Emerging Trends in Sugar Mill Cogeneration

Training on and transfer of efficient EU technologies in the sugar sector in Thailand (SPF- Sugar)

Arul Joe Mathias
Biomass and CDM expert

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Sugar Cogeneration in Thailand

• Mostly low pressure boilers
• Some are very old (over 30 years)
• Inefficient cogeneration plants.
• Boilers have been designed deliberately with low efficiency.
• Purchase of used equipments from western countries are common.
• Cogeneration within the same company
Developments in the past few years

- Use of medium pressure boilers (over 30 bar)
- Excess electricity export to the national grid.
- Use of alternative biomass fuels (rice husk, bark, other wood waste etc.)
- Several mills are studying the possibilities to upgrade/implement new projects

Developments in the past few years

- Professional approach in project development.
- Systematic feasibility studies and Implementation
- Tendering
- Negotiation
- Contract management
- Use of special purpose company
Energy requirement and supply in the sugar industry

Process energy required:
- Electricity: 25-30 kWh/t of sugarcane
- 0.4 tonne of steam

1 tonne of Sugarcane → 100 - 121 kg Sugar

Waste:
- 290 kg Bagasse ~ 100 kWh electricity

Power generation potential (partly utilised) in ASEAN

<table>
<thead>
<tr>
<th>Country</th>
<th>Sugar cane production (1,000 tonnes)</th>
<th>Bagasse production (1,000 tonnes)</th>
<th>Max. Power Generation Potential (GWh/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>31,000</td>
<td>8,990</td>
<td>2,997</td>
</tr>
<tr>
<td>Philippines</td>
<td>21,000</td>
<td>6,090</td>
<td>2,030</td>
</tr>
<tr>
<td>Thailand</td>
<td>54,000</td>
<td>15,660</td>
<td>5,220</td>
</tr>
<tr>
<td>Vietnam</td>
<td>12,000</td>
<td>3,480</td>
<td>1,160</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>118,000</strong></td>
<td><strong>34,220</strong></td>
<td><strong>11,407</strong></td>
</tr>
</tbody>
</table>

Bagasse = Sugar cane * 0.29; 1 kWh = 3 kg of bagasse (including steam for process)
Role of European Technology in Thailand’s Sugar Cogeneration

A project implemented in Danchang Bioenergy, Thailand with European technology set a new benchmark for sugar cogeneration in Thailand.

Dan Chang Bio Energy

Owner/Developer : Mitr Phol Sugar Corporation Limited
Size : 27,000 TCD (2.25 million TCY)
Location : Dan Chang, Suphanburi province
Existing equipment : Consisting of several old boilers and turbines
New boilers : 2 x 120 tph, 68 bar, 510°C
Grate type : Water cooled vibrating grate
New turbine : Extraction condensing turbine (41 MW gross)
Dan Chang Bio Energy

Fuel: Bagasse, cane leaves, wood bark and rice husk

Off-taker: Electricity Generation Authority of Thailand (EGAT)

Electricity export to EGAT: 25 MW

Export tariff: 2.14 Baht/kWh (grid); 1.85 Baht/kWh (sugar mill)

Management: Special Purpose Company

Supplier: ALSTOM

Contract type: Fixed price, fixed time turnkey with LD
Sustainable Environment through Clean and Efficient Energy Projects
Major Technical Attractions

• First high pressure boiler in ASEAN sugar industry
• Boiler efficiency above 90 % (LHV basis)
• First high pressure turbo-generator system
• Turbine efficiency around 85 % (design)
• Cogeneration efficiency above 70 %
• Optimized plant design
• High flexibility in operation
• Consistent electricity export: above 25 MW
Major Technical Attractions

- Multi-fuel firing capability
- Water cooled vibrating grate furnace
- Modern control system (DCS), monitoring
- Use of steam transformers
- No delay in construction and operation
- Plant met the performance guarantee figures agreed in the contract
- Excellent workmanship
Sustainable Environment through Clean and Efficient Energy Projects
Environmental Management

- No black smoke during the boiler operation.
- Efficient wet scrubber system to control the particulate emission
- Clean bottom ash collection system (wet)
- Clean fly ash collection system (wet)
- Proper ash disposal (used as fertiliser in the sugar plantation land sites)
Sustainable Environment through Clean and Efficient Energy Projects
Environmental Performance

• CO₂ mitigation potential: 80,000 ton CO₂/year

• Particulate emission within Thai limitations

• Stack emission
  
  \[\begin{align*}
  \text{CO} & : 70 - 260 \text{ ppm} \\
  \text{NO}_x & : 200 - 215 \text{ ppm} \\
  \text{SO}_2 & : 0 - 8 \text{ ppm}
  \end{align*}\]

Sugar Cogeneration: Future trend

• Several sugar mills expected to implement high pressure system

• Old plants are expected to be replaced by new projects

• Year round operation of the cogen plant expected

• Boilers will be designed for multi-fuels

• Potential to implement more than 20 high pressure systems in Thailand

• Confidence level in the industry will drive even higher pressure systems (close to 100 bar)
For more information, please contact:
aruljoe.mathias@cogen3.net

Thank You!