Promotion of ZEB Renovation Projects in Existing Buildings

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Current State of ZEB Renovations in Existing Buildings

1 Less existing buildings take the ZEB route than new construction

Why?

Reasons

1. ZEB has not penetrated to the owners and top management of existing buildings
2. Many people believe that a reduction rate of 50% or more on existing building renovations is difficult
3. There are not enough building drawings and equipment drawings etc. required for web performance calculations
4. There is a worry that large-scale renovations will interfere with business
5. The capital investment will increase with a large-scale renovation
6. The partial renovation of existing facilities has been completed, making it difficult to convert to ZEB
7. For large-scale renovations, it is difficult to choose partial renovation
8. Removal work ⇨ Removal and loading work adjusted to renovation times (high cost)

Considerations

1. A reduction rate of more than 50% on ZEB criteria for existing renovations is not difficult to achieve

2. Old style air conditioners and lighting ⇒ Power consumption of 50% or less with latest energy-saving models

Buildings built more than 15 years ago should be updated as soon as possible

3. Maintenance costs due to faults and repairs will soar

Life cycle costs (lifetime costs) are higher with partial repairs

4. It is time to update the facilities in buildings that were built more than 15 years ago

Should consider ZEB renovation

2 Outline of ZEB renovation projects handled by our company for existing buildings

	Name of Building	Year	Floor Area (㎡)	Use	Age (years)	Region Class	Reduction Rate (%)	
							Not incl. PV	Incl. PV
1	Home Center Brico Kera Store	2014	2,481	Market	19	7	51.4	52.9
2	Onomiso Special Elderly Nursing Home	〃	2,765	Nursing Home	22	6	51.4	54.7
3	Aonoyama Special Elderly Nursing Home	2016	3,601	Nursing Home	23	6	57.1	62.2
4	Home Center Brico Sanbashi Store	〃	3,753	Market	19	7	57.2	62.5
5	Yamasaki Orthopedic Hospital	2016-2017	4,193	Hospital	44	5	51.6	52.8
6	Sawarabi Long-term Care Welfare Center	2017	3,927	Nursing Home	23	7	52.3	54.3
7	Tosa Seifuen Special Elderly Nursing Home	〃	4,046	Nursing Home	17	7	53.9	56.8
8	Kochi Joto Hospital	2017-2018	10,716	Hospital	36	7	51.5	52.2
9	Joseikan	2018	11,944	Hotel	24	7	55.5	56.0

* Of the 19 ZEB cases from the 2014 supplementary budget to 2018, 9, or about 50% were ZEB renovations of existing buildings
* ZEB renovations are possible on existing buildings, regardless of the building use
* There are many existing buildings whose statutory useful life has passed more than 15 years, and are ready for renovation

3 Requirements and Reasons for ZEB Renovations

1 Architectural drawings are available (confirmation certificate, completion drawings, record drawings) etc.

Outer wall web performance (PAL*) can be calculated

2 Facility drawings are available (electrical work, machinery and equipment construction, record drawings)

ZEB conversion plans are simple to set up

3 Understand overview of renovated facilities

Determine whether energy-saving equipment can be reused (update if not energy-saving)

4 Owner cooperation system

ZEB renovation construction will take place while maintaining facility sales

It is essential that construction take place with response to residents and a cooperation system for the construction period

5 Cooperation on site surveys

Many inconsistencies between completion drawings and actual finished work (changes after completion)

⇨ Need to understand actual condition before a renovation

6 Organization of ZEB Promotion Committee

Organization of a project promotion system is essential (owners, managers, planners, persons in charge of design etc.)

7 Time availability

Site survey and implementation design take a long time

⇨ Not compatible with the assistance application schedule in the case of Japan

8 Other structural or aesthetic limitations of the existing building

Confirmed issues with the installation of solar power generation and solar heat use equipment etc.

Approach of ZEB Proposals to Building Owners

ZEB Renovation of Existing Buildings – Process Flow

1 Deepen understand of owners of ZEB projects

Understand important matters necessary for ZEB conversion

2 Organize ZEB Promotion Committee

Consultation on work sharing and schedule etc.

3 Construction drawing confirmation — **Very different from new construction**

(Confirmation Certificate, Completion Drawings, Record Drawings)
Obtain CAD data

4 Facility drawings confirmation — **Very different from new construction**

(Electrical work, machinery and equipment construction, record drawings)

5 Site survey — **Very different from new construction**

Check the difference between state before renovation and record drawings (architectural drawings and equipment drawings), and prepare drawings of state before renovation

6 Review outline of renovation plan for ZEB conversion

Outer wall performance, air conditioning, ventilation, lighting, hot water supply, elevators, BEMS, energy-saving

7 Determine building outer wall performance

PAL *values below standard value of Energy Conservation Act

Consider measures to strengthen insulation

8 Prepare design drawings by usage category

Calculation of energy consumption by application
(reference value, design value, BEI value)

Many haven't achieved ZEB

9 Prepare additional and modified design drawings

Recalculate energy consumption by application
(reference value, design value, BEI value)

ZEB Achieved

10

Prepare ZEB Project Plan → Report to Officers → Project Approval

11

Grant application submission → Adoption → Construction

12 Process Meeting

Very different from new construction

Meeting on practical measures such as construction plan, implementation process, cooperation requests etc.
Need to consult on safe and detailed construction management

13

Minor Changes → Check Energy-Saving Performance from Changes → Prepare Construction record

14

BELS certification
ZEB reading, owner registration

15

Construction Completion → Performance Report Submission → Project Completion → Subsidy Payment

16

Implementation Report Submission → Improve through PDCA Cycle

Issues in ZEB Renovations of Existing Buildings

Issues for the ZEB renovation of existing buildings

1 Difficult to improve outer wall performance — Very different from new construction

- Difficult to renovate insulation in outer walls
- Reinforce roof (ceiling) insulation and use multi-layer window glass

2 Reuse existing equipment — Very different from new construction

- Update to energy-saving equipment?
- Consider residual book value, durability and frequency of use

If not energy saving → Update

3 Reuse existing pipe and wiring construction — Very different from new construction

- Determine whether piping and wiring duct materials can be reused
  ⇒ If durable, reuse and partially renovate

4 Air Conditioning: Air conditioning improvement is a key point as the greatest consumer of energy

- Often the capacity of existing equipment is too large
  ⇨ Appropriate equipment capacity
- Recover heat dissipation loss through ventilation
  ⇨ Introduce complete heat exchange ventilation

5 Hot Water Supply: Difficult to reduce hot water supply energy

・Use eco hot water supply and solar heat (particularly for nursing homes, hospitals and hotels etc.)

6 Lighting: Update to LED lighting

・Automatic controls such as brightness sensors, human sensors and scheduled timer controls etc.

Very different from new construction

7 BEMS: Measure potential of existing boards and wiring systems etc. by application

Boards for renovation or new construction ⇨ Measure by application

Very different from new construction

8 Request presentation of running cost reduction

・Calculate running cost reduction against previous year actual performance by type of energy

Verification of the Effectiveness of ZEB Renovations of Existing Buildings

1 Relationship between the Web calculated primary energy reduction rate and running cost reduction rate

In the case of a reduction rate of 50%, the running cost reduction is not 50%

Request presentation of reduction of running costs

2 Running cost reduction calculation (calculation is not necessary for ZEB project application)

Calculate running costs by type or energy (electricity, oil, gas) by application category

3 Ventilation facility and other (OA equipment) energy consumption can be difficult to measure

Most existing buildings have power supplied from electric socket outlets (shared wiring with other equipment)

4 Actual Evaluation Method: Manage measurements on the computer by month for each application category (reference value, design value, actual value, achieved rate etc.)

ZEB Promotion Committee in Japan analyzes monthly and annual reports and makes improvements through the PDCA cycle.

Approach Utilizing Local Government Policies

Important to broadly spread awareness through cooperation with local governments etc.

Kochi Prefecture New Energy Promotion Division

- Holding various meetings, training sessions and presentations to promote the spread of new energy
- Subsidies to welfare facilities (evacuation centers), hospitals and clinics (rescue hospitals, medical aid centers)

  Solare power generation and storage battery assistance (1/3, up to 5 million yen)

Kochi City New Energy Promotion Division

- Holding various meetings, training sessions and presentations to promote the spread of new energy
- Subsidies to ZEB selected sites

  Solare power generation and storage battery assistance (planned from 2019, Subsidy rate of 1/6)

Value of ZEB in Planning

1 Emphasis on a building's life cycle cost (LCC: lifetime cost)

LCC = (Initial Cost) + (Running Cost) + (Repair Cost etc.) + (Disposal Cost etc.)

2 LCC is more than 4 times the initial cost ⇒ Reducing running costs reduces the LCC

ZEB is the most effective way to lower LCC ⇒ Cost-effectiveness is high ⇒ Value of introduction is high

3 Energy resources are scarce in Japan ⇒ Future energy prices will inevitably rise

Primary energy reduction ⇒ Reduction in rise range of water and utility costs ⇒ Safer, and insurance for the future

4 ZEB ⇒ Reduce ordinary expenses ⇒ Use surplus money for new services and improvements

5 ZEB ⇒ Contribute to the global environment ⇒ Improved employee consciousness and great social contribution

6 ZEB ⇒ Running cost reductions you can see ⇒ Repeat and introduce other facilities etc.

Example of a Case Study

(Yamazaki Surgical and Orthopedic Hospital)

Project outline **Fiscal 2017 Subsidy for expenses for promotion of introduction of innovative energy-saving technology for houses and buildings (Verification project of Net-Zero Energy Building)**

Name of the subsidized project	Yamazaki Surgical and Orthopedic Hospital ZEB development project	Name of the subsidized business operator	Medical Corporation Sanshukai

[Hot water supply equipment]

- Heat pump water heater (15 kW)
- Hot water storage unit for the above (560 L)

* Eco-friendly hot water supply system for business use comprised of a heat pump and a hot water storage tank unit
* Leveling of peak load by heat storage, utilization of midnight electric power and high-load high-efficiency operation
* The existing and renewed latent heat recovery type gas water heater shall be reused.

[Air conditioning equipment]

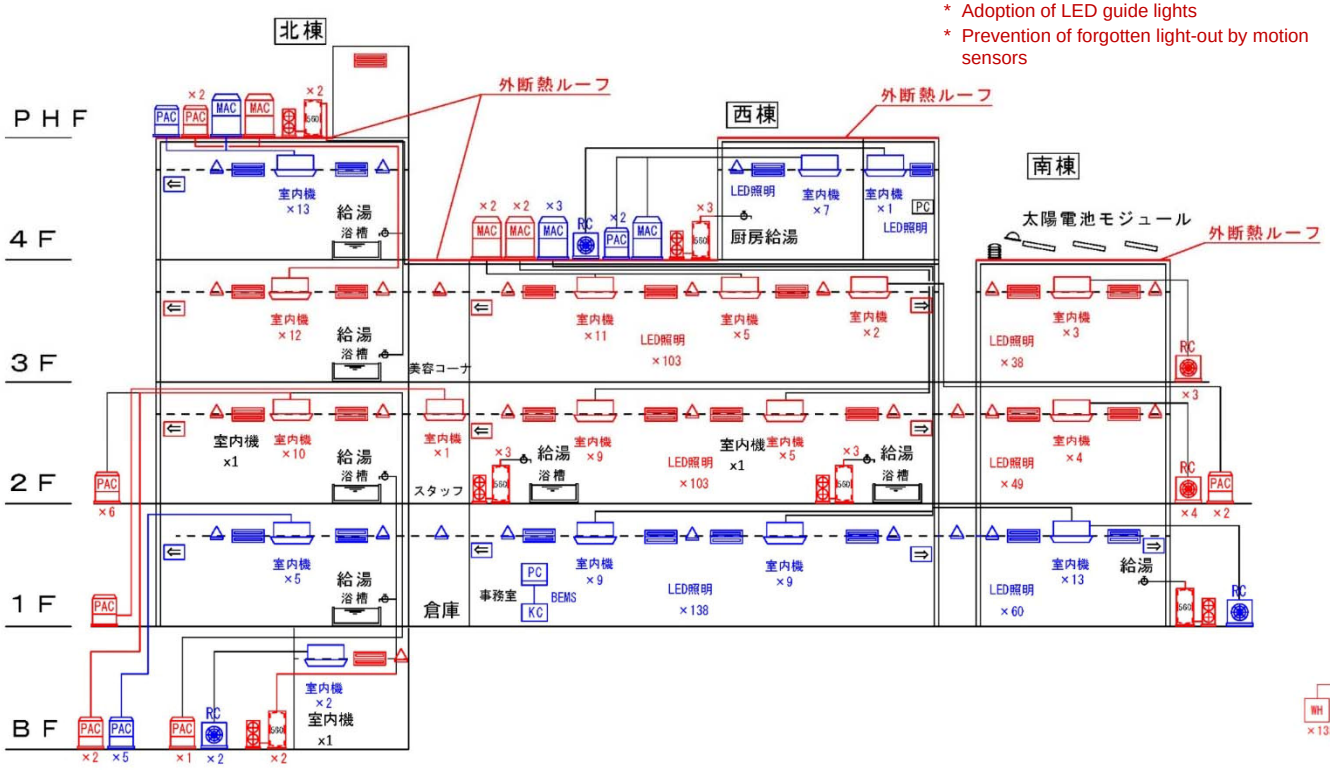
- Multi air conditioner outdoor unit (high efficiency type)
- Package air conditioner outdoor unit (energy-saving type)
- Individual air conditioner outdoor unit (energy-saving type)
- Indoor unit

* Energy-saving air-conditioning system by combination of a high-efficiency multi air conditioner for buildings and an energy-saving type individual air conditioner
* Air conditioning control by centralized remote control

[Lighting equipment]

- LED base light
- LED down light, etc.
- LED guide light
- Light control switch

* Overall adoption of LED lighting equipment
* Adoption of LED guide lights
* Prevention of forgotten light-out by motion sensors



[Photovoltaic power generation]

- Photovoltaic power generation (10.8 kW)
- Power conditioner (10 kW)
- Actinometer
- Outside-air temperature gauge

* Installation of photovoltaic power generation device on the roof surface (10 kW)
* The generated power is interconnected to the grid system of the Shikoku Electric Power Co., Inc. as well as self-consumed.
* Subsidy is applied to the Japan Environment Association.

[Performance improvement of outer surface]

* Construction of externally heat insulation on the flat roof of the top floor (rigid urethane foam 50 mm)

[BEMS]

- Central monitoring personal computer
- Control software
- Communication adapter
- Measuring equipment

◆System Concept Diagram (Comparison of Before and After ZEB Renovation)

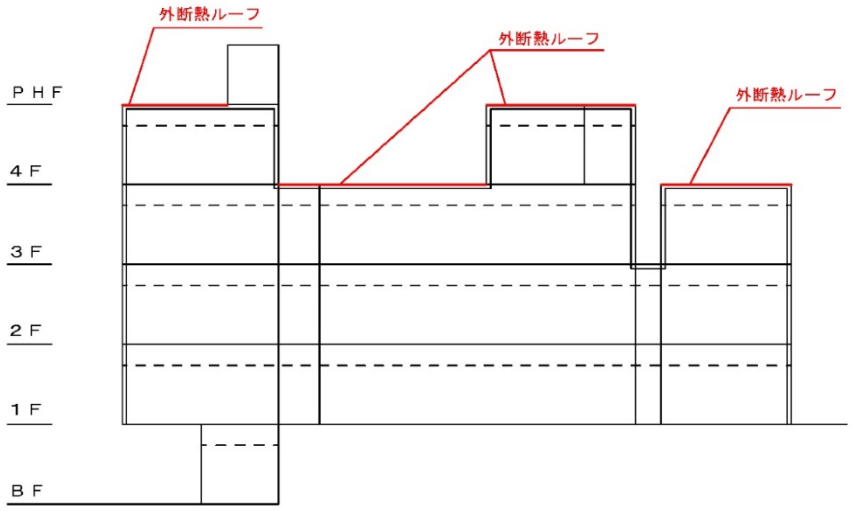
[Outer surface]

Before

After

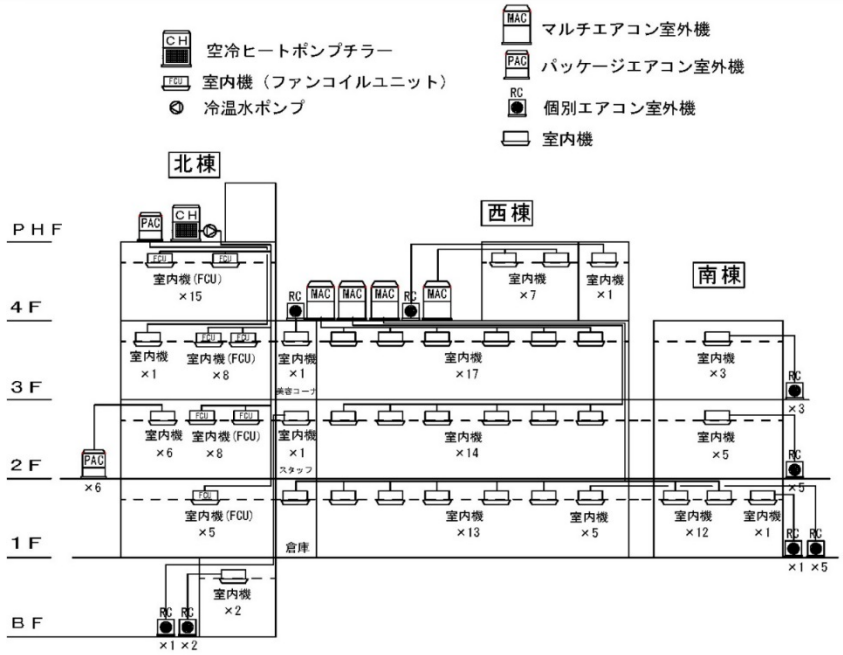
＊最上階の陸屋根部をサーモコントロール断熱防水工法により外皮性能の向上
（硬質ウレタンフォーム系断熱材５０ｍｍｔ）

ＰＡＬ＊基準値＝５９３
ＰＡＬ＊設計値＝４４２



[Air conditioning equipment]

Before

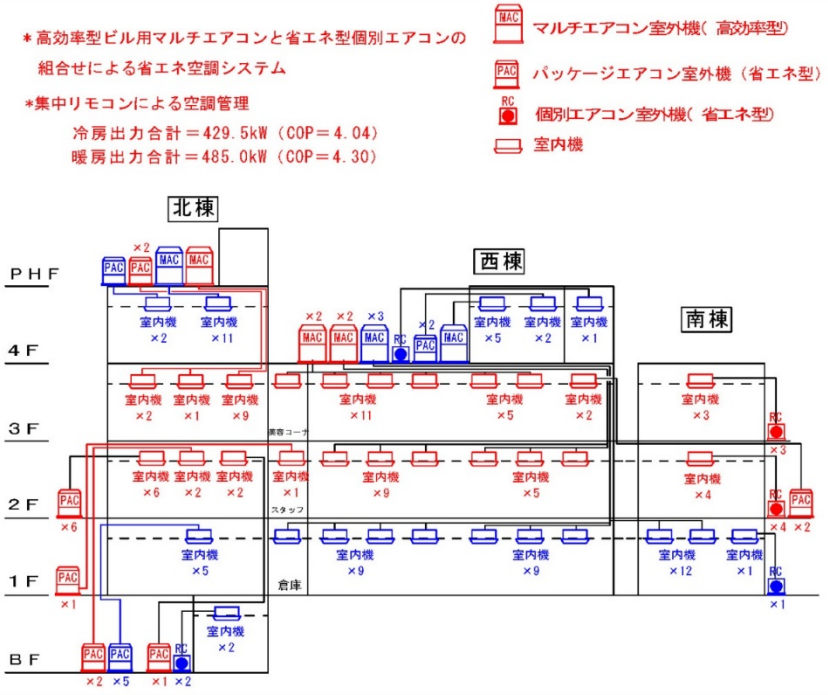


After

＊高効率型ビル用マルチエアコンと省エネ型個別エアコンの
組合せによる省エネ空調システム

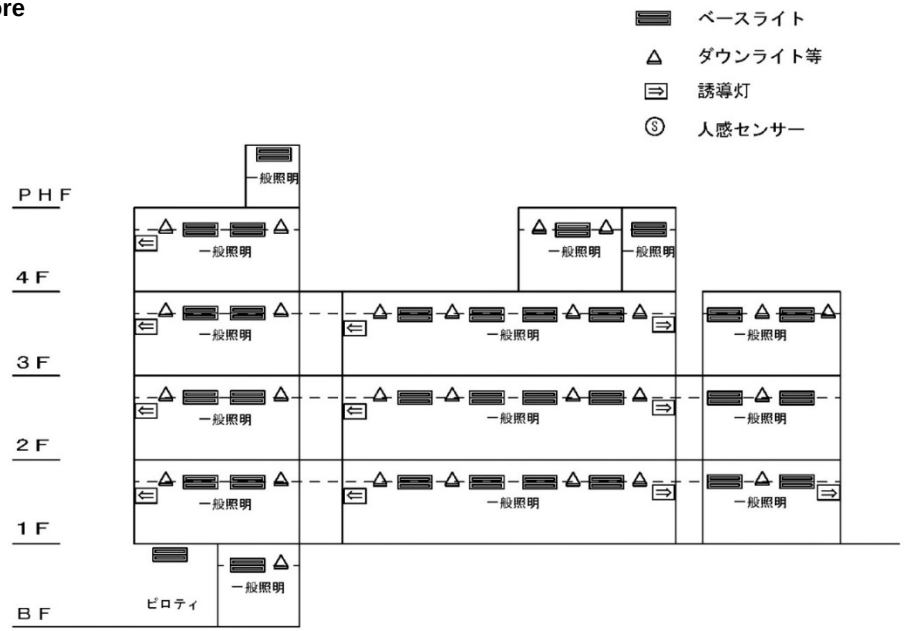
＊集中リモコンによる空調管理

冷房出力合計＝429.5kW（COP＝4.04）
暖房出力合計＝485.0kW（COP＝4.30）



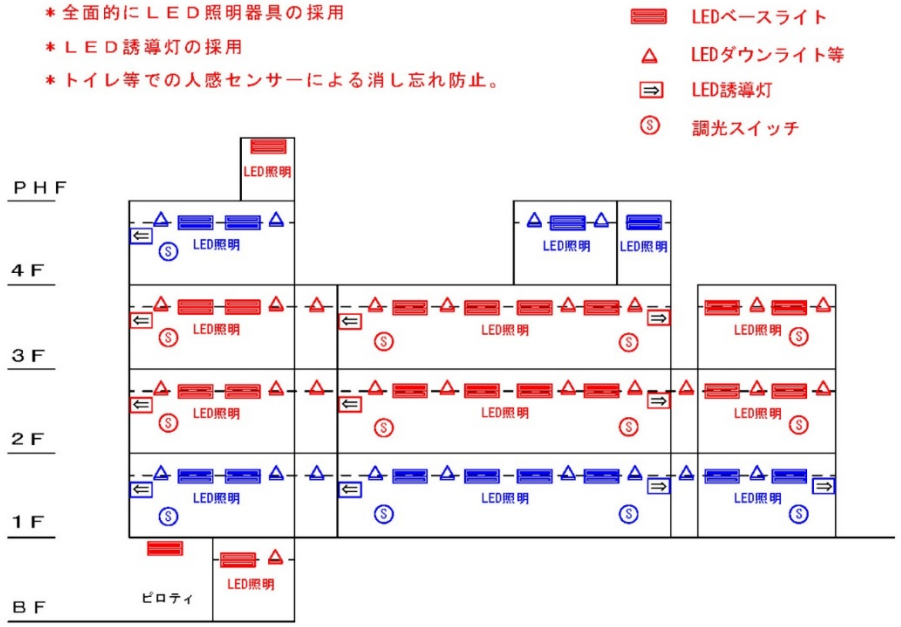
[Lighting equipment]

Before



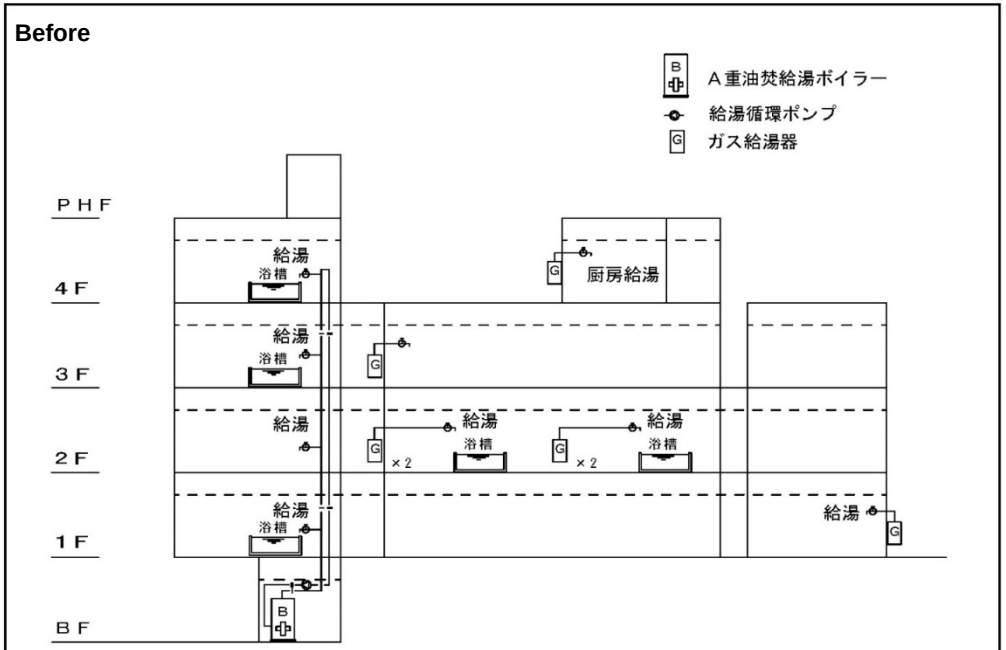
After

＊全面的にＬＥＤ照明器具の採用
＊ＬＥＤ誘導灯の採用
＊トイレ等での人感センサーによる消し忘れ防止。



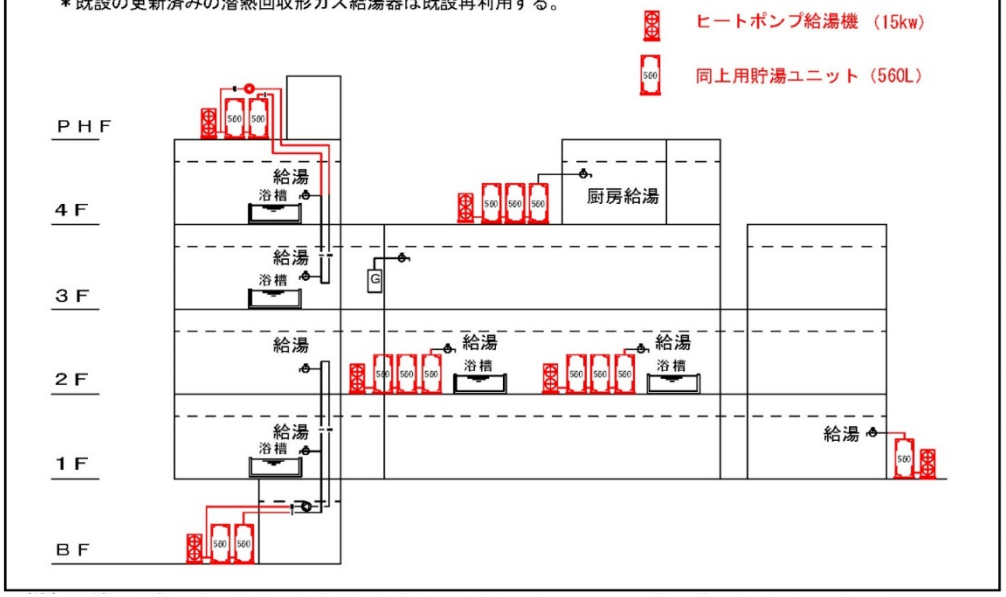
[Hot water supply equipment]

Before



After

＊ヒートポンプと貯湯槽ユニットによる業務用エコ給湯システム
＊蓄熱によるピーク負荷の平衡化，深夜電力の活用と高負荷高効率運転
＊既設の更新済みの潜熱回収形ガス給湯器は既設再利用する。



[Photovoltaic power generation]

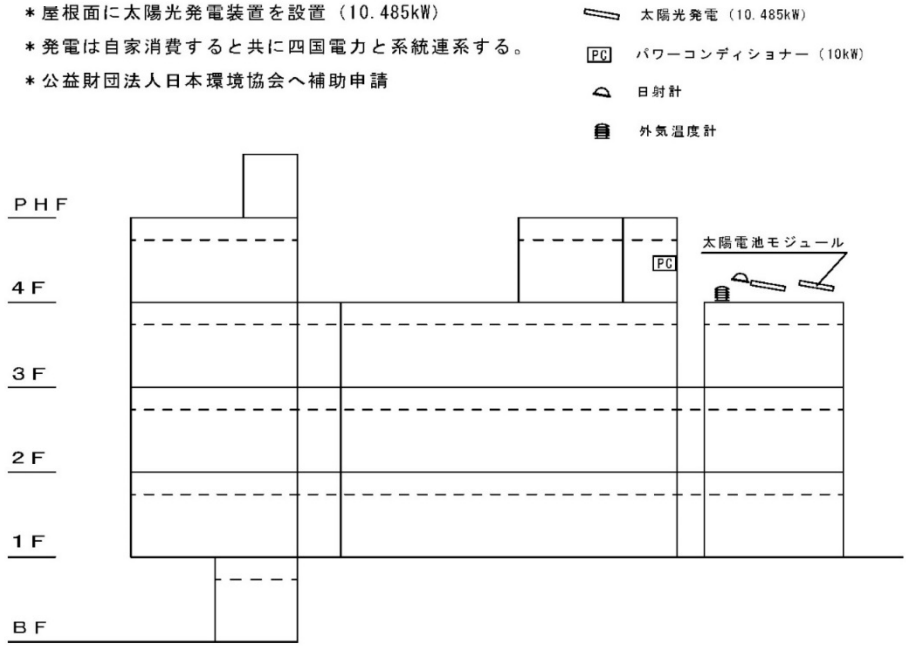
Before

After

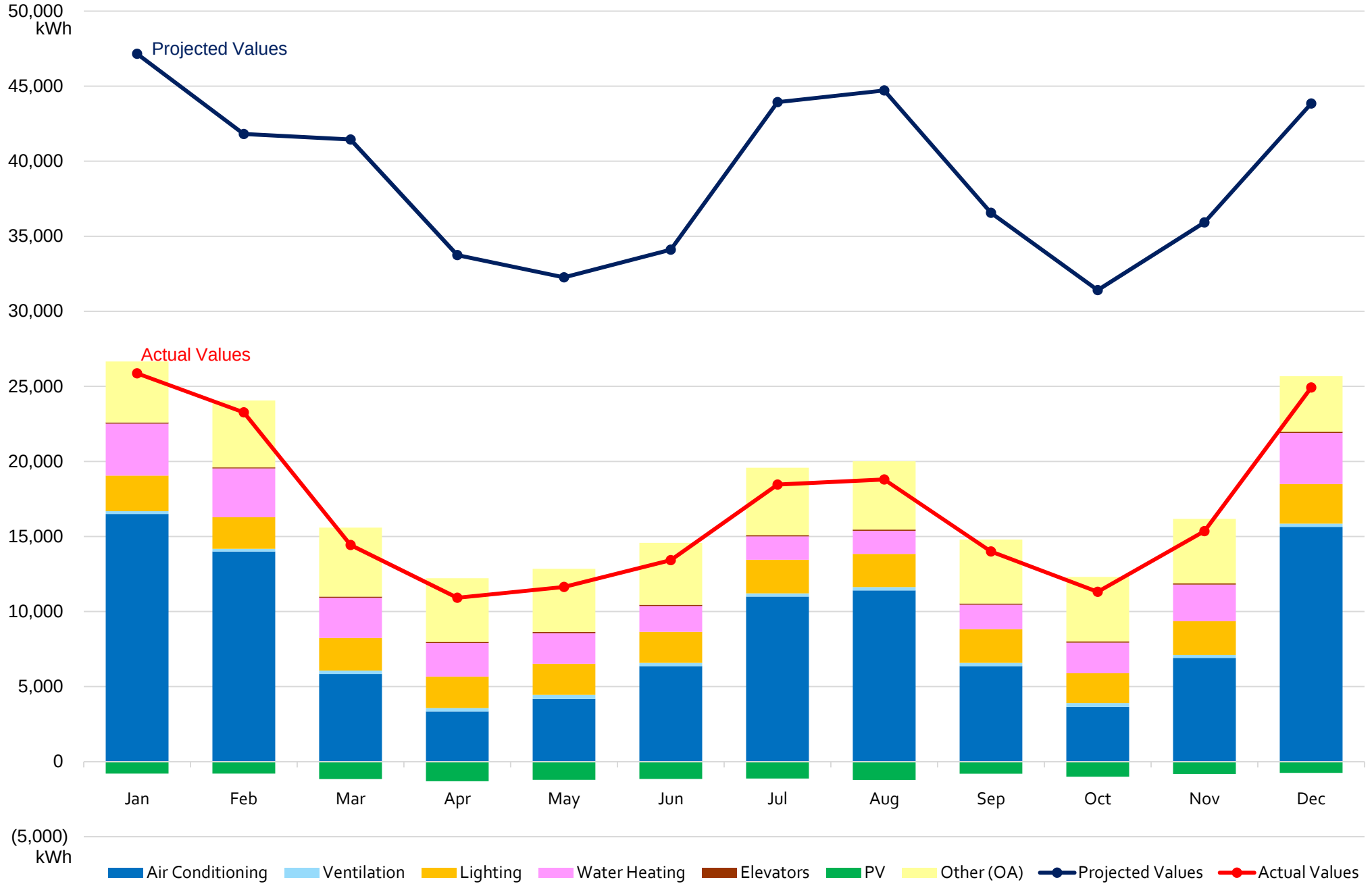
＊屋根面に太陽光発電装置を設置（10.485kW）

＊発電は自家消費すると共に四国電力と系統連系する。

＊公益財団法人日本環境協会へ補助申請



◆Comparison of Energy Consumption per Month (Jan–Dec 2018)



◆Effects of Introduction

Usage Category		Primary Energy Consumption						
		Reference Values	Design Values			Actual Values		
		MJ/Year	Consumption (MJ/Year)	Decrease (MJ/Year)	Decrease Rate (%)	Consumption (MJ/Year)	Decrease (MJ/Year)	Decrease Rate (%)
Air Conditioning		3,975,579	2,392,103	1,583,476	39.8	1,026,674	2,948,905	74.1
Ventilation		933,570	372,741	560,829	60.0	25,679	907,891	97.2
Lighting		1,916,324	443,488	1,472,836	76.8	258,015	1,658,309	86.5
Water Heating		1,524,001	787,223	736,778	48.3	273,378	1,250,623	82.0
Elevators		83,882	83,882	0	0.0	8,960	74,922	89.3
Photovoltaic Power Generation (Self-consumption)		0	-103,304	103,304	-	-118,464	118,464	-
Other		580,780	580,780	0	0.0	500,805	79,975	13.7
Total	Including PV / Including Other	9,014,136	4,556,913	4,457,223	49.4	1,975,047	7,039,089	78.0
	Including PV / Excluding Other	**8,433,356**	**3,976,133**	**4,457,223**	**52.8**	**1,474,242**	**6,959,114**	**82.5**
	Not considering PV / Excluding Other	8,433,356	4,079,437	4,353,919	51.6	1,592,706	6,840,650	81.1

◆ZEB Rank (Including PV / Excluding Other)

	Design Values	Actual Values
Consumption (MJ/Year)	3,976,133	1,474,242
Decrease (MJ/Year)	4,457,223	6,959,114
Decrease Rate (%)	52.8	82.5
ZEB Rank	**ZEB Ready**	**Nearly ZEB**

◆Primary Energy Consumption per Usage (Including PV / Including Other)