International Partnership for Energy Efficiency and Conservation (IPEEC)
Worldwide Energy Efficiency Action through Capacity Building & Training (WEACT)
2nd Workshop (At Jakarta)
Session III : Energy Efficiency Indicator
- Panel Discussion -

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(Panelist / WEACT Trainer) Kazuhiko YOSHIDA
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Cooperation Planning and Management Department
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The Energy Conservation Center, Japan (ECCJ)
On Behalf of Ministry of Economy, Trade and Industry
# Overview National Energy Efficiency Indicators and Targets (Japan and Other EAS Countries)

<table>
<thead>
<tr>
<th>Countries</th>
<th>EE Indicator</th>
<th>Goals</th>
<th>Related Target</th>
<th>Indicator</th>
<th>Goals</th>
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</thead>
<tbody>
<tr>
<td>Japan</td>
<td>Energy Intensity (TPES/GDP)</td>
<td>30% Improvement by 2030 from 2003 Level</td>
<td>Amount of GHG Emission</td>
<td>6% Reduction in 2008-2012 from 1990 Level</td>
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<td>(For Reference) Other EAS (East Asia Summit) Countries</td>
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<tr>
<td>Australia</td>
<td>Carbon Pollution</td>
<td>5% Reduction below 2000 Level by 2020</td>
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<td>Brunei Darussalam</td>
<td>Energy Intensity (TPES/GDP)</td>
<td>25% Improvement by 2030 from 2005 Level</td>
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<tr>
<td>Cambodia</td>
<td>Final Energy Demand</td>
<td>10% Reduction from BAU by 2030</td>
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<td>China</td>
<td>Energy Intensity (TPES/GDP)</td>
<td>16% Improvement during 12th 5-yaer Plan (2011-2015)</td>
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<tr>
<td>India</td>
<td>Not Submitted</td>
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<tr>
<td>Indonesia</td>
<td>Energy Intensity (TPES/GDP)</td>
<td>Reducing 1% / Year until 2025</td>
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<tr>
<td>Korea</td>
<td>Energy Intensity (TPES/GDP)</td>
<td>46.7% Improvement by 2030 from 2006 Level</td>
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<tr>
<td>Lao PDR</td>
<td>Final Energy Demand</td>
<td>10% Reduction from BAU by 2030</td>
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</tr>
</tbody>
</table>

TPES : Total Primary Energy Supply  
BAU : Business As Usual  
Source: Asia Energy Efficiency and Conservation Collaboration Center  
(URL: http://www.asiaeec-col.eccj.or.jp/dtb-policies/eegoals/index.html)
E.E. Indicators: Policy Background to Harmonize “3Es” for Sustainable Development

- Environment
  - Minimization
- Energy Security
- Natural Resources
- Economy
  - Business Units
  - Production Operation
  - Products Services Energy
  - Market
  - Consumers

Pollution
- Loss Waste
- CO\textsubscript{2}, Pollutants etc.

Impacts
- Global Warming
- Loss Waste

Energy Security
- Natural Resources

E.C.C.J.

3
Primary Energy Supply per GDP in Japan: Trend

- 1st Oil Crisis
- 2nd Oil Crisis
- Improvement by Over 35%
- Act Concerning Rational Use of Energy
- Heat Management Regulation (1951-)

Source: METI/General Energy Statistics

Kyoto Protocol 1st Campaign (2008-)

ECCJ
Main Energy Policies to Realize the “3Es” Harmonization in Japan

1. Fundamental Law on Energy Policy Measures

(1) **Legislative Measures** for Energy Supply – Demand Management (Including Financial Measures)
   1) Act Concerning Rational Energy Use (EC Law)
   2) Energy Conservation and Recycling Assistance Law

(2) Development of **Basic Plan on Energy (Long Term Plan)**
   1) Establishment of Long-term / Comprehensive / Well-planned Measures for Energy Supply - Demand Management
      - EC Law / Technological Strategy for R&D / Sectoral Benchmark Approach, etc.
   2) Establishment of Measures for Intensive R&D of E. Technologies
      - Development of Technological Strategy on Energy

2. Law Concerning the Promotion of Measures to Cope with Global Warming
Main Energy Policies to Realize the “3Es” Harmonization in Japan (Continued)

2. Law Concerning the Promotion of Measures to Cope with Global Warming (April 1999)
   Establishment of the Following
(1) **Kyoto Protocol Target Achievement Plan**
   National Basic Direction on Countermeasures against Global Warming / Measures by Sector
(2) Global Warming Prevention Headquarters

(3) Implementation Plans of National and Local Government
(4) **National System for CO2 Calculation / Reporting / Publication / Realization through the EC Act**
(5) National System to Implement Kyoto Mechanism (Registry)
   Trading Rule of Credit / Protection of Trading
(6) National and Regional Global Warming Prevention Centers to Promote Nation-wide CO2 Reduction Activities
(7) Promoters to Facilitate National CO2 Reduction Activities
Overview of Policy and Implementation System

Basic Plan on Energy
- New and Renewable Energy
  - Energy Efficiency and Conservation
    - Basic Policy
      - Basic Philosophy
      - Responsibilities (Government etc.)
      - Long-term Comprehensive Energy Plan
      - Legislative Measures, etc.
    - Regulation: Act Concerning Rational Use of Energy
    - Support: Tax Reduction for Green Investment
    - Promoting Measures (Award / Commendation System)

National Energy Database

Government
- Dialogue Opportunities (Committees, etc.)
- Report & Check System
  - Data & Info. Required to Submit

Private Sector
- Association - A
  - A: Companies
- Association - B
  - B: Companies
- Associations • • • • • • • •
  - Companies • • • • • • • ••
  - Companies • • ••

Market and Business Oriented Activities

People
National Energy Balance: Basis to Establish E.E. Indicators

Source: Energy Statistics (Ministry of Economy, Trade and Industry of Japan)
National Energy Flow and Energy Efficiency Indicators

Primary Energy Supply | Transformation | Final Energy Consumption

- LOSS
- LOSS

Transportation

Residential

Commercial

Industry

Cars
Appliances / Equipment

Energy Efficiency Standards (Top Runner Program)

Changes in Unit Energy Consumption (Target: -1% / year)

Manageable & Controllable Indicators
Basic Policy: Energy Efficiency Indicators to Setup and Target for Controlling

Factories / Buildings etc. Guided by EC Law
(Not Mandatory)

- **Incremental Target to Improve**
  - 1% or More of Improvement in Unit Energy Consumption
    - (Yearly Average (Exp. in Japan))

Factories etc. Regulated by EC Law

For Specific Energy Intense Industries

**Benchmark**

- **X > 90% (Industry)**
- **X > 50% (Commercial)**

Cumulated Energy Consumption

Size of Business Operators / Chain Business Operators
(Industry or Commercial Sector)
## Benchmark by EC Act in Japan (Iron and Steel)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Business Field</th>
<th>Benchmark Index (Definition)</th>
<th>Numerical Target</th>
</tr>
</thead>
</table>
| 1A             | Iron manufacturing using blast furnaces (Business to manufacture pig iron using blast furnaces to manufacture products) | Unit energy consumption obtained by \( A/B \)  
\( A \) : Energy consumption to manufacture steel using blast furnaces  
\( B \) : Amount of crude steel | 0.531 kIOE/t or less |
| 1B             | Conventional steel manufacturing using electric arc furnaces (EAF) (Business to manufacture pig iron using EAF and to manufacture rolled steel products, excluding 1A) | Unit energy consumption obtained by \((1) + (2)\)  
(1) EAF Process : Unit energy consumption obtained by \( A/B \)  
\( A \) : Energy consumption in the process to manufacture crude steel using EAF  
\( B \) : Amount of raw steel  
(2) Rolling Process : Unit energy consumption obtained by \( A/B \)  
\( A \) : Energy consumption in the process to manufacture rolled common steel products from slab or billet | 0.143 kIOE/t or less |
| 1C             | Special steel manufacturing using electric arc furnaces (EAF) (Business to manufacture pig iron using EAF to manufacture special steel products (rolled special steel products, hot special steel pipes, cold-drawn special steel pipes, cold-finished special steel products, forged special steel products, cast special steel products), excluding 1A) | Unit energy consumption obtained by \((1) + (2)\)  
(1) Unit energy consumption obtained by \( A/B \)  
\( A \) : EAF Process : Energy consumption in the process to manufacture crude steel using EAF  
\( B \) : Amount of crude steel  
(2) Finishing Process : Unit energy consumption obtained by \( A/B \)  
\( A \) : Energy consumption in the process to manufacture special steel products (rolled special steel products, hot special steel pipes, cold-drawn special steel pipes, cold-finished special steel products, forged special steel products, casted special steel products) from billet  
\( B \) : Amount of shipped (sold) steel | 0.36 kIOE/t or less |
### Benchmark by EC Act in Japan (Cement / Paper)

#### Cement

<table>
<thead>
<tr>
<th>Classification</th>
<th>Business Field</th>
<th>Benchmark Index</th>
<th>Numerical Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Cement manufacturing</td>
<td>Unit energy consumption obtained by (((1) + (2) + (3) + (4)))</td>
<td>3891 MJ/t or less</td>
</tr>
</tbody>
</table>
|                | (Business to manufacture Portland cement (JIS R 5210), blast furnace cement (JIS R 5211), silica cement (JIS R 5212), fly-ash cement (JIS R 5213)) | (1) Raw Material Preparation Process : Unit energy consumption obtained by \(A/B\)  
A : Energy consumption in the raw material preparation process  
B : Amount of prepared raw material  
(2) Clinker Making Process : Unit energy consumption obtained by \(A/B\)  
A : Energy consumption in the clinker making process  
B : Amount of clinker  
(3) Finishing Process : Unit energy consumption obtained by \(A/B\)  
A : Energy consumption in the finishing process  
B : Amount of finished cement  
(4) Shipping Process : Unit energy consumption obtained by \(A/B\)  
A : Energy consumption in the shipping process, etc.  
B : Amount of Shipped cement |

#### Paper

<table>
<thead>
<tr>
<th>Classification</th>
<th>Business Field</th>
<th>Benchmark Index</th>
<th>Numerical Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>4A</td>
<td>Paper Manufacturing</td>
<td>Unit energy consumption : ((\text{Energy Consumption}) / (\text{Product}))</td>
<td>8532 MJ/t or less</td>
</tr>
<tr>
<td></td>
<td>(Paper for printing, copying and wrapping, including newspaper)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4B</td>
<td>Cardboard Manufacturing</td>
<td>Unit energy consumption : ((\text{Energy Consumption}) / (\text{Product}))</td>
<td>4944 MJ/t or less</td>
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<td></td>
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</tbody>
</table>
### Benchmark by EC Act in Japan (Electric Power)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Business Field</th>
<th>Benchmark Index</th>
<th>Numerical Target</th>
</tr>
</thead>
</table>
| 2              | Electric power supplier (Industry that supplies electricity determined by 2.1 of Act on the Rational Use of Energy among general electricity industry or wholesale electricity industry defined by 2.1.3 of Electricity Utilities Industry Law) | Index obtained by A/B: \[
\frac{A}{B} = \frac{\sum_{i=1}^{n} (Pr_i \times (A/B)_i)}{\sum_{i=1}^{n} Pr_i}
\]
(Standardized thermal efficiency index)
For thermal power generation facilities of the electric power supplier specified except a low availability of facilities
- A : The actual thermal efficiency obtained by a performance test of rated output
- B : Designed efficiency of the rated output
(Data to Submit for Reference)
Thermal energy efficiency obtained by C/D
- C : Total electric power generated at the generation end
- D : Total calorific heat (gross) to generated the electric power specified by C | 100.3% or more |

### Other Specified Industries for Benchmark
Oil Refining / Chemical (Ethylene and Caustic Soda Manufacturing)

Realistic Benchmarks Manageable and Matched with The Actual Conditions for Each Industry
### Conditions / Factors Affecting Benchmark (Iron & Steel)

<table>
<thead>
<tr>
<th>Factors to Affect EE&amp;C</th>
<th>Raw Materials</th>
<th>Process Technologies</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Iron Ore</td>
<td>Ironmaking</td>
<td>* Foundry Iron (Qualities)</td>
</tr>
<tr>
<td></td>
<td>- Total Fe</td>
<td>Steelmaking</td>
<td>Slab / Billet / Bloom (Qualities)</td>
</tr>
<tr>
<td></td>
<td>- SiO2/Al2O3, etc.</td>
<td>Rolling / Finishing</td>
<td>Kinds / Qualities / Lot Size etc. (Coil, Plate, Wire, Rod etc.)</td>
</tr>
<tr>
<td></td>
<td>Limestone</td>
<td></td>
<td>Kinds / Qualities / Lot Size etc. (Coil, Plate, Wire, Rod etc.)</td>
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<tr>
<td></td>
<td>- CaO Content</td>
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<tr>
<td></td>
<td>Other Fluxes</td>
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<tr>
<td></td>
<td>Coal</td>
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<td></td>
<td>- Total C / Ash Content, etc.</td>
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<tr>
<td></td>
<td>Sizing / Blending Coke Making</td>
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<td></td>
<td>Coke Making</td>
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<td></td>
<td>Sizing / Blending Coke Making</td>
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<td></td>
<td>Utilities</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Fuel / Electricity / Gas / Water etc.</td>
<td>Cold Blast / O₂ / Fuel for Combustion / Heating Media / N₂, etc.</td>
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<tr>
<td></td>
<td>Electricity / Fuel for Combustion / Heating Media / N₂, etc.</td>
<td>Blowing Gas O₂ &amp; Ar for Refining &amp; Degassing / Electricity / Water etc.</td>
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<td></td>
<td></td>
<td>Blowing Gas O₂ &amp; Ar for Refining &amp; Degassing / Electricity / Water etc.</td>
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<tr>
<td></td>
<td>Products</td>
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<tr>
<td></td>
<td>* Foundry Iron (Qualities)</td>
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<td></td>
<td>Slab / Billet / Bloom (Qualities)</td>
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<td></td>
<td>Kinds / Qualities / Lot Size etc. (Coil, Plate, Wire, Rod etc.)</td>
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<td>Kinds / Qualities / Lot Size etc. (Coil, Plate, Wire, Rod etc.)</td>
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<td></td>
<td>Typical Technologies</td>
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<td></td>
<td>For Process</td>
<td>Sintering - Mixture Control</td>
<td>Continuous Casting (CC)</td>
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<tr>
<td></td>
<td></td>
<td>- Ignition Furnace, etc.</td>
<td>- Continuous Casting (CC)</td>
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<td>Coke Making - Combustion Control</td>
<td>- Continuous Rolling</td>
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<td></td>
<td>- Coal Moisture Control</td>
<td>- Synchronizing Control with CC (Hot Slab Direct Charge)</td>
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<td></td>
<td></td>
<td>- Recycle waste Plastic</td>
<td>- Descaling</td>
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<td></td>
<td></td>
<td>Sintering - Cooling Heat Recovery Coke Making</td>
<td>- Regenerative Burner</td>
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<td></td>
<td></td>
<td>- C.O. Gas Recovery CDQ</td>
<td>Re-heating Furnace - Combustion Control</td>
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<tr>
<td></td>
<td>For EE&amp;C (Common) Energy Control Center, VVVF for Fan / Blower / Pumps, etc.)</td>
<td>Sintering - Cooling Heat Recovery Coke Making</td>
<td>- Regenerative Type</td>
</tr>
<tr>
<td></td>
<td>Unit Energy Consumptions</td>
<td>MJ / t - Sintered Ore MJ / t - Coke</td>
<td>- Annealing Furnace</td>
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<tr>
<td></td>
<td></td>
<td>MJ / t - Hot Metal (Pig Iron)</td>
<td>- Temperature Control</td>
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<tr>
<td></td>
<td></td>
<td>MJ / t - Molten Crude Steel</td>
<td>- Regenerative Heater</td>
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<tr>
<td></td>
<td></td>
<td>MJ / t - Hot Metal (Pig Iron)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>MJ / t - Molten Crude Steel (Slab, Billet, Ingot)</td>
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<tr>
<td></td>
<td></td>
<td>MJ / t - Hot Coil etc.</td>
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<tr>
<td></td>
<td></td>
<td>MJ / t - Finished Steel</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>MJ / t - Finished Steel</td>
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</tr>
</tbody>
</table>
Steel : Process Flow and EE&C Technology (at Integrated Steel Works)

- BF Gas Holder
- Gas Turbine Combined Cycle Power Generation
- LD Gas & Heat Recovery
- BOF Gas Holder
- Continuous Caster
- Hot Slab Charging
- Continuous Annealing
- Continuous Rolling
- Hot Rolling
- Cold Rolling
- Annealing Furnace
- Sintering Machine
- Blast Furnace (BF)
- Efficient Heating Furnace
- Hot Stove Waste Heat Recovery
- Sinter Cooler Heat Recov.
- PCI* Blast Furnace (BF)
- Energy Management And Control System
- Top gas pressure recovery turbine (TRT)

*PCI : Pulverized Coal Injection

(* Source (Drawing) : JFE Steel Corporation )
<table>
<thead>
<tr>
<th>Factors to Affect EE&amp;C</th>
<th>Raw Material Pre-treatment</th>
<th>Clinker Making</th>
<th>Finishing / Shipping</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Raw Materials</strong></td>
<td></td>
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</tr>
<tr>
<td>Reutilized Waste</td>
<td></td>
<td>Utilization of Recycled Tire, Oil, Plastics, Biomass Waste etc.</td>
<td>Mixing Conditions - Gypsum - BF Slag, Fly Ash etc.</td>
</tr>
<tr>
<td>- Waste Tire</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Steel Slag</td>
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<td></td>
<td></td>
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<tr>
<td>- Fly Ash</td>
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<td></td>
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<tr>
<td>- Sludge etc.</td>
<td></td>
<td></td>
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<tr>
<td>Limestone</td>
<td>Sizing Blending</td>
<td></td>
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<tr>
<td>- CaO Contents Clay etc.</td>
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<tr>
<td>Coal</td>
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<tr>
<td>- Total C / Ash Content, etc.</td>
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<tr>
<td><strong>Utilities</strong></td>
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<tr>
<td>Fuel / Electricity / Gas / Water etc.</td>
<td></td>
<td>Electricity / Water etc.</td>
<td>Electricity / Water, etc.</td>
</tr>
<tr>
<td><strong>Products</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>For Process</td>
<td></td>
<td>Kiln Heat Utilization - Suspension Pre-heater (SP) - Caiciner (New Suspension Pre-heater(NSP)) Efficient Kiln Burner Heat Recovery of Waste Gas</td>
<td>Additive Mixing Control - Pre-grinding Control - Efficient Separator</td>
</tr>
<tr>
<td><strong>Typical Technologies</strong></td>
<td>Dry Process Blending / Sizing Control - Vertical Type of Mill with Efficient Classifier etc. (Wet / Semi-Wet Processes Remain.)</td>
<td>Cooling Control</td>
<td></td>
</tr>
<tr>
<td>For EE&amp;C</td>
<td>Application of VVVF for Blowers etc.</td>
<td>Heat Recovery of Kiln Usage of Recycled Fuel (Including Pre-Treatment)</td>
<td>Heat Recovery of Coolant Air Mixtrure of Recycled Slag and Fly Ash etc.</td>
</tr>
<tr>
<td><strong>Unit Energy Consumptions</strong></td>
<td>MJ / t - Mixture</td>
<td></td>
<td>MJ / t - Finished Cement MJ / t - Shipped Cement</td>
</tr>
</tbody>
</table>
Cement Industry: Process Flow and EE&C Technology

Reutilization of Recycled Material
- Slag / Sludge / Dust, etc.

Vertical Mill
- Reduction in Electric Power
- Excellent Classifier Control

NSP (New Suspension Pre-heater)
Drying, Pre-heating and Calcinining Raw Materials by Utilizing Waste Heat from Kiln
Utilization of Recycled Tire, Fuels
- Reduction of Fuel

Mixed Cement
Reutilization of Waste Material
(BF Slag, Fly Ash etc.)
- Mixing Rate: 22-23%

Pre-Grinding
- Reduction of Power

Reutilization of BF Slag / Used Tire etc.
Participation in International Benchmarking
- Activities in APP (Asia-Pacific Partnership) (*) -

Under Activities on Clean Development and Climate”
Benchmarking for Major Industries in 8 Areas (Cement, Steel, Aluminum, Power Generation & Transmission, etc.)
(*) Transferred to IPEEC-GSEP (Global Superior Energy Performance)

1. Define and Setup Benchmark
Based on Shared Data / Information
(1) Key Operating Data (Production, Raw Materials etc.)
(2) Energy Data
(3) Applied Technologies and Equipment

2. Typical Joint Activities to Prove Effects and Disseminate Effective Technologies to Achieve Benchmarks
(1) Energy Audit / Investigation of Cooperating Factories to Check Energy Performances etc.
(2) Implementation of Joint Projects, etc.

Source : http://www.asiapacificpartnership.org/english/about.aspx
A. Energy Efficiency Indicators Manageable by Policy etc.
To Be Suitable for National Situations and Matched with Policy
A1. National Level Indicator Matched with National Policy
Monitoring / Evaluation of National Energy Performance toward “Sustainable Development” Based on the “3Es Harmonization”
- Energy Intensity : (Total Primary Energy Supply) / (GDP)
- Energy Elasticity
- Total Primary Energy Supply, Energy Consumption, etc.
A2. Ministry Level Indicator Manageable by Policy
To Target and Check / Analyze the Actual Results under Policy / Law
- Amount of Used Energy (Incremental Change / Level)
- Energy Unit Consumption (Incremental Change / Level (Benchmark))
- Indicators Related to Environmental Indices
A3. Company Level Indicator Controllable / Manageable by EM etc.
Indicators for Main Process and Equipment to Control by Companies
- Amount of Used Energy (Incremental Change / Level)
- Energy Unit Consumption (Incremental Change / Level (Benchmark))
- Indicators Optimized with Cost and Sales Amount, etc.
B. Establishment of National Database
(Basis) System to Collect, Monitor, Analyze Data / Information and to Evaluate Energy Performance
- National Statistics (GDP, Population, Number of Households etc.)
- Reporting / Checking System on Energy Use etc. under EC Law
- Definition of Data / Information Required to Establish E.E. Indicators

C. Dissemination of Good Energy Management System
(Basis) System for Promoting EE&C through Systematic Practices of Energy Management by Company – Factory / Building
Appropriate E.E. Indicators to Monitor and Control Energy Performance by Utilizing Established Database

Energy Management System to Be Established through
- Energy Conservation Law (and/or)
- ISO 50001 Energy Management System

“EE Indicators Linked with Systematic Actions to Improve”
Thank you very much

For More Information
The Energy Conservation Center, Japan (ECCJ)
http://www.eccj.or.jp
Asia Energy Efficiency and Conservation Collaboration Center (AEEC : Established in April 2007)
http://www.asiaeec-col.eccj.or.jp/index.html
Japanese Business Alliance for Smart Energy Worldwide
http://www.jase-w.eccj.or.jp/eng/index.html