PROMEEC (INDUSTRY) 2006 IN LAO PDR

PROMEEC Post-Workshop
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Dr. Daovong Phonekeo
Deputy Director General
Department of Electricity,
Ministry of Energy and Mines, Lao PDR

Outline

1. Energy audit
2. Seminar
1

Energy audit

Auditing Background

- Industry type: Cement
- Auditing dates: 2 - 5 October 2006
- Venue:
  1. Vangvieng Cement Factories No.1
  2. Vangvieng Cement Factories No.2, Vientiane, Lao PDR
Photos of the two cement factories

Vangvieng Factory No.1

Vangvieng Factory No.2

Information of Vangvieng cement factory No. 1
General Information of the factory

- Established Year: 1996
- Employees: 244
- Energy consumed per year:
  - Electricity: 8,307,924 kWh
  - Anthracite: 15,500 Ton
  - Fuel: 191,156 L

Information of Vangvieng cement factory No. 2
General Information of the factory

- Established Year: 2001 October
- Employees: 294
  - Technology engineer: 1
  - Mechanical Engineers: 5
  - Electrical Engineers: 3
  - Maintenance service technicians: 45
  - Operators: 18

Design capacity

- Clinker: 210,000 t/y
- Cement: 240,000 t/y
- Heat Consumption: 850 Kcal/Kg-cl
- Electric Power: 115 kWh/t cem.
Energy consumption (2005)

1. Electricity: 30,957,252 kWh
2. Anthracite: 31,071 T
3. Diesel: No data

Power average consumption
137.98 Kwh/t of cement
**Energy consumption (Anthracite)**

<table>
<thead>
<tr>
<th>Item</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinker (T)</strong></td>
<td>179,220</td>
<td>226,821</td>
<td>224,747</td>
<td>205,157</td>
</tr>
<tr>
<td><strong>Coal (T)</strong></td>
<td>26,428</td>
<td>35,634</td>
<td>33,090</td>
<td>31,071</td>
</tr>
<tr>
<td><strong>Heat</strong></td>
<td>811 Kcal/kg cl</td>
<td>864 Kcal/kg cl</td>
<td>809 Kcal/kg cl</td>
<td>832 Kcal/kg cl</td>
</tr>
</tbody>
</table>

**Activities of Energy Saving**

- Policy for Energy saving from the end of Year 2005
- Beginning from Electricity energy in January 2006. First training held in cement plant No II
- Making and monitoring of monthly records, analyzing of records
- Goal or objective determination 125 kWh/t cement
- Results from January-August/2006 133.49 kWh/t cement
Future plan of Energy Efficiency and Conservation in the Cement factory

- Raising awareness of Energy Efficiency and Conservation to all employees;
- Enhancing efficiency on machine and equipment maintenance to avoid the unscheduled shutdown;
- Keeping or increasing the productivities (quantity and quality);
- Establishment of Energy Efficiency and Conservation Committee to monitor the energy consumption and energy saving in the factory.
Pre-audit coordination

• Contacting the two Vangvieng Cement factories that proposed to be audited and asking them to fill up questionnaires for discussion during our visit.

• Organising a small team to join the on-the-job training on energy audit in the factory;

• Arranging a seminar on Promotion of Energy Efficiency and Conservation in Industry in Southeast Asia on 6 October 2006 including invitation of 80 participants.

List of participants

• Ministry of Energy and Mines, Lao PDR : 4
• ECCJ, Japan : 3
• ACE : 2
• PTM, Malaysia : 2
• The factories : 18

Total: 29 people
### Audit Items & Measurement

<table>
<thead>
<tr>
<th>Items</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat</td>
<td>Clinker (t/d), coal to kiln (t/d), coal to precalcer (t/d), Temperature (SP exit gas, cooler exit gas, clinker)</td>
</tr>
<tr>
<td>Waste heat recovery</td>
<td>Same as above</td>
</tr>
<tr>
<td>Big motor load factor</td>
<td>Motor power, pressure balance</td>
</tr>
<tr>
<td>Transformer load factor &amp; power factor</td>
<td></td>
</tr>
<tr>
<td>Air compressor</td>
<td>Motor power, pressure balance</td>
</tr>
<tr>
<td>Data management</td>
<td>Recording, targeting (SEC)</td>
</tr>
<tr>
<td>Employee awareness</td>
<td>SEC reporting, training, promotion committee</td>
</tr>
</tbody>
</table>

### Measuring Instrument List

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kanomax</td>
<td>PTM</td>
<td>Grate cooler air(2ry air), Coal comb air (1ry air)</td>
</tr>
<tr>
<td>Contact thermometer</td>
<td>PTM</td>
<td>Ambient air</td>
</tr>
<tr>
<td>Power monitor</td>
<td>PTM</td>
<td></td>
</tr>
<tr>
<td>Radiation thermometer</td>
<td>ECCJ</td>
<td>Kiln surface (3 locations) Cooler surface (3 locations) SP surface</td>
</tr>
</tbody>
</table>
Data collection in Factory 1

- Raw material
- Exhaust gas
- Coal
- Combustion air
- Clinker

Data collection in Factory 2

- Raw material
- Exhaust gas
- Pre-heater Section
- Pre-calciner
- Kiln Section
- Cooler Section

Gas flow vs. material flow
Participants measuring the temperature of the kiln

Monitoring of SEC & Key Variables

<table>
<thead>
<tr>
<th>Process</th>
<th>Calculation</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Mill</td>
<td>= Electric Power / Raw Material Charge</td>
<td>(kWh/kg-raw mat’l)</td>
</tr>
<tr>
<td>Burning</td>
<td>= Fuel / Clinker production</td>
<td>(kcal/kg-cl)</td>
</tr>
<tr>
<td></td>
<td>= O2% of Kiln Exhaust Gas</td>
<td>(%)</td>
</tr>
<tr>
<td>Cement Mill</td>
<td>= Electric Power / Cement Production</td>
<td>(kWh/kg-cement)</td>
</tr>
</tbody>
</table>
Participants closely analyzing the data

Participants paid attention at controlling system
Recommendations to the factories

Energy Management System

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Major Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accountability</td>
<td>Employee education (awareness)</td>
</tr>
<tr>
<td>Organization</td>
<td>EE&amp;C promotion committee Appoint an energy manager</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Data recording &amp; Sharing by all employees</td>
</tr>
<tr>
<td>Targeting</td>
<td>Specific energy consumption (SEC)</td>
</tr>
<tr>
<td></td>
<td>Key efficiency parameters (O2%)</td>
</tr>
<tr>
<td>Technology</td>
<td>Technical review (energy audit)</td>
</tr>
<tr>
<td>Operation &amp; maintenance (O&amp;M)</td>
<td>Product yield (avoid off-spec product) Preventive maintenance (avoid unscheduled shutdown)</td>
</tr>
</tbody>
</table>
Energy Saving Measures in Cement Factory

<table>
<thead>
<tr>
<th>Raw material section</th>
<th>Clinker burning section</th>
<th>Finishing section</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First step</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Selection of raw materials</td>
<td>1) Prevention of unscheduled shutdown</td>
<td>1) Management of particle fineness</td>
</tr>
<tr>
<td>2) Management of particle fineness</td>
<td>2) Selection of fuel</td>
<td>2) Management of grinding media</td>
</tr>
<tr>
<td>3) Management of grinding media</td>
<td>3) Prevention of leakage</td>
<td></td>
</tr>
<tr>
<td><strong>Second step</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Replacement of fan rotor</td>
<td>1) Use of industrial waste (waste tire, etc)</td>
<td>1) Installation of closed circuit mill (separator)</td>
</tr>
<tr>
<td>2) Improvement of temperature and pressure control system</td>
<td>2) Heat recovery of pre-heater exhaust gas and cooler exhaust gas (drying of raw material and generation of electricity)</td>
<td>2) Installation of feed control system</td>
</tr>
<tr>
<td>3) Improvement of mixing &amp; homogenization system</td>
<td>3) Replacement of cooler dust collection from multiclone to EP</td>
<td></td>
</tr>
<tr>
<td>4) Installation of closed circuit mill (separator)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Third step</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Conversion from wet process to dry process</td>
<td>1) Conversion of fuel from petroleum to coal</td>
<td>1) Use of industrial waste (slag, pozzolan)</td>
</tr>
<tr>
<td>2) Replacement of ball or tube mill by vertical roller mill</td>
<td>2) Conversion of SP to NSP</td>
<td></td>
</tr>
<tr>
<td>3) Pneumatic transfer of raw material to mechanical transfer</td>
<td>3) Conversion of planetary cooler to grate cooler</td>
<td></td>
</tr>
</tbody>
</table>

Monitoring of SEC & Key Variables

<table>
<thead>
<tr>
<th>Section</th>
<th>Monitored Item</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Raw Mill</td>
<td>SEC = Electric Power / Raw Material Charge</td>
<td>(kWh/kg-raw mat’l)</td>
</tr>
<tr>
<td>Clinker Burning</td>
<td>SEC = Fuel / Clinker production 02% of Kiln Exhaust Gas</td>
<td>(kcal/kg-cl) (%)</td>
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<tr>
<td>Cement Mill</td>
<td>SEC = Electric Power / Cement Production</td>
<td>(kWh/kg-cement)</td>
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</table>
Recording of SEC on a Graph

Grinding Ball Management

SEC should be monitored daily, and when SEC arrives at certain level, grinding balls is compensated.

Raw mill SEC (kWh/kg-mat’l)

Filling level of grinding balls is also important in grinding efficiency. Optimum level of filling should be maintained.

Ball diameter shrinks as time passes due to erosive effect. This leads to gradual increase of raw mill SEC.

Monitor raw mill SEC daily and add grinding balls in right timing

→ 10% energy saving expected
Seminar Background

• Seminar title: Seminar on the promotion on Energy Efficiency and Conservation (PROMEEC) for Major Industries in Southeast
• Seminar held: 6 October 2006
• Venue: Don Chan Palace, Vientiane, Lao PDR

Seminar Background

• Presenters:
  • ECCJ: 2, ACE:2, Malaysia: 1, Myanmar:1, The Philippines: 1, Lao PDR: 3
• Participants: 60
**Session 1**

**Policy and Initiatives on EE&C**

- Overview of EE&C Programs of ASEAN/ACE
- Overview of Plans and Programs on EE&C in Lao PDR, Ministry of Energy and Mines
- Initiatives and Programs of ECCJ on EE&C in Industry in Japan Mr. Hideyuki TANAKA, ECCJ

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**Session 2**

**EE&C Best Practices in Industries**

- Presentation: Case Study 1 (Cement factory and Hydropower plant, Lao PDR)
- Presentation: Case Study 2 (Textile, Glass and Food Malaysia) *Best Practices for Energy Efficiency and Conservation for the Textile, Glass and Food Industries in Malaysia*
- Presentation: Case Study 3 (Oil Refinery, Myanmar) *Best Practices for Energy Efficiency and Conservation for the Oil Refinery Industry in Myanmar*
Session 3
The Way Forward

• Presentation from ECCJ
• Presentation: Updates on the Development of Technical Directory ACE
• Presentation: Updates on the Development of Database/ Benchmark/ Guideline for Industry ACE

Thank you for your attention