For ECAP17

ZEB related Best Practices in Japan
From ECCJ's Energy Conservation Grand Prize Award

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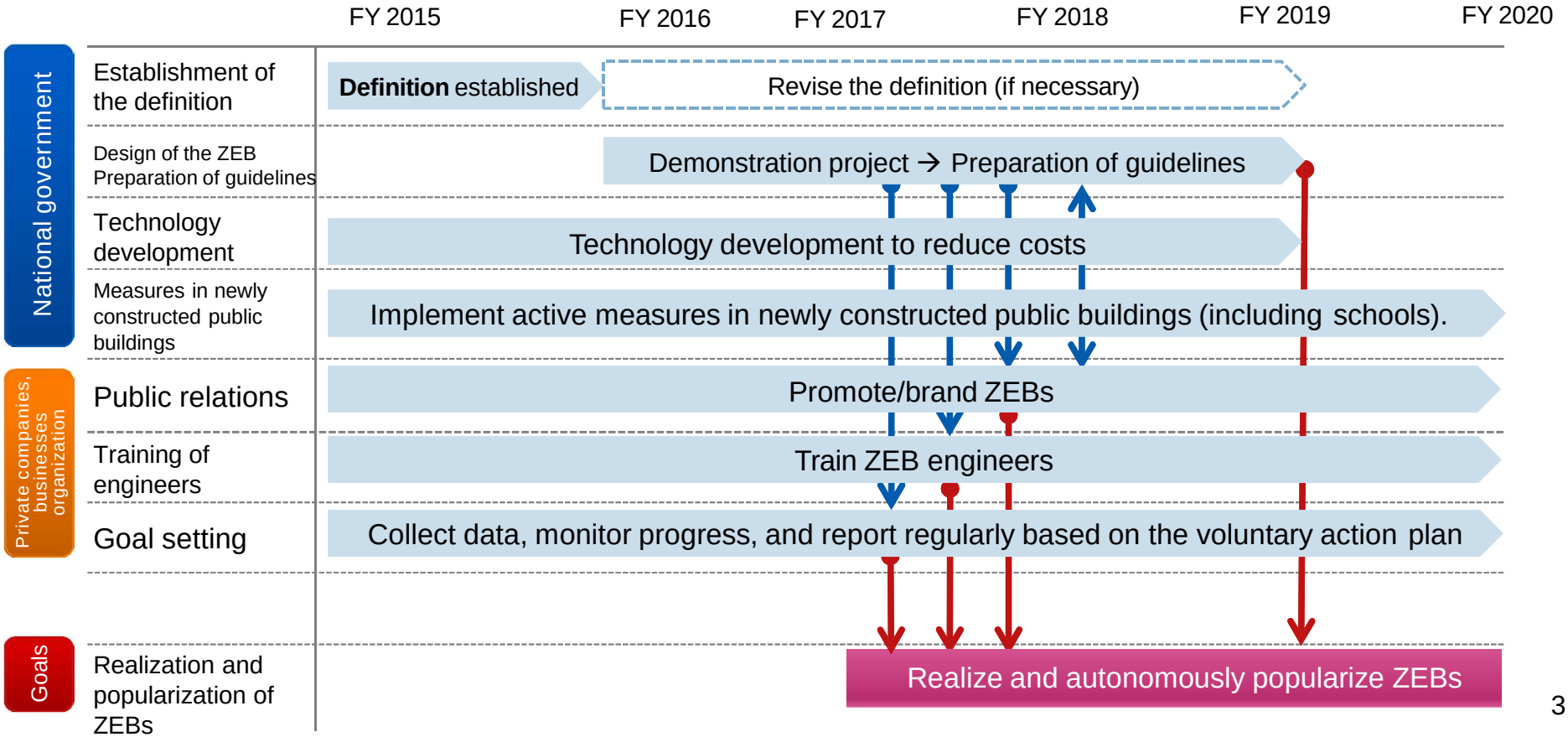
Contents

The ZEB Roadmap – ZEB diffusion schedule for newly build building in Japan

Japan's Strategic Energy Plan (adopted at the Cabinet Council in April 2014) establishes the following goals to realize and promote of ZEBs:

- **Realize ZEBs in newly constructed public buildings by 2020**
- **Realize ZEBs in average newly constructed public and private buildings by 2030**

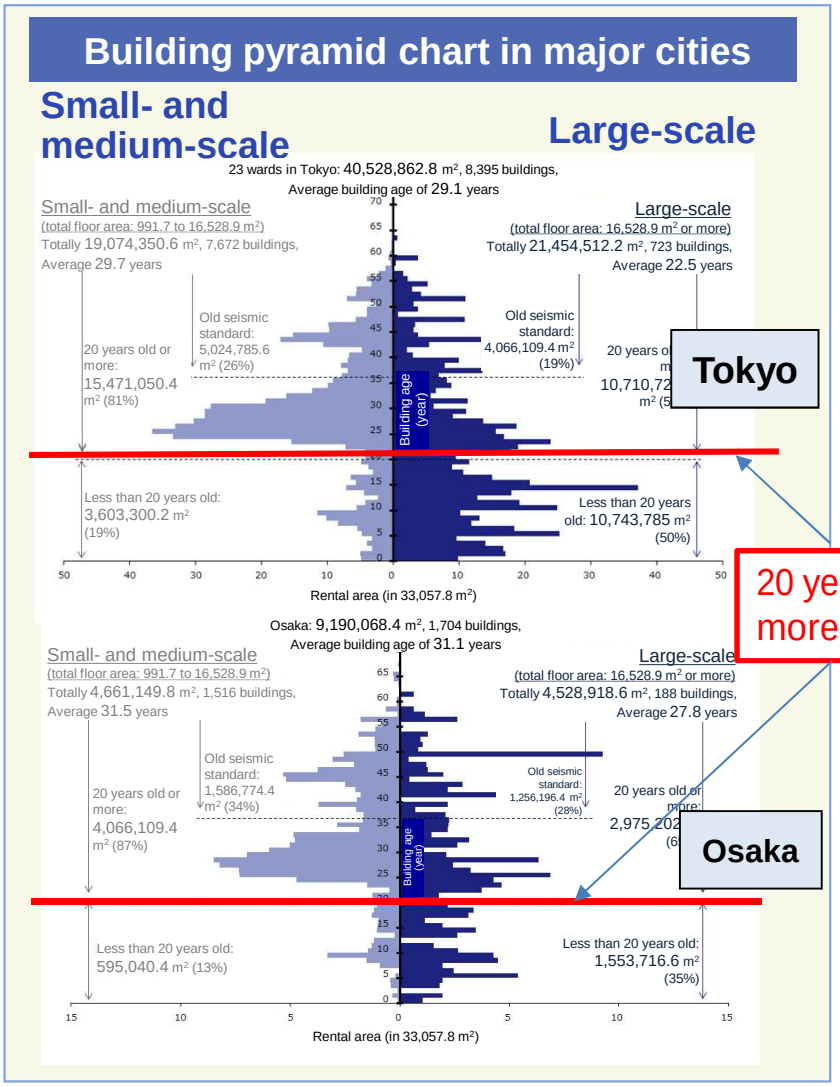
<The ZEB Roadmap>



Current Situation of Existing Buildings and Recognition of Problems

➢ **Promotion of EE&C in small- and medium-scale buildings is future target**

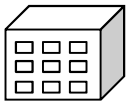
Building pyramid chart in major cities



20 years old & more

Features of the buildings across the country

Small- and medium-scale buildings



- Cases 95% of the whole
- Area 60% of the whole
- No resident building manager
- Many renewed buildings

Large-scale buildings

- Advanced introduction of BEMS
- Resident energy manager

Energy management of current small- and medium-scale buildings

- No resident manager, backward energy reduction
- Many buildings are renewed in the bubble economy period

High energy reduction potential

* Source: Website of XYMAX Corporation

Contents

Office Building Cases
(Large-scale New Buildings, Small- and Medium-scale Existing Buildings)

DAIKIN's approach (1)

Location : Settsu, Osaka
Type of building : Office/laboratory
Structure, stories : S/SRC construction
6 stories above ground, 1 basement, 2-story penthouse
Total floor area : 47,911.86 m^2
Completed in : Nov. 2015

LEED "Platinum"

CASBEE "S rank"

Energy consumption result
(Apr. 2016 to Mar. 2017)
Nearly ZEB (90% reduction)

DAIKIN's approach (2)

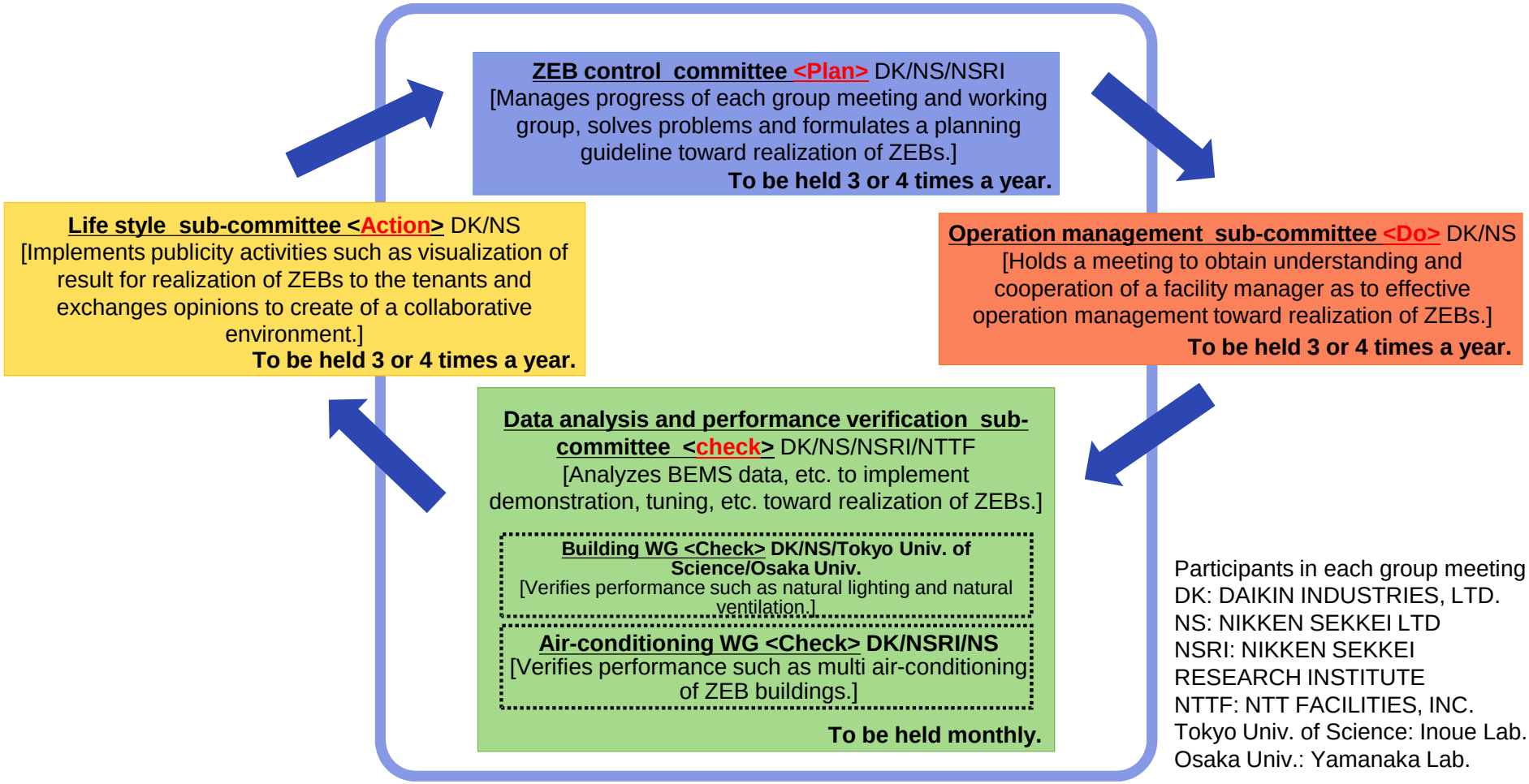
Location : Hakata-ku, Fukuoka
Type of building : Office
Structure, stories : S construction
4 stories above ground, 1-story penthouse
Total floor area : 2,620 m^2
Completed in : Sep.1996
Renewed in : May, 2017

BELS "ZEB Ready"

Energy consumption result
(Jun. 2017 to May, 2018)
ZEB Ready (67% reduction)

Energy Management Structure (Approach (1))

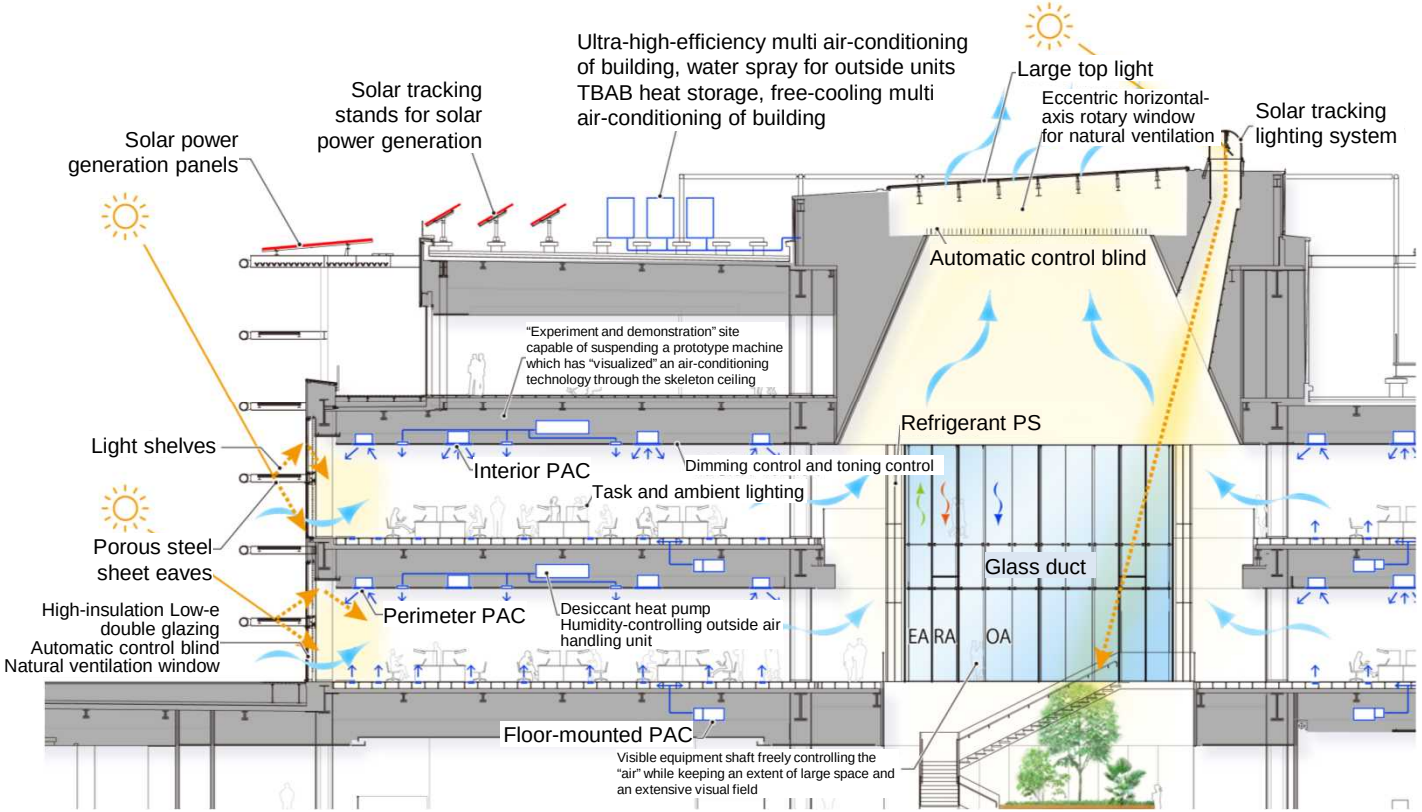
- Establishment of a performance verification system immediately after completion.
- Promotion of a PDCA cycle participated by operation managers, users and researchers.



Participants in each group meeting
DK: DAIKIN INDUSTRIES, LTD.
NS: NIKKEN SEKKEI LTD
NSRI: NIKKEN SEKKEI RESEARCH INSTITUTE
NTTF: NTT FACILITIES, INC.
Tokyo Univ. of Science: Inoue Lab.
Osaka Univ.: Yamanaka Lab.

Overall Office Plan (Approach (1))

- Aims at both **EE&C** and **comfort** as a progressive advanced technology laboratory.
- Obtained **LEED-NC Platinum, CABEE S rank**.
- Establishment of evolved air-conditioning technologies by **making maximum use of natural energy.**
- Constant commissioning by an office worker (AC technology developer) thanks to the **real-time visualization of the on-going situation**
- Rational location of the shaft while maintaining openness with the glass duct



Platinum 85/110

Summary (Approach (1))

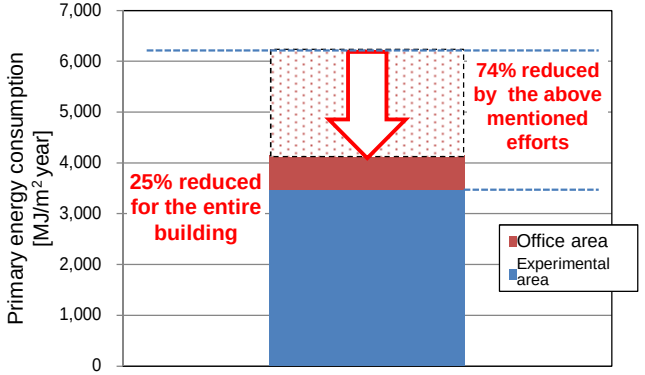
Advanced nature and originality

- **Collaboration of an air-conditioner manufacturer and a building equipment designer from the design phase**
- **Early marketing of an excellent product by running the PDCA cycle at site**
- **Development and introduction of a system allowing verification by real-time comparison with** the energy consumption result **to accelerate commissioning** and to continually feed back the result to technological development

EE&C performance

- Evaluation of the office area based on the FY2013 Energy Conservation Act standard
  Annual primary energy consumption: **145 MJ/m^2 year**
  Reduction rate: 90% (electric outlets excluded) = Nearly ZEB
  * Reduction rate: 74% (electric outlets included)
- **Crude oil equivalent reduction** for the entire office area: **737 kl/year**

* With operating time correction



* Entire building with no operating time correction

Versatility and expandability

- **Available for non-office buildings due to high versatility and expandability**
- **Capable of contributing to reduction of greenhouse gas emissions on a world scale** owing to globally expanded sales of the product

[Expected merit by diffusion of the technology (Annual)]

Fiscal year	2017	2020	2025	2030
Reduction (crude oil equivalent) (in 10,000 kl/year)	0.075	3.90	20.0	133

Improvement and sustainability

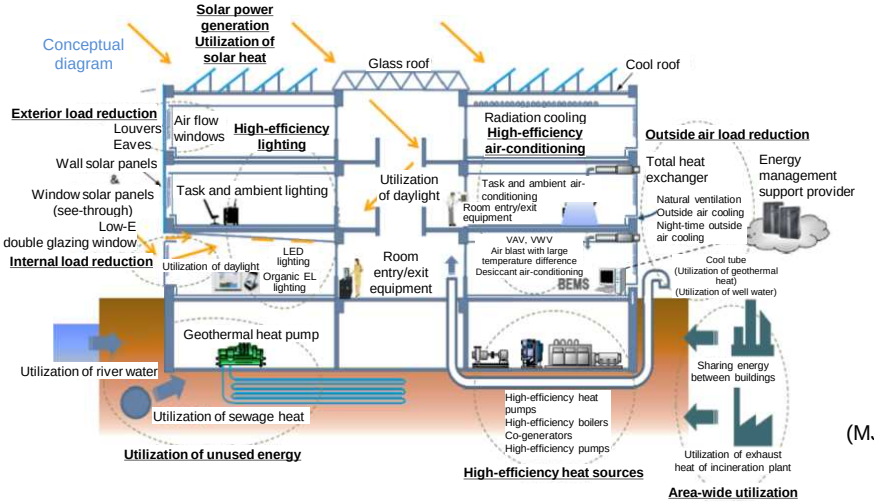
- Maintain the management structure by the persons concerned such as designers, facility managers and air-conditioning development engineers to **continue operational improvement toward realization of ZEBs.**

Standard ZEB for Small- and Medium-scale Buildings (Approach (2))

➢ Promotion of dissemination of ZEBs by “Equipment Renewal with Versatile Technology”

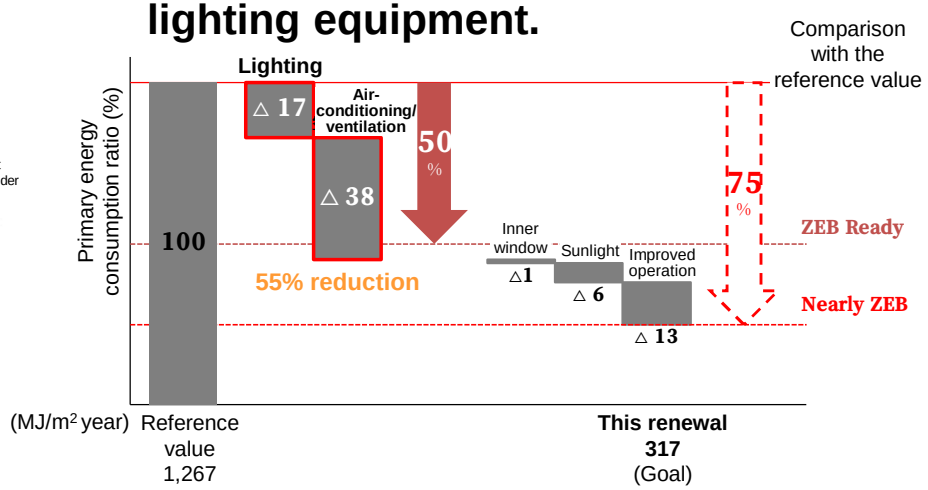
[Conventional technology for realizing ZEBs]

Difficulty because of many required element technologies



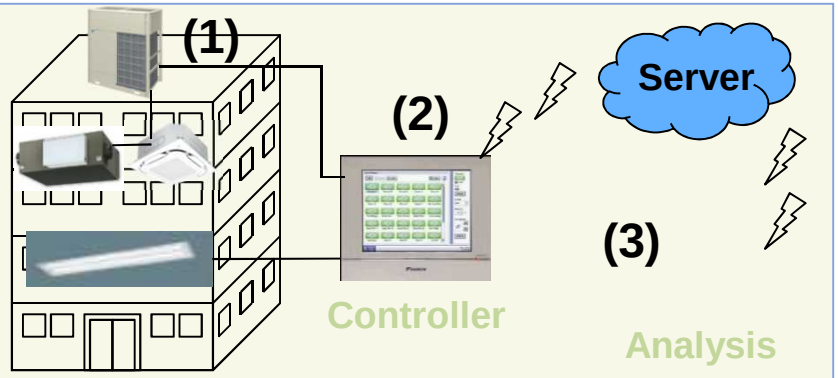
Goal for realizing ZEBs

To achieve ZEB Ready only by renewing the air-conditioning/ventilation and lighting equipment.



Features of ZEB-oriented renewal

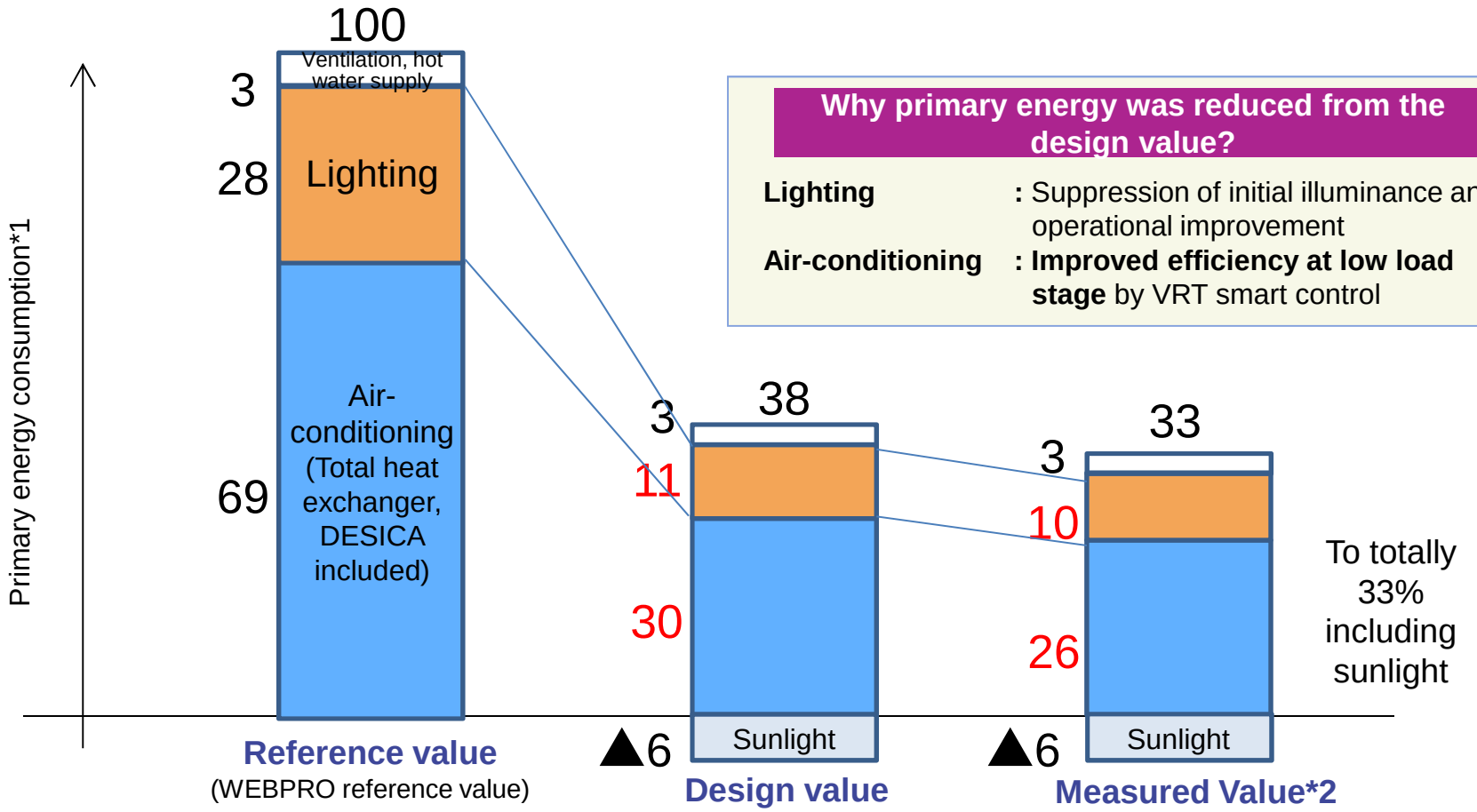
(1) AC system with separation of latent heat and sensible heat
(2) Batch control of air-conditioning/ventilation & lighting
(3) Selection of optimum capacity by a remote monitoring system



Summary of Approach (2) (Reduction of Primary Energy Consumption)

Actual result was 67% reduction against the design value which is 62% reduction to the referential value(including solar power generation).

Lighting and solar power generation were as initially designed, and air-conditioning/ventilation was further reduced from the design value.



*1 ZEB evaluation does not include power consumption by electric outlets.

*2 With operation time correction (results between Jun. 2017 and May, 2018)

ZEB-oriented Renewal of Equipment at 3 Welfare Facilities for Elderly Peoples by Social Welfare Corporation

Okayama Central Welfare Association
14 business establishments, No. of employees: 423

1. Points

- Renewal of equipment under insufficient funds → Not simple renewal, but realized by introduction of energy-saving equipment (payout period ≤ equipment service life)
- Implementation of the measure including a change in equipment operation → Realization of an ESCO project establishment scenario
- Elaborate renovation and operation in line with individual features of the buildings

2. Total Effect

* Nursing home, nursing healthcare facility and low-cost nursing home

- **EE&C effect**
  Before renovation: 21,551 → 14,403 (▼7,148 GJ/year, Energy conservation rate: ▼33%)
- **EE&C investment efficiency**
  Total investment: ¥119,000,000
  Annual energy conservation amount: ¥15,000,000
  Simple payout period: 7.9 years

Features of EE&C Measures of Each Facilities

(1) Nursing home	➢ **ESCO project** ➢ Initially figured impossible to launch the ESCO project in the feasibility study, but materialized by a plan including a change in the scrupulous operating conditions. ➢ Renovated equipment without increasing utility charges. ➢ Also reduced equipment maintenance cost. ➢ **Combination of the solar panels and heat pump water heating system** 
(2) Nursing healthcare facility	➢ **Realized an all-electric nursing home.** ➢ **Introduced fully LED-based lighting and total heat exchange ventilation fans.** ➢ **Heavy oil-A boiler → Heat pump oil feeder** 
(3) Low-cost nursing home* * Rental house with nursing care support	➢ **Introduced double glazing and high-efficiency air-conditioners in order to reduce utility charges.** ➢ Cost reduction by renewal to energy-saving and high-efficiency equipment ➢ Utilization of a subsidy ➢ Improved amenity and lower utility charges paid by the residents ➢ **Introduction of the BEMS** ➢ Introduced a demand controller. ➢ Capable of responding to a demand control instruction from the outside. 

Renovation and EE&C Results

Renovation	Residents, day care users/day	Equipment after renovated * Renovated equipment indicated by red bold letters.					
		Window	Air-conditioning	Hot water supply	Ventilation	Lighting	Others
(1) Nursing home	80 residents, 7 day-care users	Single glazing → **Vacuum double glazing**	Ice heat storage chiller → **Multi air-conditioner (motion detector)**	Kerosene boiler → **Solar heat pump water heater**	Regular ventilation (invariable)	**Communal area:** Fluorescent lamp → **LED**	Solar hot water system
(2) Nursing healthcare facility (Rehabilitation center)	80 residents, 56 day-care users	Single glazing	**Multi air-conditioner (invariable)**	Heavy oil-A boiler → **Heat pump water heater**	Regular ventilation → **Total heat exchange ventilation fan**	Fluorescent lamp → **LED**	
(3) Low-cost nursing home	50 residents, None	Single blazing → **LOW-E double glazing**	Communal area: Multi air-conditioner → **Same (motion detector)** Private room: Air-conditioner (invariable)	Kerosene boiler → **Heat pump water heater**	Regular ventilation (invariable)	**Communal area:** Fluorescent lamp → **LED**	Solar hot water system → **Solar power generation (all power sold) BEMS**

<Effect of reduced energy consumption (GJ/year, year)>

* Simple payout period refers to an amount including a subsidy.

	Before renovation (GJ)		After renovation (GJ)		Energy conservation rate	Simple payout period	Remark
(1)	8,210	(2010)	5,087	(2013)	**38%**	**6.3**	10-year ESCO contract
(2)	8,172	(2011)	5,782	(2013)	**29%**	**9.9**	Initially no demand reduction effect. Now, intensifying demand monitoring to address operational improvement.
(3)	5,169	(2012)	3,534	(goal)	**32%**	**9.5**	Currently under energy measurement due to completion at the end of FY2013.

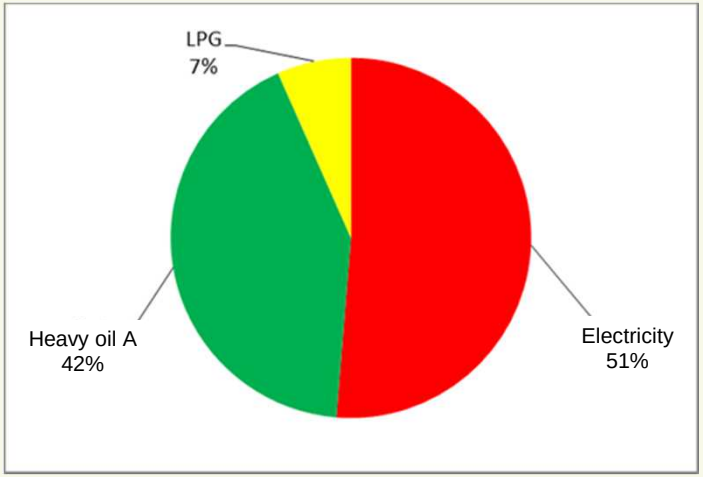
Realization of ZEB at Golf Course

Facility Overview

Name : Five Eight Golf Club
Location : Yaita, Tochigi
Usage : Club house of the golf course
Building overview : Total floor area 3,928 m^2, completed in 1987
Site : 94 ha, forest area 47 ha

Background

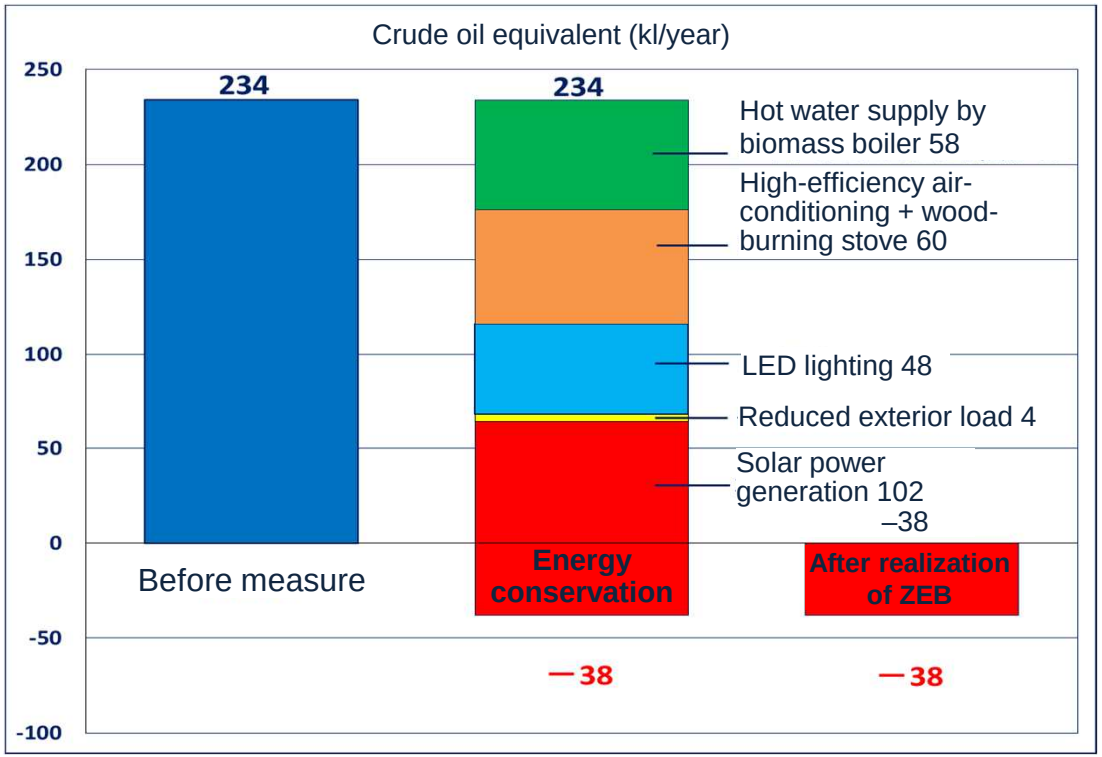
- **Needs for local production and consumption of energy and food (realization of ZEBs)**
  - Designated as a shelter at the time of Great East Japan Earthquake, but failed to function because of supply shortage of heavy oil A for hot water supply/heating.
    Reference: High consumption of electricity, heavy oil A, etc.
    (Energy ratio in management cost: 20%)
  - Energy price hike
- **Needs for promoting disposal of constant forest thinnings**
- **Adverse effect and higher cost due to aged equipment**



Specific Measures for Realization of ZEB

Item	Introduced system	Description
Improved performance of exterior surface	**Low-E double glazing**	Shield solar radiation and reduce heat conduction by means of Low-E double glazing to realize indoor amenity.
Introduction of EE&C system	**Biomass boiler**	Supply hot water by a biomass boiler, using forest thinnings produced at the golf course as fuel. (Zero consumption of heavy oil A after taking the measure) --- J-credit certification
	High-efficiency air-conditioning	Introduce individual air-conditioning equipment available for partial use and high-efficiency heat pump type air-conditioning, and carry out air-conditioning start-stop control by a motion detector as a further energy conservation measure.
	LED lighting	Replace all the fluorescent lamps and incandescent lamps with LED lighting. Carry out lighting control by a motion detector as a further energy conservation measure.
	BEMS	Implement visualization of energy by the BEMS. Reduce unnecessary energy consumption by confirming power consumption status for each line.
Introduction of energy creation	**Solar power generation**	Annual power generation: 403,693 kWh/year

EE&C Result



➢ Versatility and expandability of this case are as follows.

- ➢ Model case of ZEB-oriented improvement among golf courses
  → Replicable case approx. 2,400 golf courses across the country
- ➢ Potential effect when spread to all the facilities in Japan
  260 kl/location x 2,400 locations = **620,000 kl worth of energy conservation in terms of crude oil equivalent**

Challenge of Business Type Conversion after Closing the Golf Course

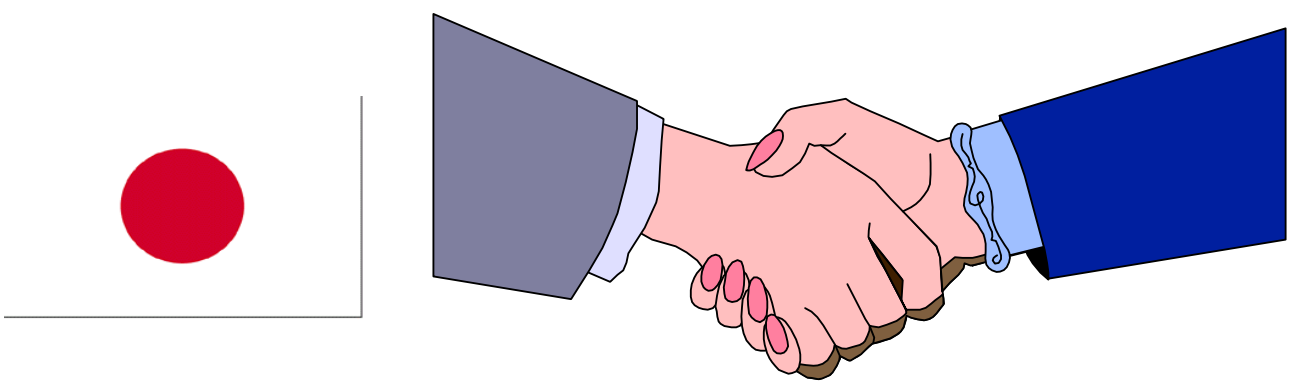
- After closure in 2016 due to a declining demand, etc., this golf course has been rented for mega solar power generation company. (Total area: 65 hectares)
  (Power scale: 300 kW at the time of closure → Currently 41 MW)
- Promotion of using untapped forest thinnings as energy (subject of J-credit certification)
  (Established a local council including golf course owner, forest owner, etc.)
- Development of a restaurant (old club house), campground, “marche*” i.e. a kind of “free market”, food education farm, etc. in cooperation with the local community

Focus on environmentally-friendly natural entertainment by making use of approach at the golf course.

* Additionally rolling out mobile wood-burning biomass boilers (3 kW) overseas (For Laos).

* Marche:Means a market in French. Based on the concept of hand-made and local production for local consumption, this event aims at exchange with and activation of a local area and recommends a sustainable life style in consideration of health and environment.

Thank You Very Much



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)
https://www.jase-w.org/

The Energy Conservation Center, Japan
Since 1978

Symbol mark of energy conservation
SMART CLOVER

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.