Success story of energy efficiency policy development in Japan

Yasuhiro Miki
miki-y92i2@mlit.go.jp
National Institute for Land and Infrastructure Management

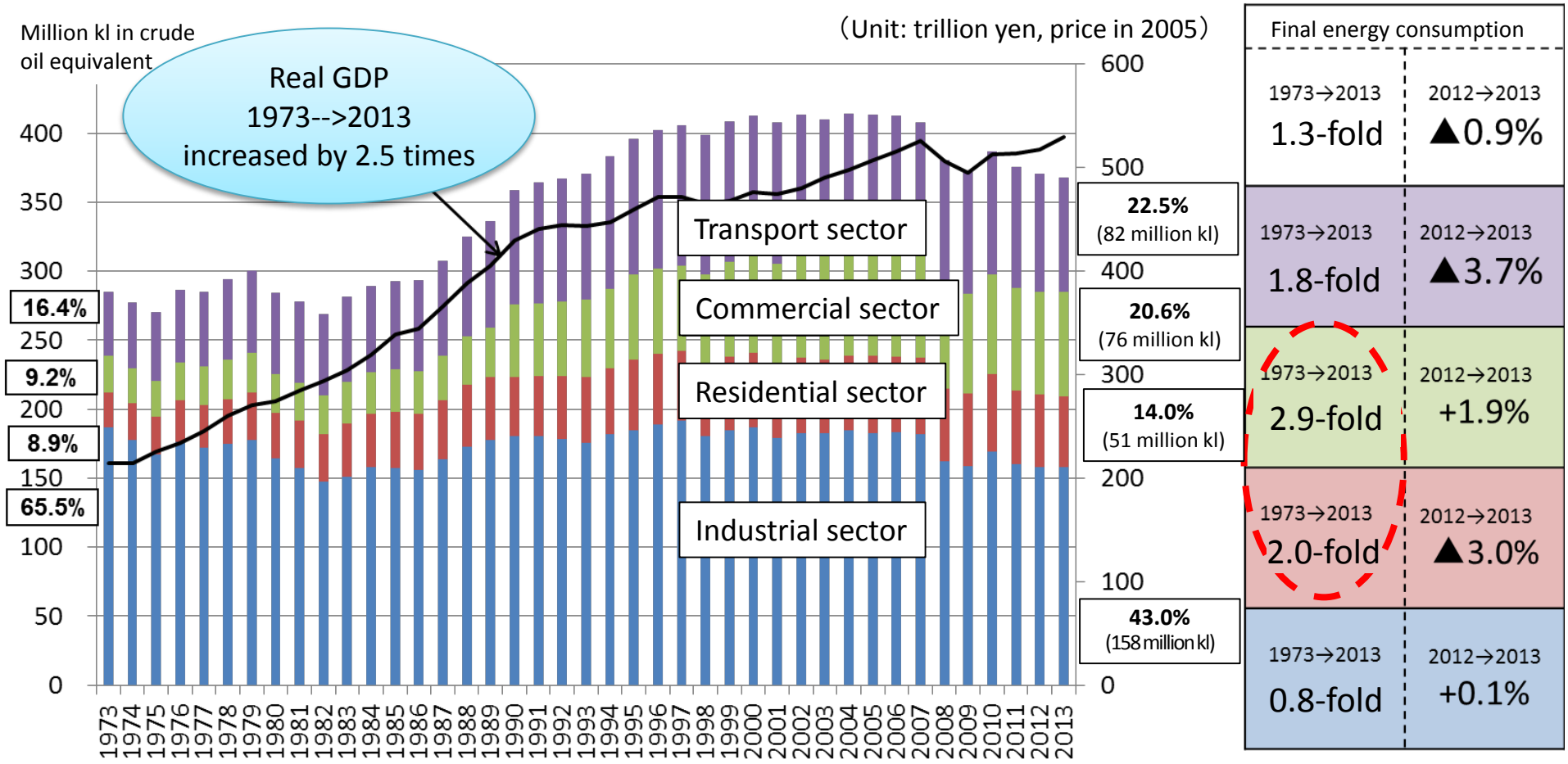
Outline

1. Brief Overview of Energy Policy in Japan

2. Evaluation Method (Commercial Buildings)

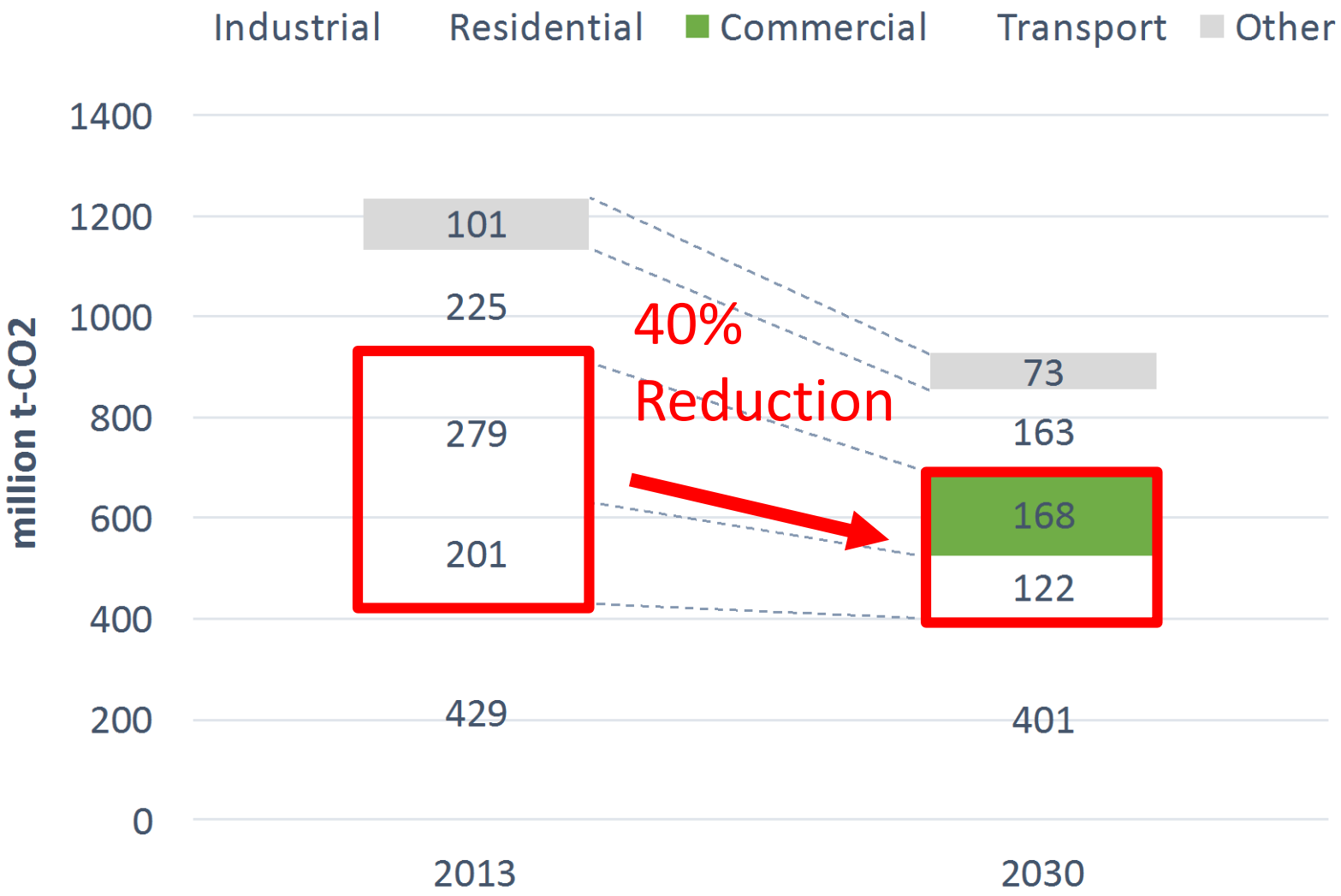
1. Brief Overview of Energy Policy in Japan

Status of energy consumption



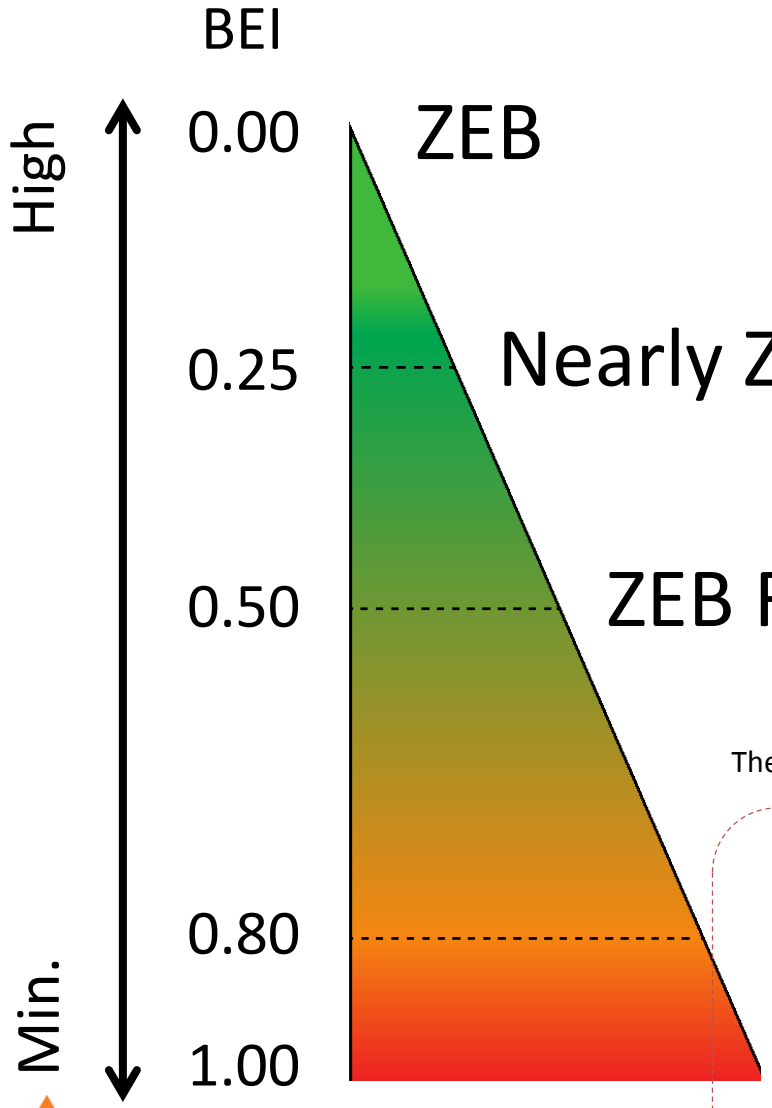
[Sources] *Comprehensive Energy Statistics, Annual Report on National Accounts, EDMC Handbook of Japan's & World Energy & Economic Statistics*

Our Goal (Civilian Sector)



[Sources] Ministry of Economy, Trade and Industry: Long-term energy supply and demand outlook July, 2015

Targets for the Goal



BEI = Designed primary consumption
/ Reference primary consumption (2013)

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

[source] Japan's Strategic Energy Plan (April 2014)

The Act on the Improvement of Energy Consumption Performance of Buildings

Certification Standards

(new built buildings, retrofit buildings)

Energy Efficiency Standard

(mandatory from 2017)

History and Future of the Building Energy Standard

1979 The Energy Conservation Law was established.

1980 The Building Energy Standard was established according to the law. No obligation was taken on building owners. So the Standard was similar to recommendation.

1992 The Standard for housings was revised owing to the Gulf War.

1993 The Standard for buildings was revised as well as for housings.

1999 The levels of the Standard were enhanced because of the Kyoto Protocol.

2009 Reporting on the Standards was mandatory except small buildings and housings.

2013 The whole Standard was revised. Primary energy consumption is needed as criterion index, in addition to envelope performance.

2020 Compliance to the Standard will be mandatory for all new buildings and residences.

The Act on the Improvement of Energy Consumption Performance of Buildings

Review Process

March 24, 2015	**Cabinet decision**
June 4	**Unanimously passes in House of Representatives**
July 1	**Unanimously passes in House of Councilors, and is adopted**
July 8	**Promulgation of law**

Promulgation of Cabinet/ministerial ordinance etc.

Implementation Schedule

Advisory measures within 1 year of promulgation of law (April 2016)

1. Announcement of basic policy
2. Mandating efforts of construction clients/owners etc., and business operators in selling and leasing of building
3. Performance Improvement Planning Approval System (Floor space ratio exceptions)
4. Display System
5. Preparations for Registered Energy Conservation Evaluation Institutions and Registered Energy Conservation Performance Appraisal Institutions (applying for registration etc.)

Regulatory measures within 2 years of promulgation of law (Planned for April 2017)

1. Instruct/advise construction clients, designers/builders, construction material manufacturers
2. Mandate/evaluate compliance, register etc. Registered Energy Conservation Evaluation Institutions
3. Notification System, instructions/orders etc. via administrative agencies with jurisdiction
4. Minister-authorization system for special structure/equipment, register etc. Registered Energy Conservation Appraisal Institutions
5. Housing Top-Runner Program

*Abolish Energy Conservation Act-based regular report system for renovations, remodeling, installations and repairs and notification system

Mandatory Compliance with Standards by Construction Clients of Specified Buildings

- **Section 11 Mandatory Compliance with Standards**
  - When construction client attempts to undertake specified construction (*1), the specified building （Limited to non-residential） must comply with the building energy efficiency standards.
  - The stipulation in the preceding paragraph is one of relevant provisions of Building Code in Japan.

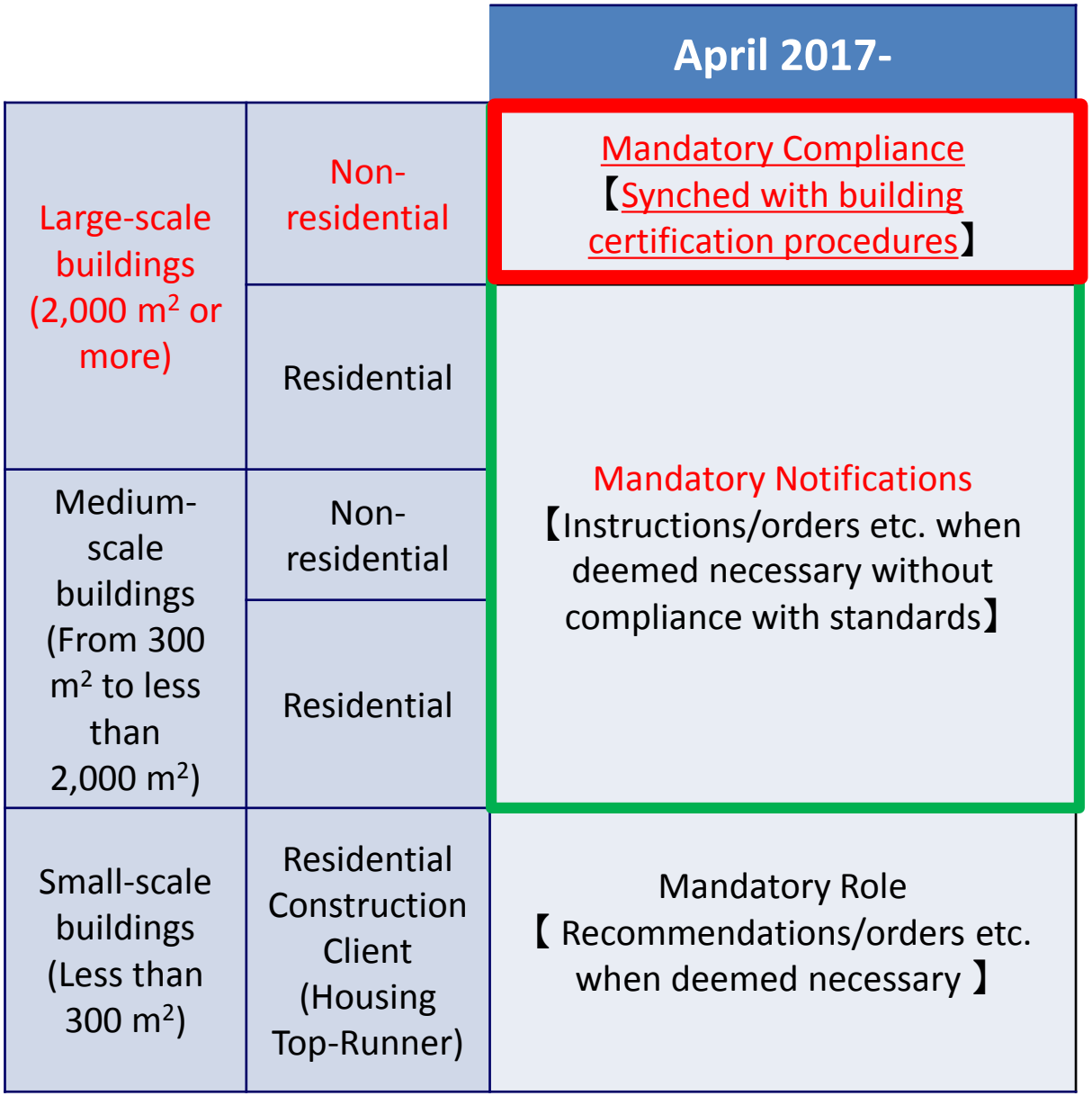
***1 Specified construction**

1. New construction on a specified building (*2)
2. Extension/renovation on a specified building (The scale of the extension/renovation for non-residential portions shall only be for the Cabinet-ordered scale or larger [planned to be 300 m^2].)
3. Extension on buildings other than specified buildings (The scale of the extension for non-residential portions shall only be for the Cabinet-ordered scale or larger [planned to be 300 m^2], and when the building in question will become a specified building after the extension construction.)

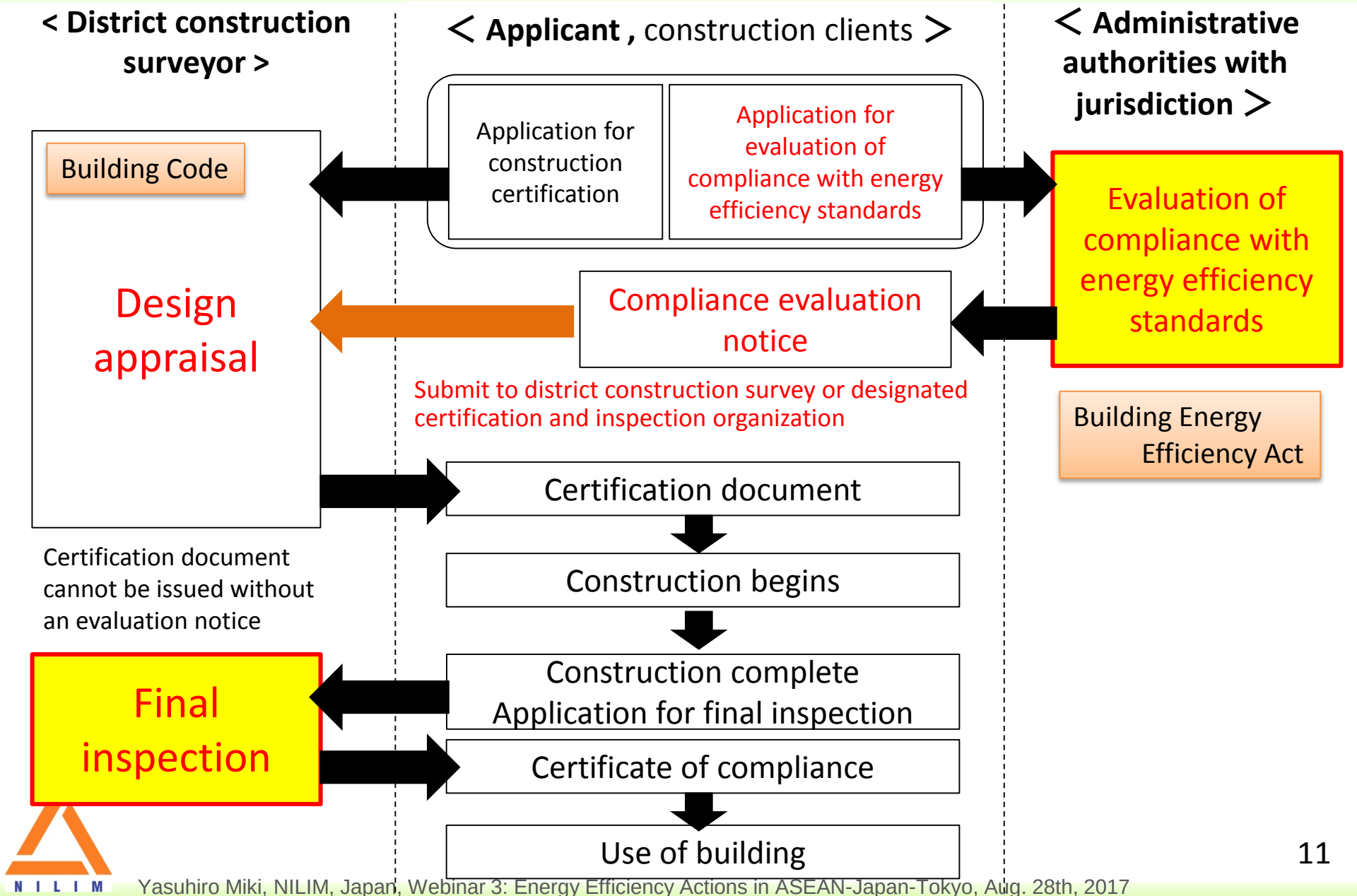
***2 Specified buildings**

This refers to buildings that are at the Cabinet-ordered scale or larger (planned to be 2,000 m^2) and are of a scale large enough to particularly require the attainment of energy consumption performance for a non-residential area.

New Building Energy Conservation Act

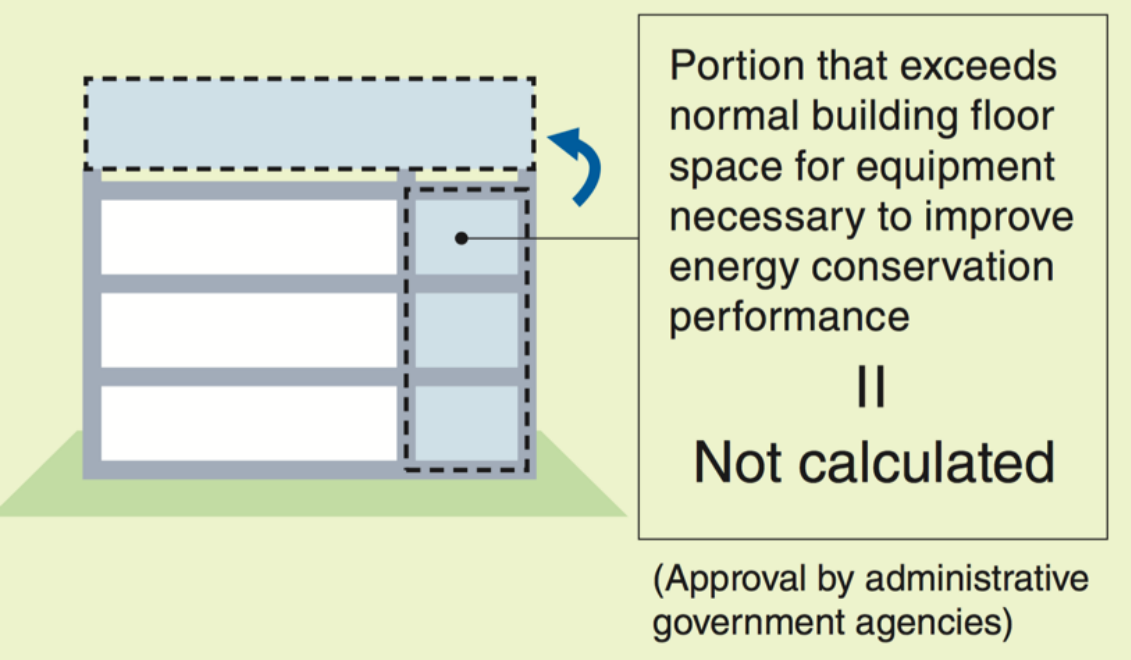


Scheme for Evaluation of Energy Conservation Compliance and Building Certification/Inspection From April 2017



Certification Standards (Article 29)

- When carrying out new construction and renovations for energy conservation(*), certification of compliance with guidelines that exceeds the level of energy conservation standards (BEI<=0.80) may be received.
  - (*) Extensions, renovations, improvements/remodeling, installation of equipment such as A/C, repairs



Renovation that has been certified may receive special exception status, such as for floor space ratio

Labeling System (Article 7)

Emphasize Energy efficiency Performance at or above Level of Standards

- Third party verification (BELS) label with stars.

★★★★★ **BEI<=0.60**

★★★★ **BEI<=0.70**

★★★ **BEI<=0.80**

★★ **BEI<=1.00**

★ **BEI<=1.10**

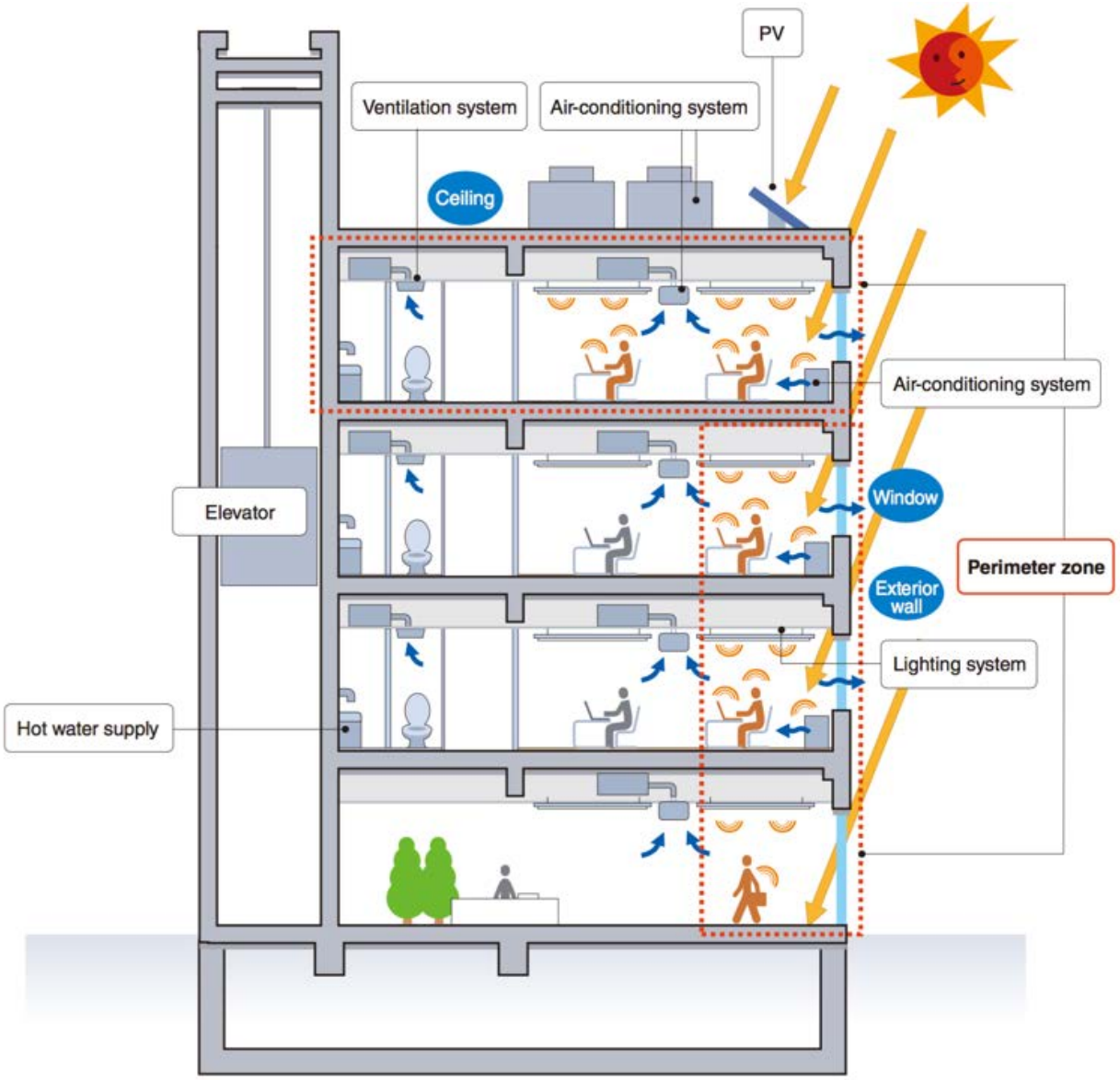
2. Evaluation Method (Commercial buildings)

Calculation methodologies

- NILIM and BRI have developed new methodologies for evaluating the primary energy consumption.

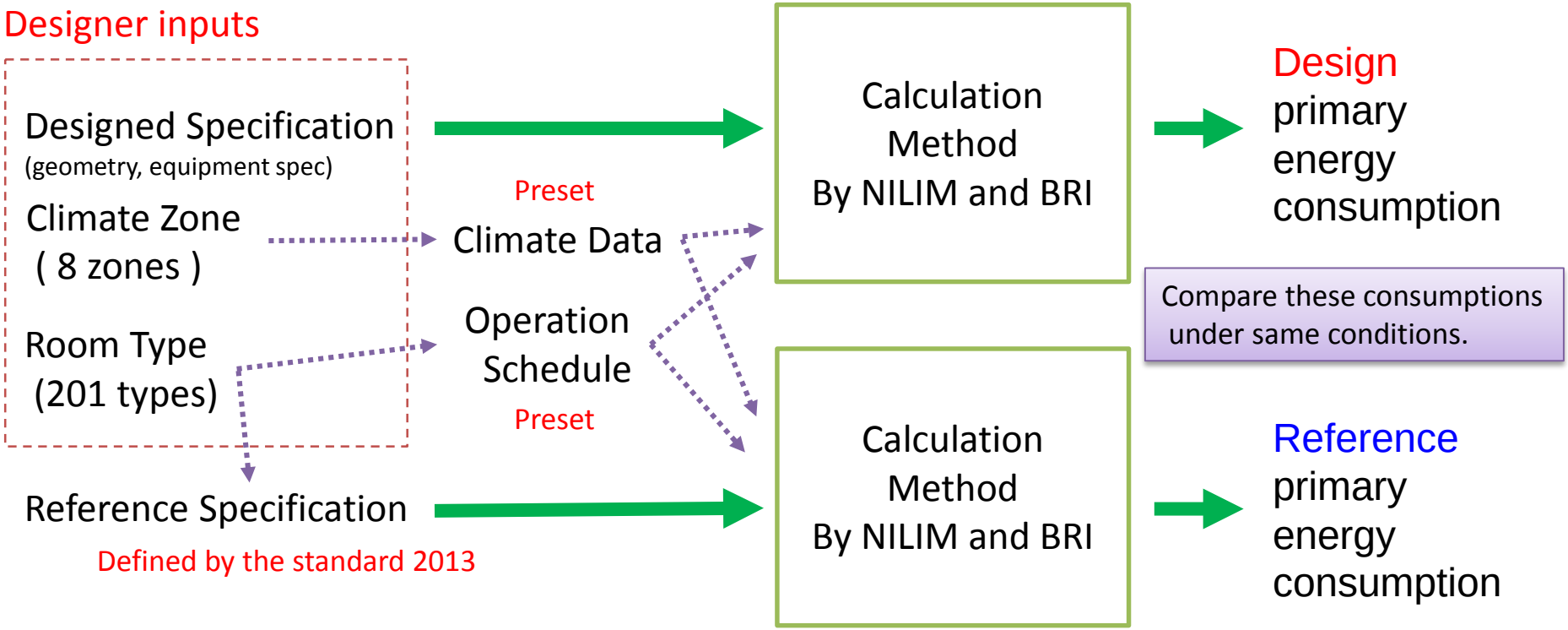
- The methodologies are expected to be suitable for the mandatory standard.
  - Easy to understand evaluation logic (simplified and streamlined)
  - Easy to understand evaluation results
  - A fair, reliable, and transparent evaluation logic
  - Streamlined and efficient evaluation and review
    - Provision of evaluation-assistance simulation tools
  - Defined and unified evaluation rules
    - Same results regardless of who makes data entries
    - Same results regardless of who performs a review

Index : Primary Energy Consumption



Primary energy consumption amount
= air-conditioning system
+ ventilation system
+ lighting system
+ hot water supply
+ elevator primary
+ other (Plug load)
- PV and
cogeneration system

Flow of Calculation of Primary Energy Consumption for Commercial Buildings



- BEI（*Building Energy Index*）
  = Design consumption / Reference consumption

Example of the room types

No.	Type of room (Office)
O-1	Office room
O-2	Office higher heat
O-3	Meeting room
O-4	Tearoom
O-5	Central control
O-6	Locker room
O-7	Canteen
O-8	Hall
O-9	Lobby
O-10	Toilet
O-11	Smoking room

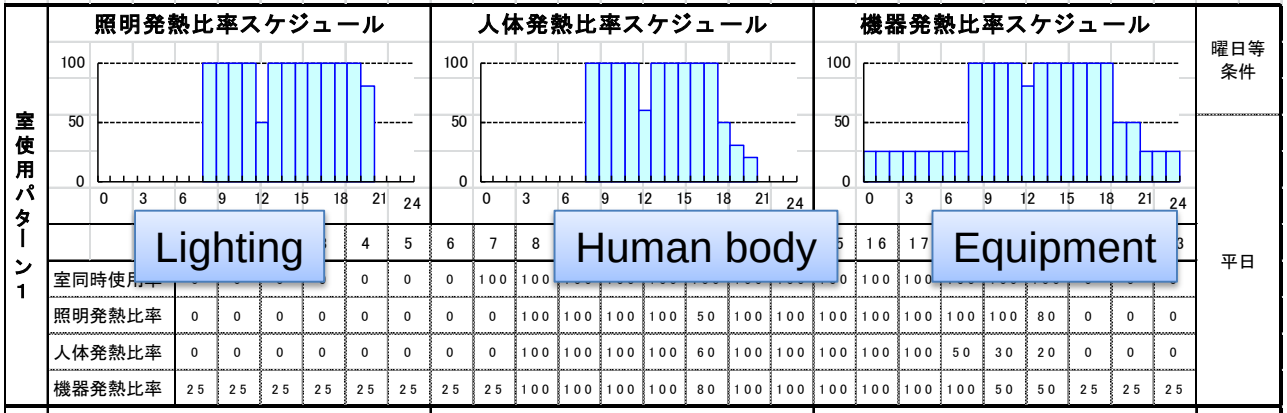
No.	Type of room (Hotel)
H-1	Guest room
H-2	Guest room's bath room
H-3	Banquet higher heat
H-4	Banquet hall with medium heat emission
H-5	Banquet hall with low heat emission
H-6	Restaurant
H-7	Lounge
H-8	Lounge open only at night
H-9	Shop
H-10	Office room (24 hours)
H-11	Office room (closed during night)
H-12	Canteen for employees
H-13	Locker room

Standardized room-use conditions
(Office room in office building)

Reference value for heat-generation density
Lighting: → 12 W/m²
Human body→ 0.1 persons/m²
Equipment:→ 12 W/m²

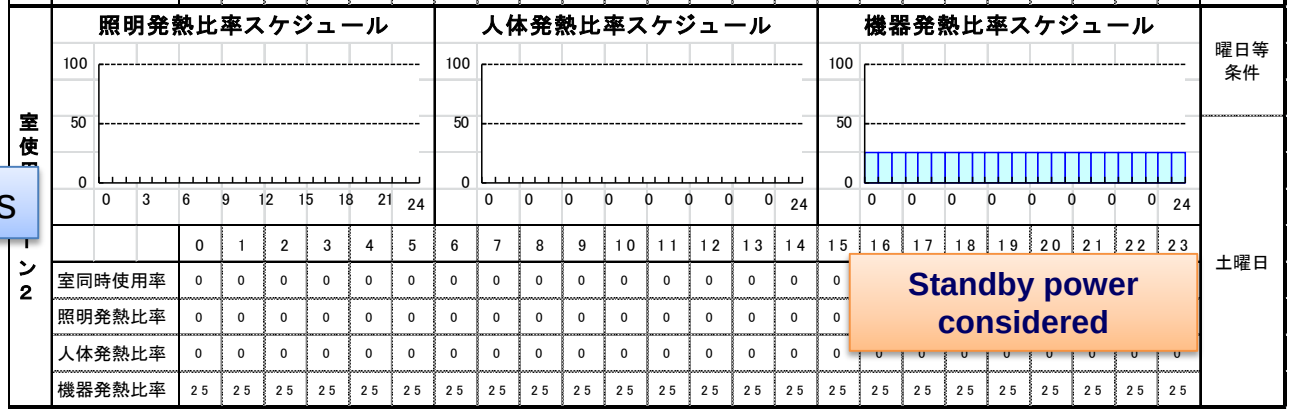
共通		空調						空調以外の換気				照明					給湯
カレンダパターン		年間空調時間		照明発熱参照値	在室者数参照値	機器発熱参照値	新鮮外気導入量	年間換気時間		基準設定換気風量	基準設定換気回数	年間照明点灯時間		基準照明消費電力	基準設定照度	基準設定保守率	年間給湯日数
A		[h/年]		[W/㎡]	[人/㎡]	[W/㎡]	[m3/㎡・h]	[h/年]		[m3/m2h]	[回]	[h/年]		[W/㎡]	[lx]		[日]
室使用パターン別年間日数		3374		12.0	0.1	12.0	5.0	0		0.0	−	3133		16.3	750	0.69	241
		空調時刻（時間）			人体発熱参照値	待機電力参照値	作業強度指数	換気時刻（時間）			基準設定全圧損失[Pa]	照明点灯時刻（時間）			基準設定器具形式	基準設定光源	基準設定湯使用量
1	241	1	7	21	(14)			1	−	−	(0)	0	1	8	21	(13)			
2	51	2	−	−	(0)	[W/㎡]	[W/㎡]	[-]	2	−	−	(0)	基準設定換気方式	2	−	−	(0)			L/人日
3	73	3	−	−	(0)	11.9	3.0	3	3	−	−	(0)	−	3	−	−	(0)	C	FHF32	3.8

Weekdays



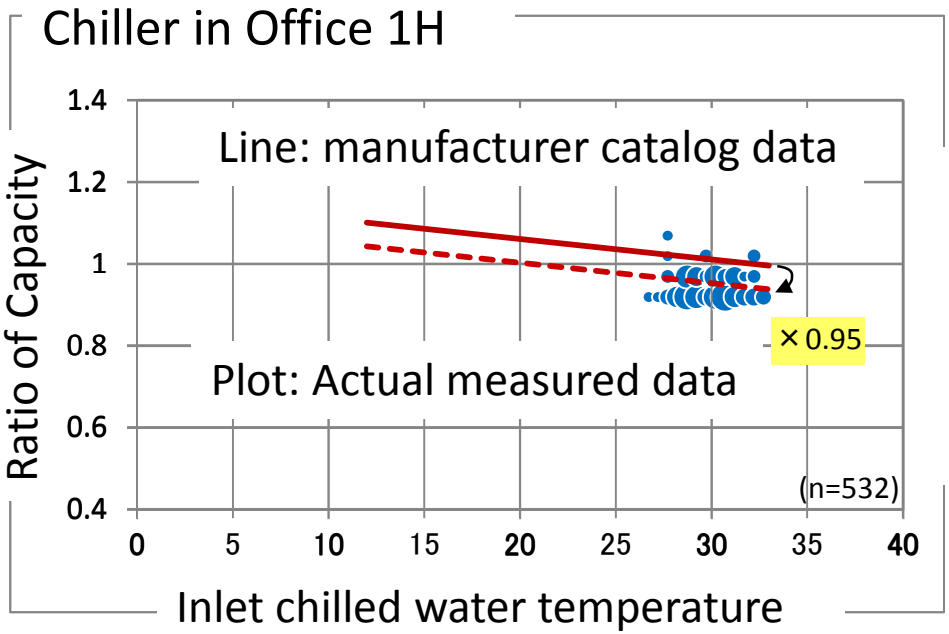
Saturdays

Sundays/Holidays

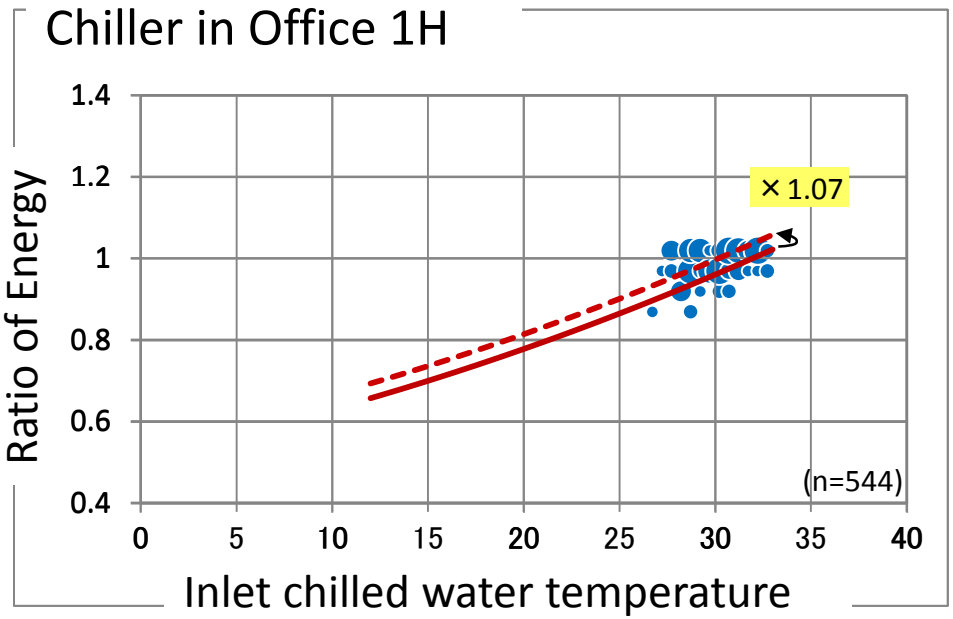


Measurement of Actual performance of Equipment

- In order to estimate the primary energy consumption accurately, NILIM and BRI measured the actual performance of the building equipment in several buildings and developed a method to estimate the actual performance based on manufacturer catalog data.



Cooling Capacity



Energy Consumption

Information Disclosed by NILIM and BRI

- Official Guides

- BRI's website provides technical information on the Energy Efficiency Standards: http://www.kenken.go.jp/becc/index.html
  - Links to various support tools
  - Instructions for the tools
- How to use https://www.youtube.com/watch?v=lL1cqCkbFaE

Web-based Simulation Tool for Compliance with 2013 Energy Efficiency Standard

Windows Azure

Computational engine on cloud computing platforms

Design documents

Specification Input Sheet

XML files

Calc. results

BRI Website

Download

.xls
Microsoft® Excel®

- Excel Sheet
- Manual
- Interface of the web-based simulation tool

Upload

Input the product specification of the building equipment to the Excel file.

Calculation Results

Flow for evaluation of a building's primary energy consumption in commercial buildings

Simplified Approach

Building to be evaluated

Conventional calculation method

The area of each room and the specifications for the envelope and the equipment are entered.

Design value by the conventional method

Baseline value by the conventional method

Web-based program for primary energy consumption calculation

Model Building Method

Enter only the main specifications for the envelope and the equipment to be used in the model building.

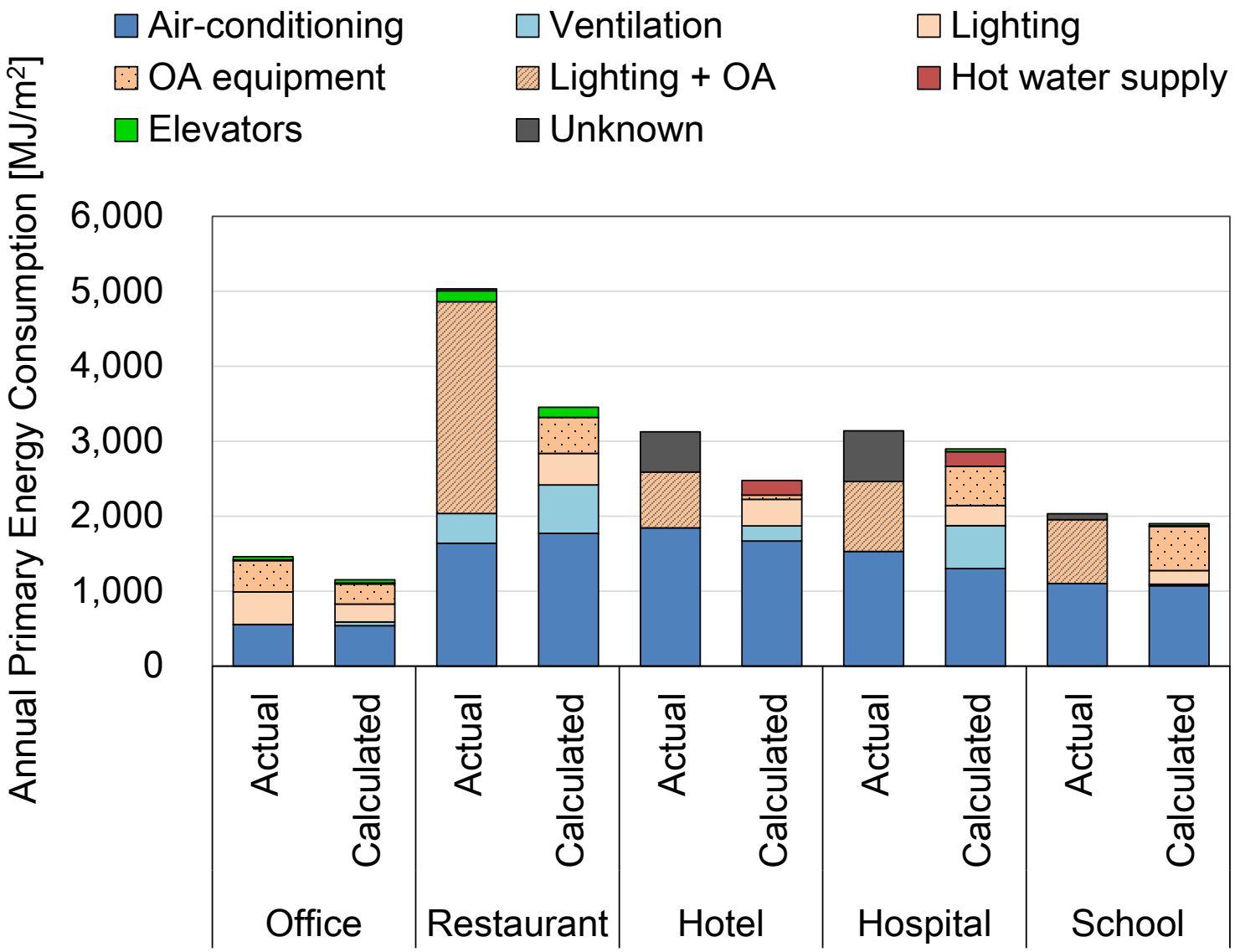
Model building

BPI_m

BEI_m

$$\frac{\text{Design value by Model Bldg Method}}{\text{Baseline value by Model Bldg Method}}$$

Application to actual buildings



Summary

- The building energy standard was revised in April 2013.
  - Primary energy consumption is needed as criterion index, in addition to envelope performance.

- Until 2020, compliance to the standard will be mandatory for all newly built buildings and housings.
  - From April 2017, compliance with the standard is mandatory for large scale non-residential buildings.

- NILIM and BRI have developed the on-line calculation tools for the new energy standard and certification system.