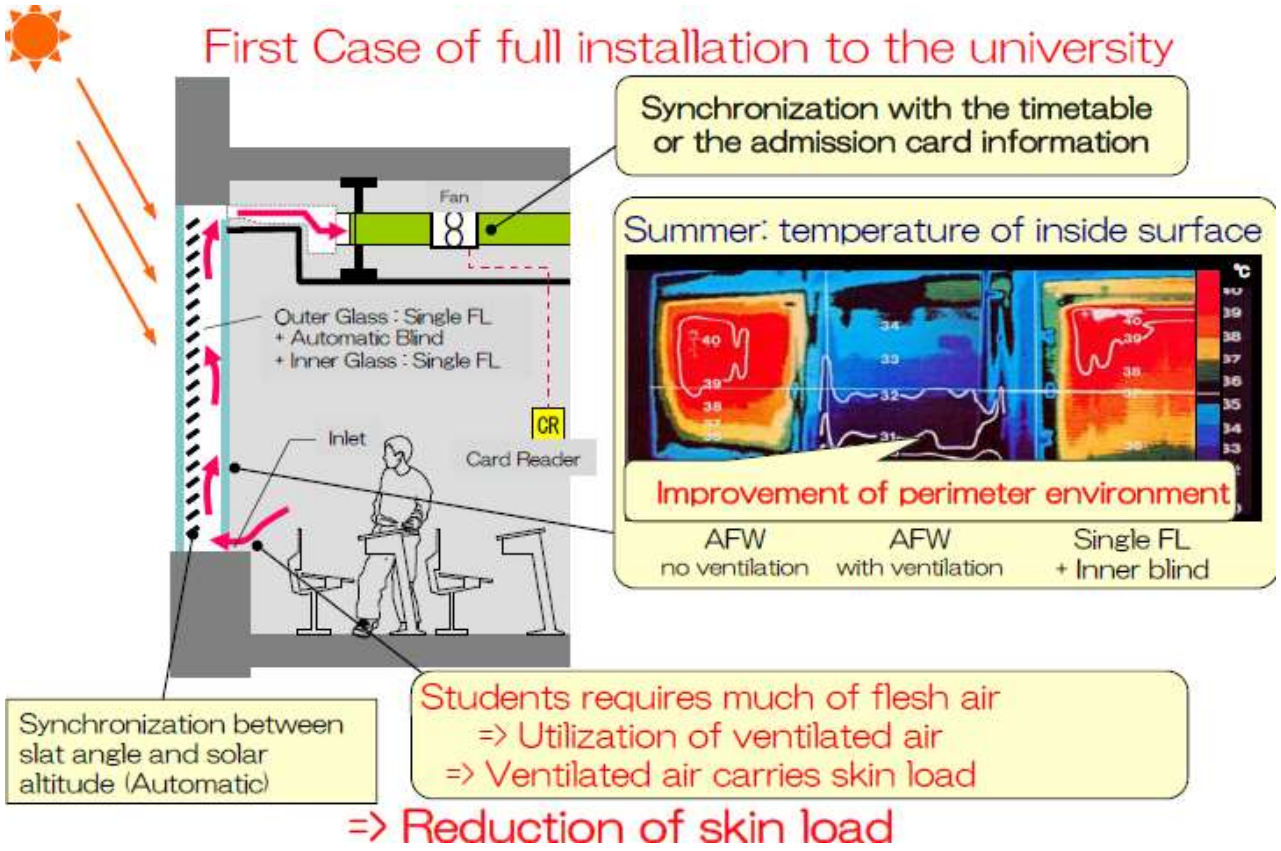


Installs a double window and wall in a perimeter part. **Lessens** influence of outdoor air temperature and solar radiation. **External Wall Load Reduced**

Unnecessary to divide the zoning of air-conditioning into an interior zone and a perimeter zone. **Improvement in indoor environment**

Source: Construction equipment and piping construction, November 2011 issue

Air Flow Window System

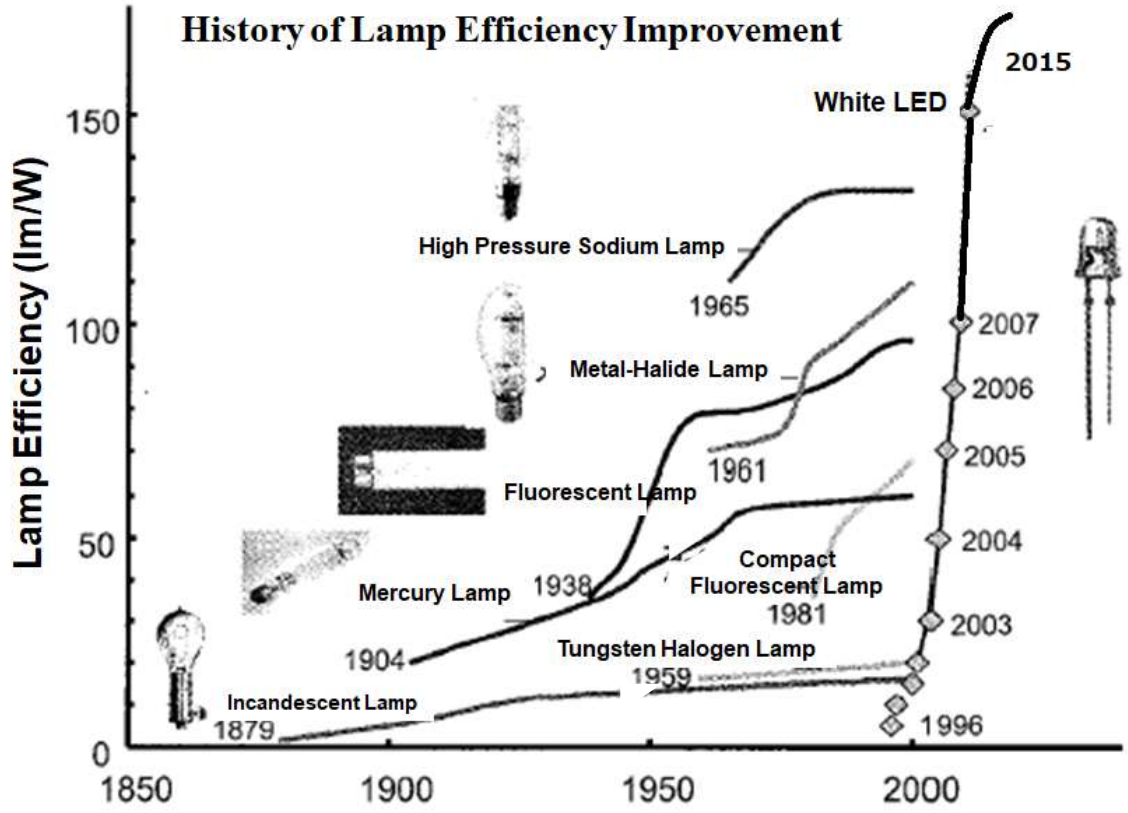


Enhancement of insulation and sunlight shielding performance

Source: Information from Tokyo Denki University Tokyo Senju Campus

Case 9

Replacement of the lamps by LED Lamps

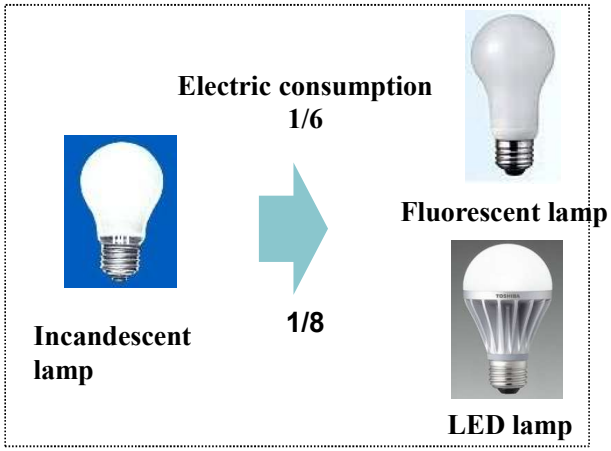


Latest data

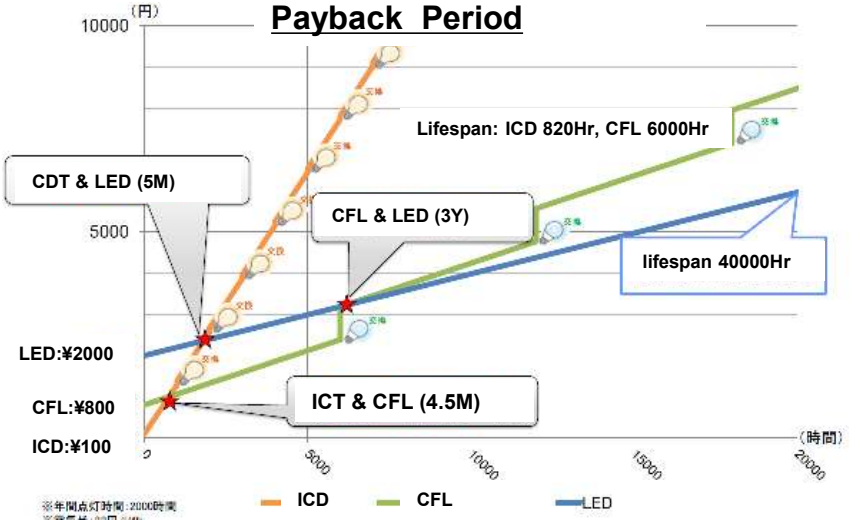
Top performance LED	High Performance LED	Good Performance LED	Low Performance LED
220 lm/W	150-200 lm/W	100-149 lm/W	50-99 lm/W

Source: 照明学会誌第92号 第6号

Replacement of the lamps to LED Lamps

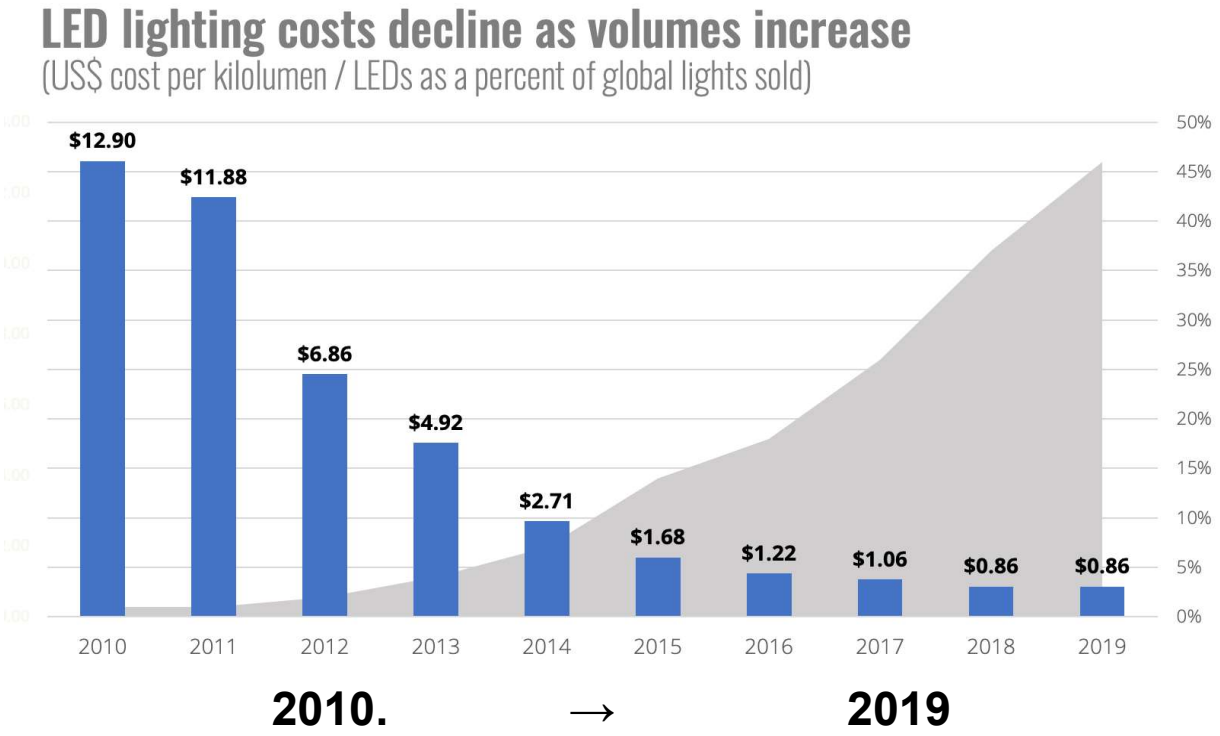


Payback Period



ICD: Incandescent Lamp
CFL: Compact Fluorescent Lamp

Price of LED lamps



2010. → **2019**

Source: METI 商務政策局

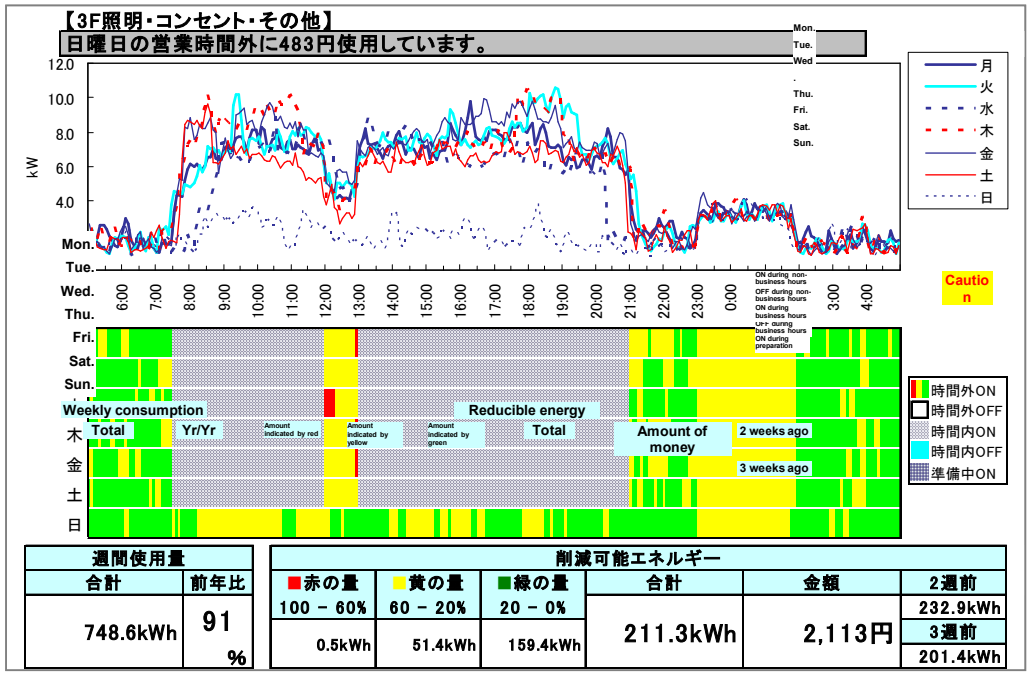
Case 10

Visualization of Energy Consumption

Monitor the power consumption of all the offices and deliver a weekly report

[3rd-floor lighting, electric outlets, others]

Spent electricity ¥483 during non-business hours on Sunday.



週間使用量	
合計	前年比
748.6kWh	91 %

削減可能エネルギー					
■赤の量	■黄の量	■緑の量	合計	金額	2週前
100 － 60%	60 － 20%	20 － 0%			232.9kWh
0.5kWh	51.4kWh	159.4kWh	211.3kWh	2,113円	3週前 201.4kWh

Sharing energy consumption information with the employees in the morning meeting and committees

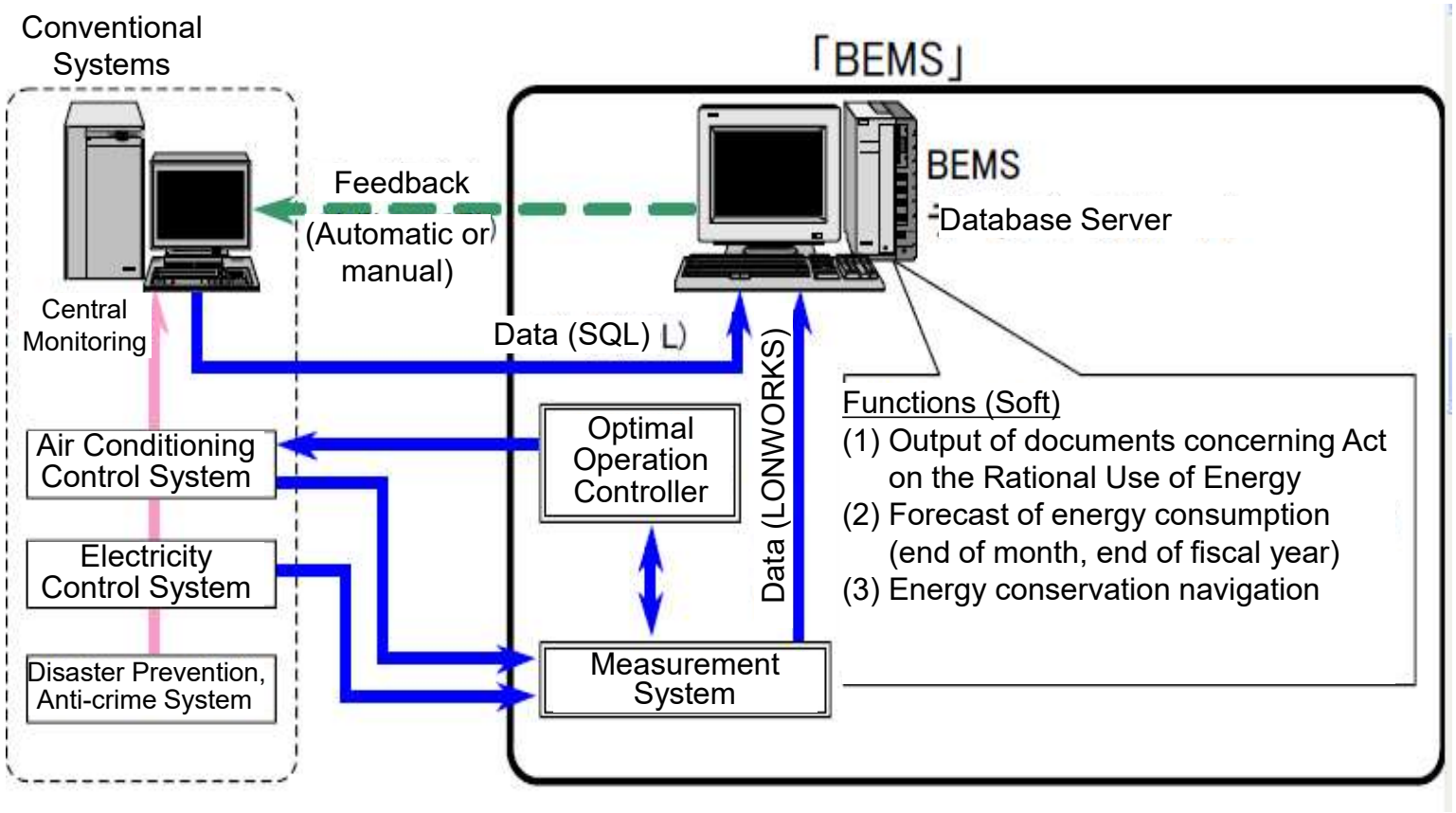
Power consumption has been reduced 13.3 % after introduction

*** Actual result in a model office (Kawagoe)**

BEMS (Building Energy Management System)

BEMS (Building Energy Management System)

Building management system for optimizing indoor environment and energy performance



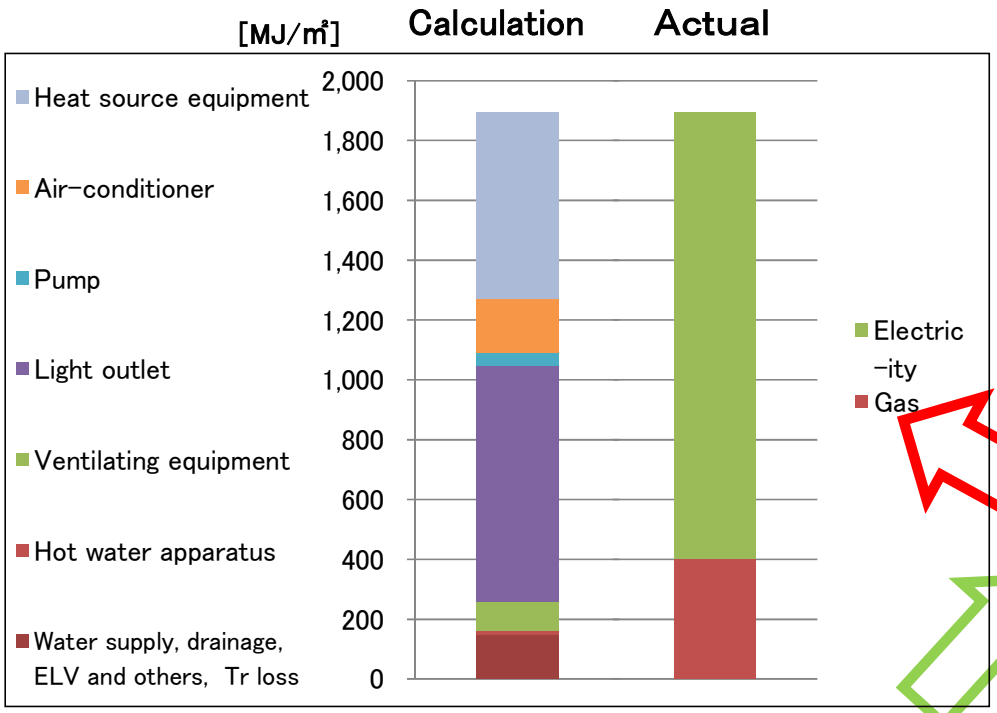
Source: Sanki Engineering Co., Ltd.

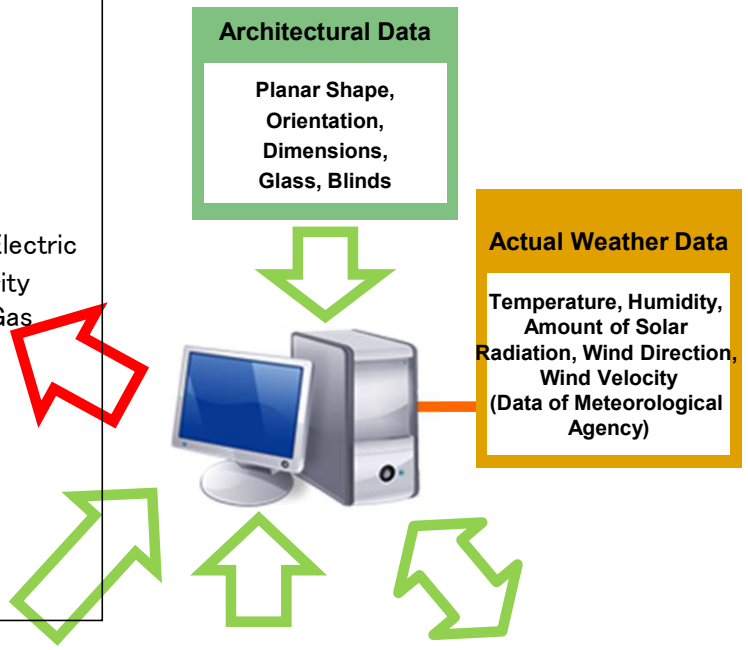
4.4 Summary and Introduction of Effective Tool for Energy Management in Buildings

- The Energy Conservation Center Japan (ECCJ) has been implementing various activities to promote and disseminate Energy Conservation in Japan since 1978.
- As one of these activities, ECCJ dispatches energy conservation experts to small and medium sized factories and buildings, and provided the proposals and the advices on specific techniques and technologies for improving energy efficiency.
- According to the data and information ECCJ have obtained through these experiences, the energy saving measures and their proper technologies with no cost, low/medium cost and large cost for office buildings have been presented.
- Finally, introduce the effective simulation tool for energy management for buildings, ESUM(Energy Specific Unit Management) tool which ECCJ has developed. By this tool, analyze the effects of the energy efficiency & conservation (EE&C) measures presented today assuming these measures to be applied to the typical office building in Tokyo and show the results for further understanding on the EE&C measures for office buildings.

ESUM: Energy Specific Unit Management tool

Annual energy consumption (Office Building)





The Energy Specific Unit Management tool (ESUM) can calculate whole energy of the various building types ,

an office,
a commercial building,
a hospital and a hotel.

Purposes of use of unit energy consumption control tool

(1) Grasping the energy consumption structure of the entire building and by departments

Easy to set an energy conservation goal because you can see energy consumption and unit energy consumption by consumption destinations such as air conditioning, lighting, and hot water supply, of the entire building and by departments.

(2) Evaluating the energy conservation measures quantitatively

Possible to quantitatively evaluate an energy conservation effect when you change the room temperature, up-to-date heat source equipment, or introduce different energy conservation techniques.

(3) Unit energy consumption (energy intensity) control

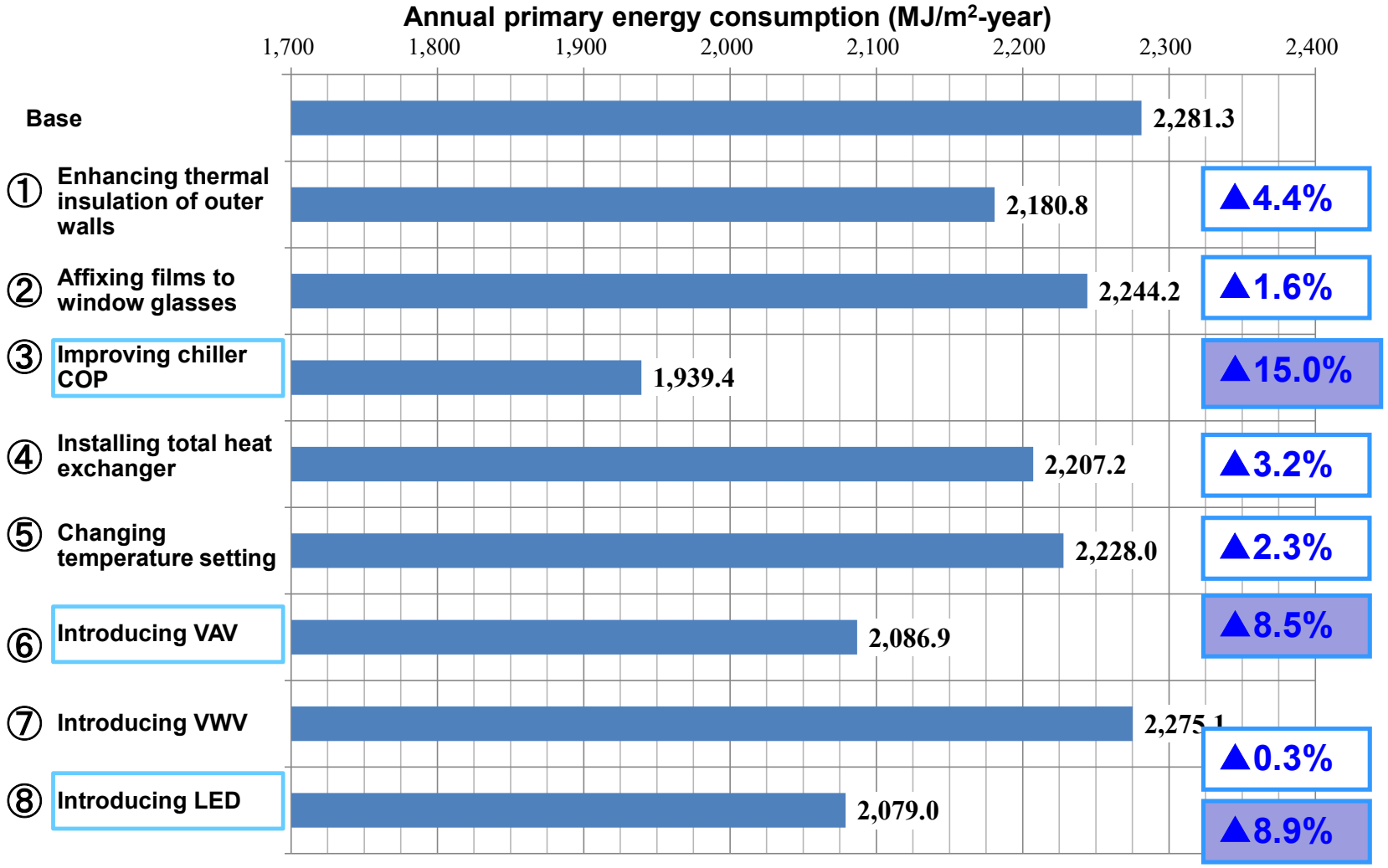
Possible to decide a target energy consumption value to control an energy consumption goal by modeling the building and

Possible to calculate the difference of actual energy intensity caused by climate changes.

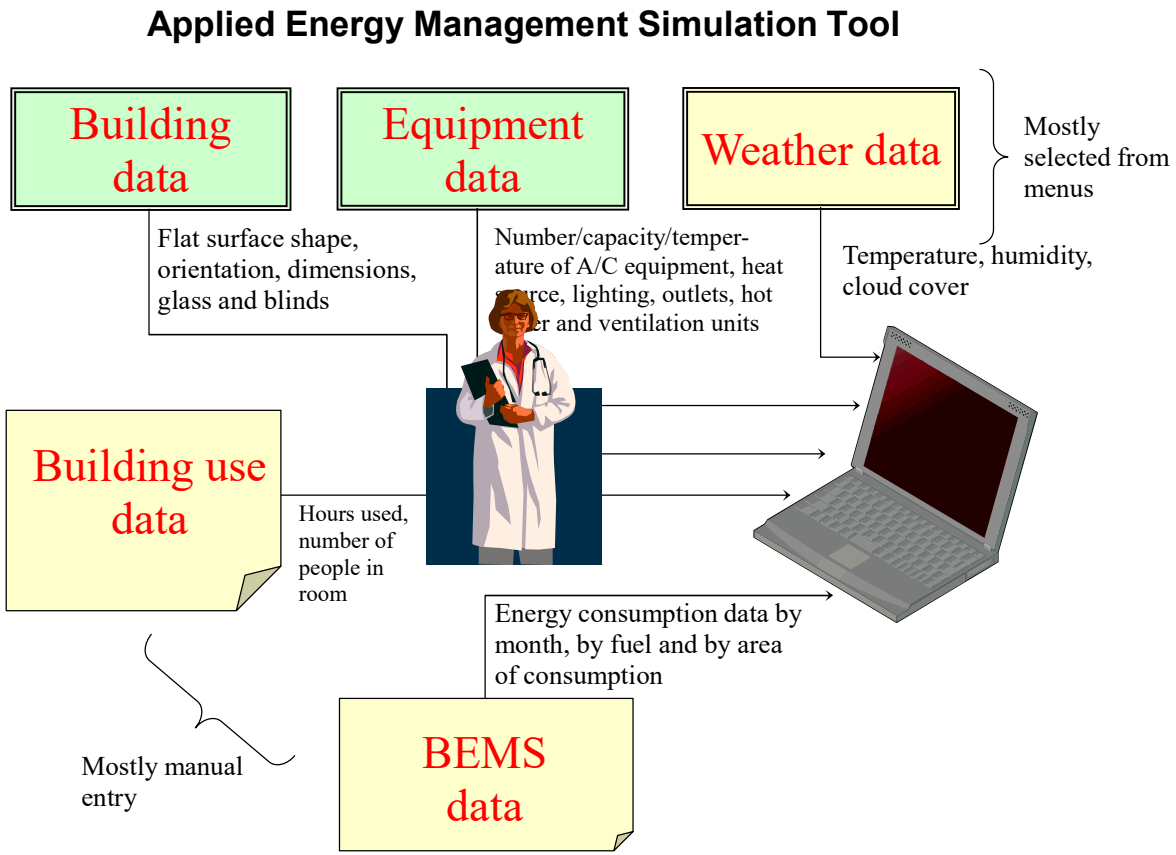
(4) Confirming the operating method

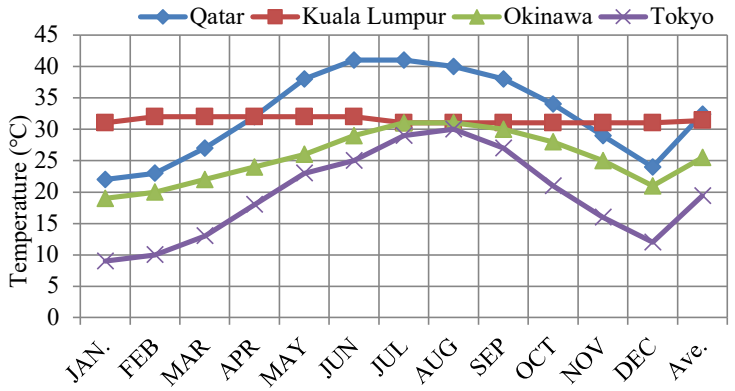
Possible to select various/multiple heat sources and confirming the optimum number of units at that time of the day.

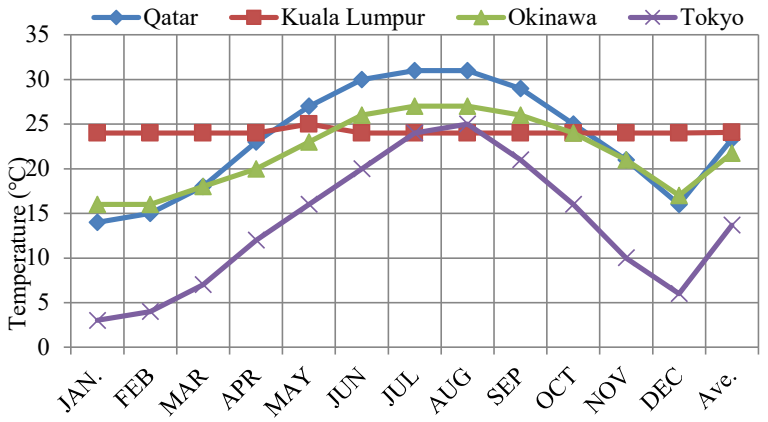
Results of Simulation Analysis of Energy Conservation Measures in Office Buildings



The simulation analysis using the ESUM tool (the building in Qatar)







The simulation analysis using the ESUM tool

•Using Doha climate data and the information gathered during this energy audit, simulation analysis was done to calculate the energy saving potential of this building. The typical energy saving measures were considered in this analysis. The results are shown in Table 18. This simulation study confirm that the following recommended measures in the energy audit in September should contribute much to energy saving of the building.

(1)Raising setting room temperature,
(2)Reducing outdoor air intake,
(3)Replacing to LED and
(4)Installation of the total heat exchanger

Table 18 The results of the simulation analysis

NO.	Item	Energy Saving (%)	
		From June to October	From January to December
SM-1	Rm temp +1℃	2.8%	2.0%
SM-2	Replace to LED lighting (50%)	16.8%	12.2%
SM-3	Install an inverter (VAV)	4.7%	3.4%
SM-4	Reduce outdoor air intake by 25%	3.3%	2.4%
SM-5	Installation of the total heat exchangers	8.0%	5.8%
SM-6	High-efficiency equipment (COPvalue+0.5)	6.2%	4.5%
SM-7	All energy saving measures (SM-1 to SM-6)	36.7%	26.7%

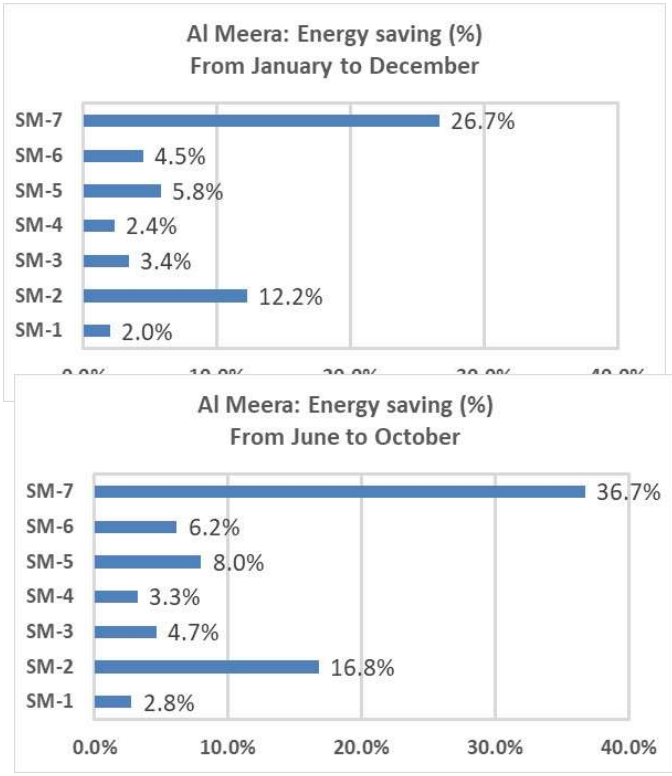
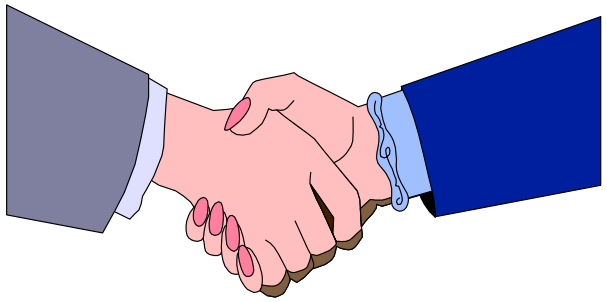


Fig. 18 Energy saving measures and their estimated saving

Thank You Very Much



Symbol of EE&C

SMART CLOVER

Since 2005, ECCJ has been disseminating the Smart Clover, a four-leaf clover which is believed to bring happiness, as a symbol of the persons who are concerned with EE&C .

The Energy Conservation Center, Japan

URL: http://www.eccj.or.jp

3.2 Promotion and dissemination of Zero Energy Houses (ZEH)

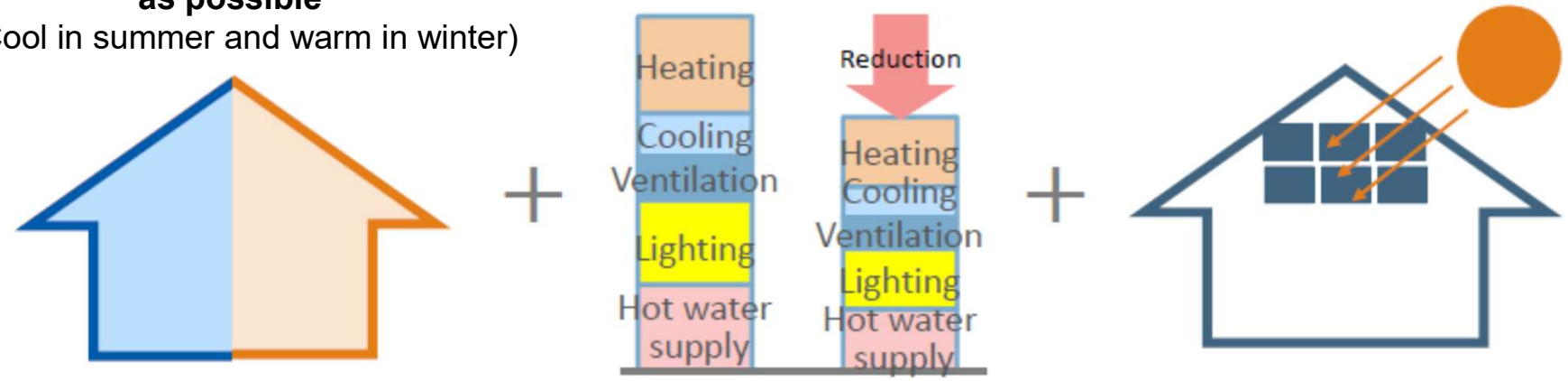
Background of Dissemination of ZEH (What is ZEH ?)

- A ZEH is a house with an annual net zero energy consumption around zero (or less) by saving as much energy as possible while maintaining comfortable living environment. This can be achieved through better heat insulation, high-efficiency equipment, and creating energy with photovoltaic power generation.
- The Strategic Energy Plan (adopted at the Cabinet Council in July 2018) sets the following goals to realize and promote ZEHs.
  - **More than half of newly-constructed custom-built detached houses constructed by housing manufacturers aim to be turned into ZEHs by 2020.**
  - **ZEHs aim to be realized as the average of new residential construction by 2030.**

Require as little energy as possible
(Cool in summer and warm in winter)

More efficient use of energy

Create energy



ETI Website

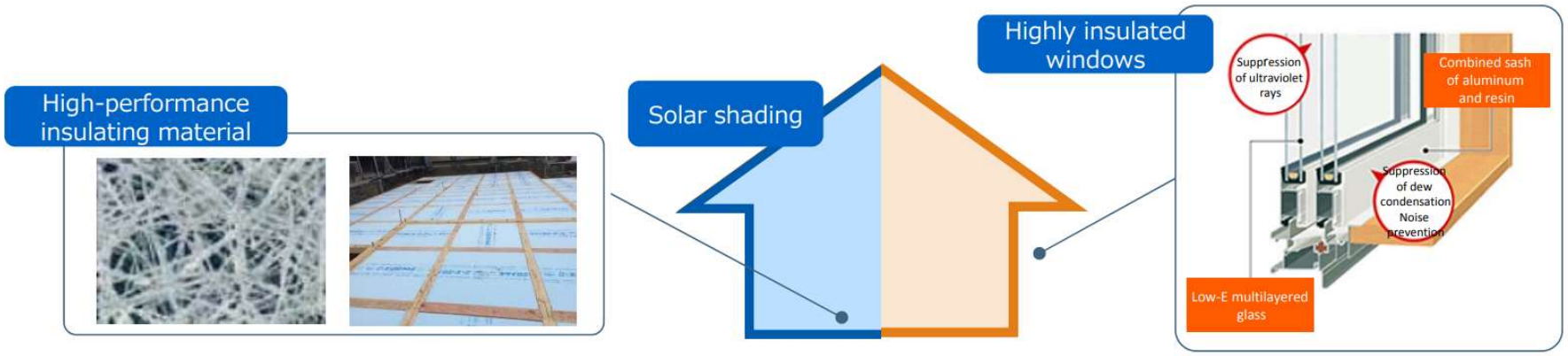
3.2 Promotion and dissemination of Zero Energy Houses (ZEH)

Definition and evaluation methods of ZEH

- To achieve energy savings in the housing sector for the next two to five decades and to create an excellent housing stock, it is important to improve the efficiency of the building envelope, which is difficult to fundamentally improve after completion.
- Therefore, the high insulation standard, which is the reinforced version of the Energy Saving Standard, is adopted as the ZEH standard.

Region category	Region 1 (Asahikawa, etc.)	Region 2 (Sapporo, etc.)	Region 3 (Morioka, etc.)	Region 4 (Sendai, etc.)	Region 5 (Tsukuba, etc.)	Region 6 (Tokyo, etc.)	Region 7 (Kagoshima, etc.)	Region 8 (Naha, etc.)
ZEH Standard	0.4	0.4	0.5	0.6	0.6	0.6	0.6	–
Energy Saving Standard	0.46	0.46	0.56	0.75	0.87	0.87	0.87	–

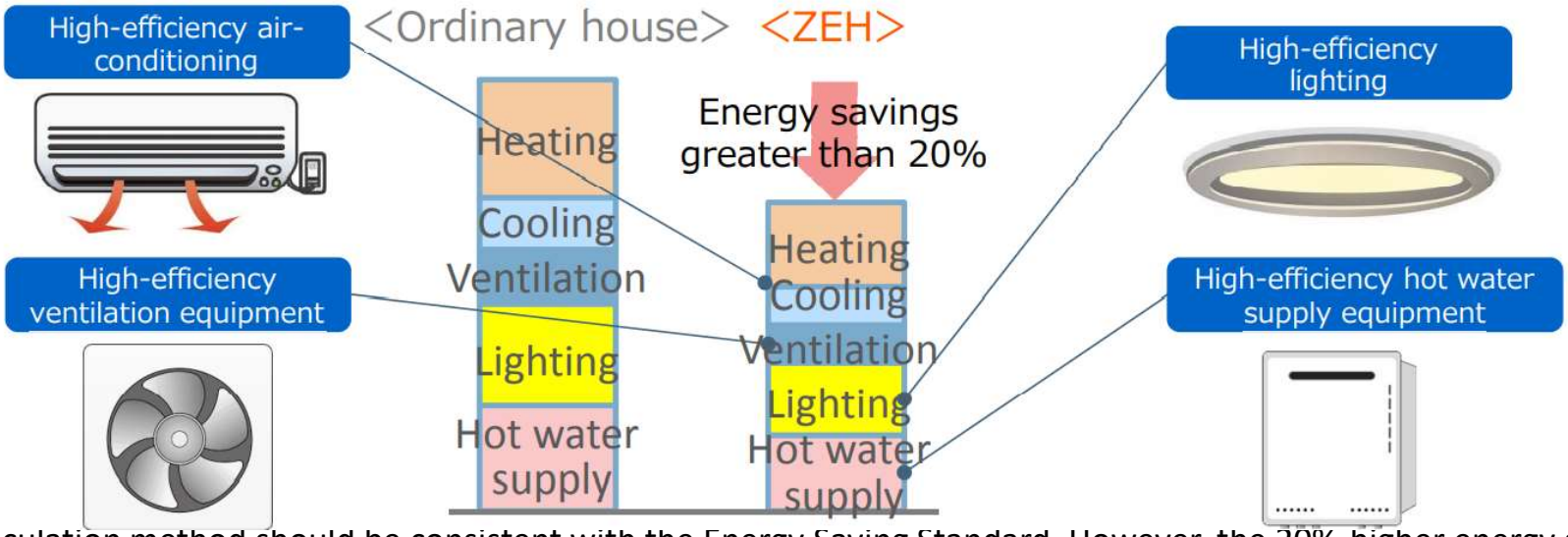
Table: Standards for the average heat transmission coefficient of the envelope (UA value)



3.2 Promotion and dissemination of Zero Energy Houses (ZEH)

Definition and evaluation methods of ZEH

- It is important to improve the efficiency of air-conditioning, ventilation, lighting, and hot water supply equipment to effectively use energy while realizing the “high insulation standard” of the ZEH and maintaining comfortable living spaces.
- The ZEH standard requires energy savings of more than 20% higher than the Energy Saving Standard via better insulation of the building envelope and higher equipment performance.

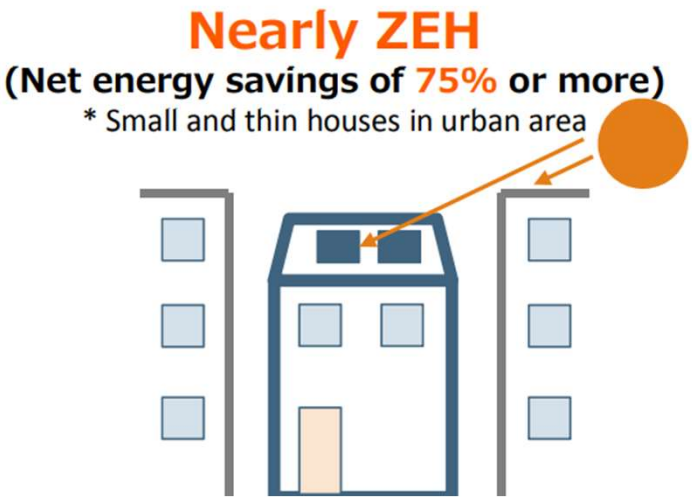


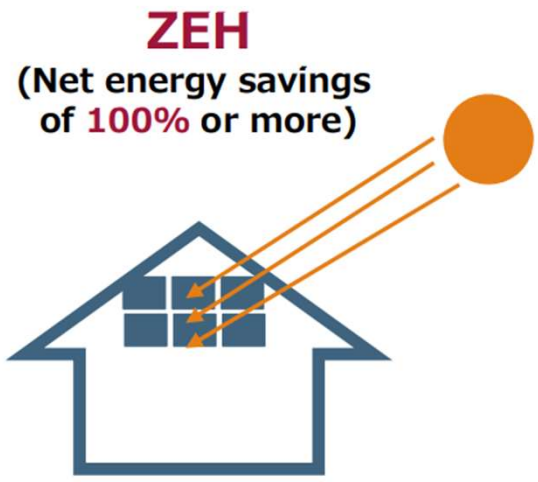
* The calculation method should be consistent with the Energy Saving Standard. However, the 20%-higher energy saving rule applies to air- conditioning, hot water supply, ventilation, and lighting equipment. Although the reduced volume with renewable energy should not be taken into consideration, the reduced volume with fuel cells should be considered if the effect due to the fuel cells (consumption) has been separately calculated.

3.2 Promotion and dissemination of Zero Energy Houses (ZEH)

Definition and evaluation methods of ZEH

- The goal is to achieve a net zero energy consumption by generating energy through photovoltaic power production while adopting “better insulation” and “higher equipment performance” set forth for ZEHs to achieve 20% energy savings.
- For evaluation purposes, houses with small roofs or poor sunshine should be considered in the evaluation even though the potential for energy production is limited.
- If energy savings of 75% of the net value is achieved, the Nearly ZEH status is granted. If energy savings of 100% or more is achieved, the ZEH status is granted. Z

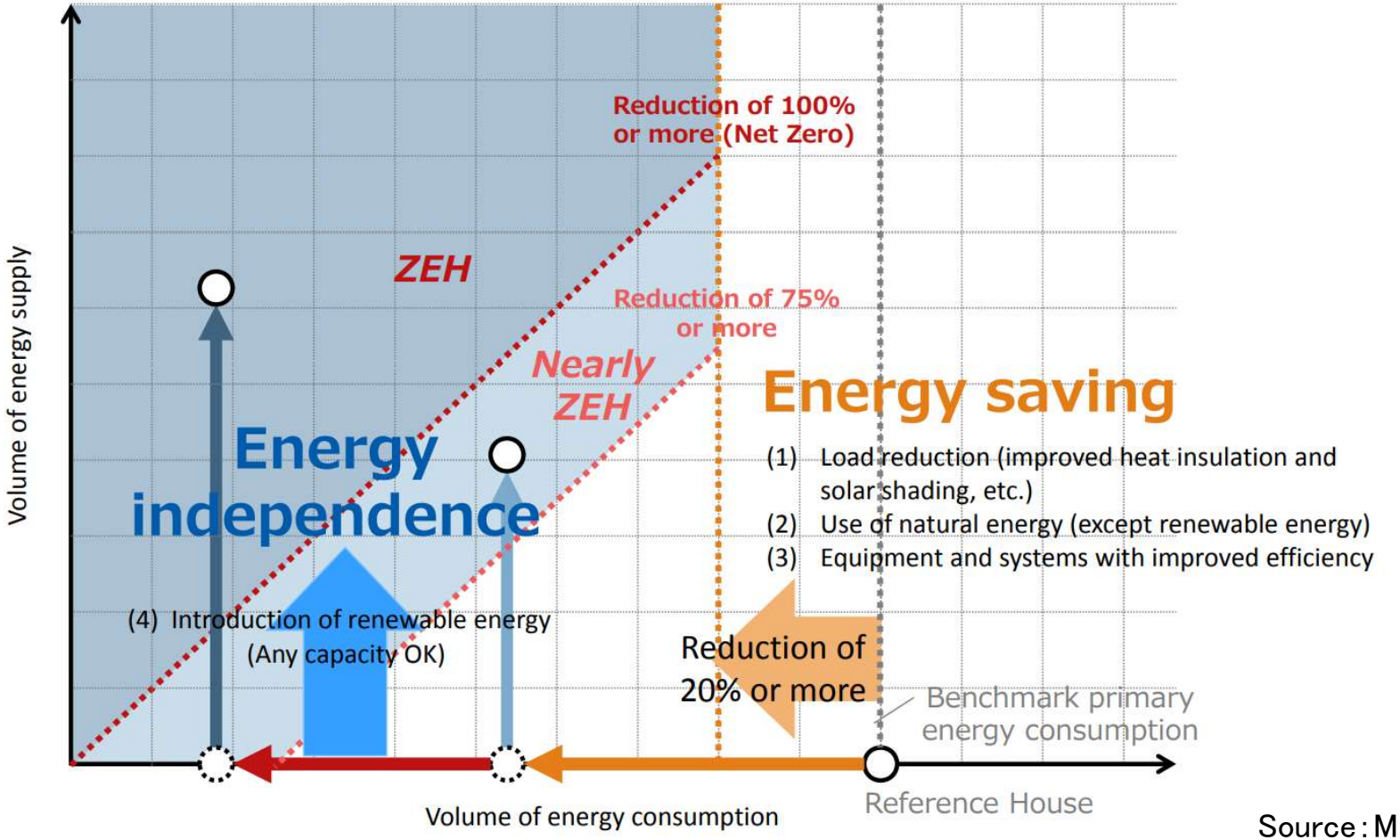




* The method to determine 75% or 100% energy savings should follow the Energy Saving Standard. This rule should apply to air-conditioning, hot water supply, ventilation, and lighting. In addition, while only the part of self-consumption is counted in the Energy Saving Standard, the electricity sale should also be taken into consideration. (However, this is limited to the sale of surplus power in the system of surplus electricity purchase.)

3.2 Promotion and dissemination of Zero Energy Houses (ZEH)

Definition and evaluation methods of ZEH



Source : METI Website

3.3 Progress Status of government target in ZEH / ZEB

■ Although the introduction of ZEH and ZEB is progressing, further efforts are required to achieve the target.

■ Target and progress of ZEH

Target		Progress
～2020	More than half of custom-built detached houses	The number of ZEH units supplied in newly built custom-built detached houses (about 280,000 units) in 2019 is 57,000 units. (20.3%) ⇒ More effort is required to achieve the target
～2030	Average of newly houses	

■ Transitions in the number of units supplied newly custom-built houses of ZEH

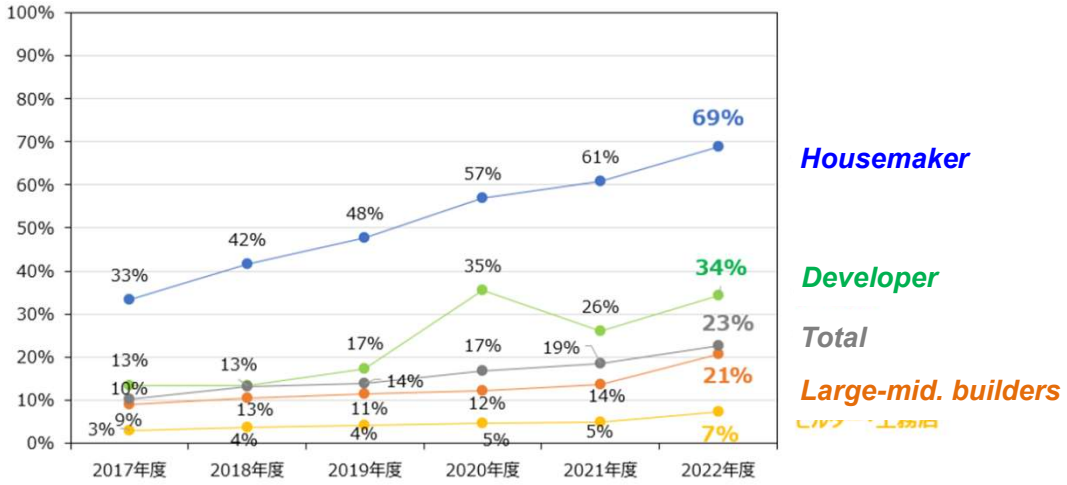


図１　事業者区分ごとの新築住宅全体におけるＺＥＨ化率

Source：METI Website