Introduction of EEC policy in Japan
- One of the most important energy policies -

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Manila
Jun.2018
Transition of Japan’s Final Energy Consumption and Real GDP

● After the oil crisis, though GDP has increased 2.4 times, final energy consumption has increased 1.2 times.

● While energy consumption in the industrial sector has decreased, that in the commercial, residential and transport sectors have been increasing.

Source: The Consultant based on the material by METI (Feb. 2017)
Aim for 2030 (Long-Term Energy Supply and Demand Outlook)

<table>
<thead>
<tr>
<th>Sector</th>
<th>FY2013 (actual value)</th>
<th>FY2030 (with EEC measures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>0.361 billion kl</td>
<td>0.376 billion kl</td>
</tr>
<tr>
<td>Transport</td>
<td>0.376 billion kl</td>
<td>0.361 billion kl</td>
</tr>
<tr>
<td>Commercial</td>
<td>0.326 billion kl</td>
<td>Approx. 0.326 billion kl</td>
</tr>
<tr>
<td>Industrial</td>
<td>0.376 billion kl</td>
<td>0.361 billion kl</td>
</tr>
</tbody>
</table>

Economic growth 1.7%/year

13% reductions with thorough EEC measures

Final energy consumption

Source: The Consultant based on the material by METI (Feb. 2017)
To achieve the target (▲13%), EE improvement (final energy consumption / real GDP) which is similar to that after oil shock (35%) is required.
5th energy basic policy (draft)

• Currently, under process of public comment (May 19.2018 - June 17.2018)
  • Securing resources
  • **Realizing a thorough energy saving society**
  • Accelerate the introduction of renewable energy
  • Restructuring of nuclear energy policy
  • Efficient and stable use of fossil fuels
  • Drastic strengthening of efforts toward realization of hydrogen society
  • Energy system reform
  • Strengthening domestic energy supply network
  • Improvement of secondary energy structure
  • Energy industry policy
  • Development of international cooperation
## Overview toward 2030 relating to EEC policy

<table>
<thead>
<tr>
<th>2018 to 2030</th>
<th>Approach</th>
<th>Verification</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific action target</td>
<td></td>
<td>Progress verification</td>
<td>Emphasis on achievements of targets</td>
</tr>
<tr>
<td>↓</td>
<td></td>
<td>✓ Action plan of low carbon society</td>
<td>✓ Energy saving is 4th energy source</td>
</tr>
<tr>
<td>A linear approach with emphasis on implementation (= 2030 mix)</td>
<td>✓ Regulation by EE law</td>
<td>✓ Challenge to the global top</td>
<td></td>
</tr>
<tr>
<td>• Self-sufficiency rate: 6% to approx. 25%</td>
<td>- Top runner program for equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Power cost suppression</td>
<td>- Top runner program for industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 25% reductions of CO₂ emissions</td>
<td>- EE improvement of buildings</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Energy management and EE subsidy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: The Consultant based on the material by METI (Apr. 2018)
1. Outline of EEC policy in Japan

Total primary energy supply per GDP

Source: The Consultants based on IEA Scoreboard 2011

Second best
Top runner program for equipment

Top runner program for equipment started in 1998 which was defined in EE law (establishment: 1979)

- Standards for performance of appliances, etc. are set at the top runner performance in that year.
- Other products (runner-up, etc.) have to catch up and qualify the top runner level in designated duration.
- Cover rate of the top runner target equipment exceeds 70% in energy consumption in a house.

Current Target Products: 31

Source: The Consultant based on the material by METI (Feb. 2017), etc.
2. Top runner program for equipment

Efficiency improvements by top runner program for equipment

Passenger Vehicles
Change in average new vehicle fuel consumption

Change in average new vehicle fuel consumption:
- 96.7% improvement

Air Conditioners
Change in power consumption in a period

Change in power consumption in a period:
- 30.7% improvement

Fuel consumption (km/L)

Power consumption in a period (kWh)

Source: The Consultant based on the material by METI (Feb. 2017)
3. Top runner program for industry

Top runner program for industry - Benchmark system -

Top runner program for industry started in 2008 - 2009 which was defined in EE law.

- Business operators that use energy of more than 1,500 kl/year are obligated to submit periodic reports every year (end of July).

- In the event that business operators do not follow government’s guide, they shall be publicized and receive an order.
  ➔ Never happened since EE law establishment.

- In the event that business operators do not follow government’s order, they shall be penalized.
  ➔ Never happened since EE law establishment.
3. Top runner program for industry

**Top runner program for industry - Benchmark system -**

- The EE law urges business operators to improve energy intensity based on **evaluation criteria** and government provides measures such as guidance if necessary.

**<Evaluation criteria>**

- Efforts of energy conservation measures
- Trends of energy intensity (Targeted 1% reduction/year has become difficult)
- Situation on **benchmark** indicator

- Set **benchmark** to the level satisfied by the top business operator (10 to 20%) in each subsectors in all businesses which includes industrial and commercial sectors.
It is aimed to cover 70% of energy consumption of all businesses (industrial and commercial sectors) during FY 2018.

Source: The Consultant based on the material by METI (Feb. 2016)
EEC approach for buildings

Regulation of buildings started in 1993 by EE law.

[Current situation]

- While energy consumption of other sectors (industrial and transport) is declining, that of building sector has increased significantly. Currently, occupying 1/3 of the total.

- Industrial sector: -12.5% (1973-2013)
- Transport sector: -0.7% (1990-2013)
- Building sector: +33.5% (1973-2013)

- It is essential to drastically strengthen the EEC measures of the building sector.

Source: The Consultant based on the material by METI (Feb. 2017)
### Outline of buildings EE law -measures pertaining to new construction- (enforcement : Apr. 2017)

<table>
<thead>
<tr>
<th>Category of buildings</th>
<th>Buildings EE law</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Large-scale buildings</strong></td>
<td></td>
</tr>
<tr>
<td>Over 2,000m²</td>
<td><strong>Non-residential</strong></td>
</tr>
<tr>
<td></td>
<td>Compliance obligation to EE standards</td>
</tr>
<tr>
<td></td>
<td>➢ Linked to construction confirmation procedure</td>
</tr>
<tr>
<td></td>
<td><strong>Residential</strong></td>
</tr>
<tr>
<td></td>
<td>Notification obligation</td>
</tr>
<tr>
<td></td>
<td>➢ In case of nonconformity to EE standards, direction/order, etc. if necessary</td>
</tr>
<tr>
<td><strong>Medium-scale buildings</strong></td>
<td></td>
</tr>
<tr>
<td>300m² – 2,000m²</td>
<td><strong>Non-residential</strong></td>
</tr>
<tr>
<td></td>
<td>Notification obligation</td>
</tr>
<tr>
<td></td>
<td>➢ In case of nonconformity to EE standards, direction/order, etc. if necessary</td>
</tr>
<tr>
<td></td>
<td><strong>Residential</strong></td>
</tr>
<tr>
<td></td>
<td>Obliged to make efforts</td>
</tr>
<tr>
<td><strong>Small-scale buildings</strong></td>
<td></td>
</tr>
<tr>
<td>Less than 300m²</td>
<td><strong>Residential</strong> (Construction Client)</td>
</tr>
<tr>
<td></td>
<td>Obliged to make efforts</td>
</tr>
</tbody>
</table>

Source: The Consultant based on the material by METI (Feb. 2017), etc.
Introduction of innovative energy saving technologies in buildings has been supported by government.

**Image of ZEB (Net Zero Energy Building)**

- Use of PV generation
- Use of solar heat
- Glass roof
- Cool roof
- Reduce the load from outdoor air
- Total heat exchanger
- Natural ventilation
- Outdoor air cooling
- Night purge
- Use of underground or well water
- Networking of neighboring buildings
- Use of waste heat from incineration plant
- Local energy network
- Reduce the load thru building envelope
- Louvers, eaves
- PV panel for wall
- PV panel for window (see-through)
- Reduce the internal load
- Use of daylight
- LED lighting
- Organic EL lighting
- Air-flow window
- High efficiency lighting
- Task ambient lighting
- High efficiency air-conditioning
- Radiant cooling
- Blast with large temperature difference
- Desiccant air-conditioning
- Use of energy from river
- Geothermal heat pump
- Use of thermal energy from sewage
- Use of urban thermal energy
- Use of waste heat from incineration plant
- Cogeneration
- High efficiency equipment
- High efficiency heat pump
- High efficiency boiler
- High efficiency pump
- Use of urban thermal energy
- Use of thermal energy from sewage
- Use of daylight
- High efficiency equipment
- High efficiency air-conditioning
- Use of urban thermal energy
- Use of thermal energy from sewage
- Use of daylight
- High efficiency equipment
- High efficiency air-conditioning
- Use of urban thermal energy
- Use of thermal energy from sewage
- Use of daylight
- High efficiency equipment
- High efficiency air-conditioning

Source: The Consultant based on various materials
### 5. EEC approaches by Tokyo metropolitan government

#### EEC approaches by Tokyo metropolitan government for existing facilities (1)

<table>
<thead>
<tr>
<th>Target business establishment</th>
<th>Entity with energy consumption of 1,500 kL/year or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction plan period</td>
<td>Phase 1: FY2010 - FY2014</td>
</tr>
<tr>
<td></td>
<td>Phase 2: FY2015 - FY2019</td>
</tr>
<tr>
<td>Standard emissions</td>
<td>Average of three consecutive years from FY2002 to FY2007</td>
</tr>
<tr>
<td>Reduction obligation rate</td>
<td>Phase 1: Office buildings etc. 8%, factories etc. 6%</td>
</tr>
<tr>
<td></td>
<td>Phase 2: Office buildings etc. 17%, factories etc. 15%</td>
</tr>
<tr>
<td>Promotion system at business establishment</td>
<td>Obligation of election of supervising management and technical manager -&gt; Organizational energy management</td>
</tr>
<tr>
<td>Measures in case of non-compliance</td>
<td>In case of not achieving obligated reduction obligation</td>
</tr>
<tr>
<td></td>
<td>➢ Order: Reduction in obligation by x 1.3 times</td>
</tr>
<tr>
<td></td>
<td>➢ In the event of an order violation, fines, publication of violation facts etc.</td>
</tr>
</tbody>
</table>

Source: The Consultant based on homepage of Tokyo metropolitan government
5. EEC approaches by Tokyo metropolitan government

**EEC approaches by Tokyo metropolitan government for existing facilities (2)**

- Priority shall be given to reducing emissions by EEC measures.
- Utilization of cap & trade mechanism is also possible.

*Image of cap & trade mechanism*

Source: The Consultant based on homepage of Tokyo Metropolitan government
5. EEC approaches by Tokyo metropolitan government

EEC approaches by Tokyo metropolitan government for existing facilities (3)

- Promotion system at business establishment is required
- Obligation of election of supervising management and technical manager -> Organizational energy management

Realization of purpose at system introduction
⇒ "Make EEC measures from the worksite to top management issues"

Has management's interest in the trend of CO₂ reduction increased?
(Results of questionnaire in 2014)

Source: The Consultant based on homepage of Tokyo Metropolitan government’s material
6. Best practices of EEC

Best practice of EEC (1) : shopping mall

● Outline of the building
  • Location: Tokyo
  • Floor area: 19,550m²
  • Building structure: RC (Basement 1F – 4 floors)
  • AC system: DHC (District Heating and Cooling) + AC units (partially)
  • Number of workers: Approx. 200 persons

● EEC approaches
  ➢ Introduction of auto timer to lighting and AC in 2009. (ON/OFF switch was operated manually in the past)
  ➢ Introduction of LED to spot lighting equipment (approx. 1,000 units) in 2012
  ➢ Introduction of LED to regular lighting equipment (approx. 2,000 units) in 2014
6. Best practices of EEC

Best practice of EEC (1)
Trend of power consumption reductions
(approx. 8 years: Apr. 2009 - Jan. 2017)

38% reduction in 2016 compared with 2009

Source: The Consultant based on the material by the Tokyo metropolitan government (Jul. 2017)
Introduction of LED realized reductions of waste heat from lighting equipment, and achieved cooling demand reductions in summer.

Source: The Consultant based on the material by the Tokyo Metropolitan government (Jul.2017)
### Best practice of EEC (1)

**Evaluation of energy consumption reductions on primary energy basis**

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
<th>Primary energy consumption reductions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
<td>2009</td>
<td>2013</td>
<td>2015</td>
</tr>
<tr>
<td>Electric power consumption</td>
<td>275 MWh x 12 = 3,300 MWh/year</td>
<td></td>
<td>171 MWh x 12 = 2,052 MWh/year</td>
</tr>
<tr>
<td>Primary energy consumption</td>
<td>3,300 x 9.97 = 32,901 GJ/year</td>
<td></td>
<td>2,052 x 9.97 = 20,458 GJ/year</td>
</tr>
<tr>
<td>Cooling &amp; heating demand</td>
<td>445 GJ x 12 = 5,340 GJ/year</td>
<td></td>
<td>325 GJ x 12 = 3,900 GJ/year</td>
</tr>
<tr>
<td>Primary energy consumption</td>
<td>5,340 GJ x 1.36 = 7,262 GJ/year</td>
<td></td>
<td>3,900 GJ x 1.36 = 5,304 GJ/year</td>
</tr>
<tr>
<td>Total</td>
<td>32,901 + 7,262 = 40,163 GJ/year</td>
<td></td>
<td>20,458 + 5,304 = 25,762 GJ/year</td>
</tr>
</tbody>
</table>

**Note1:** Calculation was made by the Consultant.

**Note2:** Conversion factors for electric power and DHC were based on the guide for completing periodical report regarding EE law. (METI, Aug. 2017)

**Note3:** Changes of both heating and cooling demands by the introduction of LED are taken into account.

**Source:** The Consultant based on the material by the Tokyo Metropolitan government (Jul. 2017)
6. Best practices of EEC

**Best practice of EEC (2)**

*Co-gen introduction example in chemical factory*

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**Schematic flow of co-generation system in chemical factory**

<table>
<thead>
<tr>
<th>CO₂ emissions before EE measure (t)</th>
<th>CO₂ emissions after EE measure (t)</th>
<th>CO₂ emissions reduction (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction of co-gen</td>
<td>99,927 (FY2005)</td>
<td>75,238 (FY2007)</td>
</tr>
</tbody>
</table>

**Effects on CO₂ emissions reductions**

Source: CGS NEWS Vol.2 No.12 Dec.2010
### Best practice of EEC (3)

**Co-gen introduction example in beer factory**

<table>
<thead>
<tr>
<th>Description</th>
<th>Major specification of co-gen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas turbine co-gen</td>
<td>1,220kW x 2</td>
</tr>
<tr>
<td>Generation efficiency</td>
<td>24.9%</td>
</tr>
<tr>
<td>Heat recovery efficiency</td>
<td>46.2%</td>
</tr>
<tr>
<td>Total efficiency</td>
<td>71.1%</td>
</tr>
</tbody>
</table>

*Source: Advanced co-generation and energy utilization center, Japan*

#### Before

- **Electric power**: Power purchased 100%
- **Steam**: Steam purchased

#### After

- **Electric power**: Power purchased 60%
- **Co-gen**: 40%
- **Steam**: Steam purchased 60%
- **Co-gen**: 40%

*Source: Advanced co-generation and energy utilization center, Japan*
6. Best practices of EEC

Best practice of EEC (4)
Example of railway station building

- EEC project: Railway station building
- EEC measures taken:
  - Mounting inverter to fans of air-handling units.
  - Mounting inverter to pumps for chillers and cooling water.

<table>
<thead>
<tr>
<th></th>
<th>Before retrofitting</th>
<th>After retrofitting (Actual results or estimates)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption of electric power (kWh/year)</td>
<td>1,476,696</td>
<td>1,003,121</td>
</tr>
<tr>
<td>Consumption of primary energy (GJ/year)</td>
<td>14,515</td>
<td>9,860</td>
</tr>
</tbody>
</table>

32.1% reduction

Source: Japan Association of Energy Service companies
6. Best practices of EEC

**Best practice of EEC (5)**

**Inverter introduction example**

- **EEC project:** Office building
- **EEC measures taken:**
  - Mounting inverter to fans of air-handling units.
  - Mounting inverter to pumps for cooling water.
  - Adoption of efficient reflector for lighting.

![Newly added module for inverter](image)

<table>
<thead>
<tr>
<th>Before retrofitting</th>
<th>After retrofitting (Actual results of estimates)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption of electric power (kWh/year)</td>
<td>20,413,120</td>
</tr>
</tbody>
</table>

- **18.1% reduction**

![Graph showing energy consumption before and after retrofitting](graph)

*Source: Japan Association of Energy Service companies*
6. Best practices of EEC

**Best practice of EEC (6)**

LED lamps introduction example

- EEC project: Security lamps (streets in H city)
- EEC measures taken:

<table>
<thead>
<tr>
<th>Existing equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,988 fluorescent lamps</td>
</tr>
<tr>
<td>134 mercury lamps</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EE measures taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange to 12,122 LED lamps</td>
</tr>
</tbody>
</table>

42% reductions of electric power consumption

*Source* JAPAN FACILITY SOLUTIONS, INC
7. New EEC business model

New EEC business model: Eco-tuning (soft ESCO)

✓ Facility management of conventional government buildings etc. is aimed at appropriately managing facilities according to the manual etc.

✓ In facility management by eco-tuning, eco-tuning will be added to facility management in daily government buildings.

✓ In eco-tuning, operational improvements will be achieved from the viewpoint of EEC without compromising comfort and productivity, under detailed analysis of energy consumption.

Source: The Consultant based on homepage of Ministry of Environment
Government buildings, Company buildings, etc

Contract

Certified Eco-tuning companies

Implement operational improvement based on the proposal of eco-tuning company

Cost reduction of governments/building owners

Reductions of CO₂ emissions and utility costs

Remuneration for eco-tuning companies (part of utility costs reduction)

Source: The Consultant based on homepage of Ministry of Environment
8. Three EEC promotion strategies

Three EEC promotion strategies

Ultimate goal (long-term)
Voluntary EEC actions

Policy and regulation
Strengthening EEC regulation
• EEC law
• Strong leadership by government
• Formulation of EE standards & labeling

Incentives
Governmental support for EEC measures
• Subsidy
• Low-interest loan
• Interest subsidy
• Tax exemption or special depreciation

Public awareness
Improvement and strengthening of EEC consciousness
• Awarding of excellent activities
• Awarding for excellent equipment
• Annual energy & environment event

Quantitative information on technologies and effectiveness toward EEC acceleration

Source: The Consultant
Thank you so much for your kind attention!

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