Workshop on
Energy Efficiency Enhancement in Refineries under PAT Scheme

Energy Conservation Opportunities in Refineries :
A case of BPCL, Kochi

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ISO 9001 : 2008 Certified Institute

Back Ground

Aim of the Project
To meet the compliance of Energy Conservation Act 2001 (52 of 2001), as Designated Consumer – Kochi Refinery (90,000 MTOE or above)

Main objectives of Project
- Identify energy efficiency opportunities in refinery operations and its utilities, to reduce costs and negative environmental impacts, while up grading the capacity;
- Assessment of technical feasibility & cost benefit analysis;
- Meeting statutory requirements of BEE & SDA and to develop a comprehensive strategy for implementation of identified potential energy savings;

Time Line : 3 months (January – March 2016)
Refinery Profile: BPCL Kochi

Installed Capacity: 9.5 MMTPA

Integrated Refinery Expansion Project (IREP) under progress to 15.5 MMTPA; To meet the growing demand of petroleum products in Indian market (as well as improve the auto-fuel quality to Euro-IV/VI levels)

Energy Audit Methodology

- Preliminary Survey
- Data Collection
  Plant records, energy input, equipment specifications, Process flows, etc.,
- Field Measurements using instruments
- Data Analysis (Historic & actual measured data)
- Discussions with individual plant production teams
- Techno-economic evaluation of energy conservation measures
- Presentation to Management
- Submission of draft report for Review to Individual units
- Discussions with Individual units for acceptance of proposals
- Final report submission
TERI Experience : Energy Audit Services (Last 3 years)

Petroleum & Natural Gas Sector

<table>
<thead>
<tr>
<th>Company</th>
<th>Type of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Gas India</td>
<td>Offshore Exploration</td>
</tr>
<tr>
<td>Kochi Refinery</td>
<td>Lighting Adequacy</td>
</tr>
<tr>
<td>GAIL</td>
<td>Gas Processing Stations</td>
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<tr>
<td>HPCL</td>
<td>Product Pipeline</td>
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</tbody>
</table>

TERI Experience : Energy Audit Services (Last 3 years)

Offshore Exploration Study :
- Air filter design change for Solar mars turbines;
- Optimization of wash Cycles;
- Inter connection of Power systems;
- Minimizing the flare gas emissions by additional storage (floating).

Estimated GHG emission reduction - 9820 MT of CO₂ eq (4% of present level)

Lighting Adequacy Study : Implementation investment **Rs 225 lakhs**

- Plant Lighting load : 1.75 MW
- 700 HPSV/HPMV lamps replaced with Metal Halide in Plant premises
- 17 Induction lamps / LED for street lighting
- 3 High Mast towers for Improving lighting adequacy levels
- Optimize the tap setting in lighting transformers

Estimated energy conservation Potential - 250 MTOE
How different from other sectors (under PAT)

- Entry Authorization (permits) for the team
- Mandatory safety training
- Daily Work permits for different types of works from different departments
- Continuous presence of team in field
- Co-ordination between plant internal team with audit team
Energy Performance : Indian Refineries

Captive energy consumption of refineries is 8.3 liters for barrel of crude (159 liters);

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughput</td>
<td>Million Metric Ton per annum, MMTPA</td>
<td>2.81 - 41.44</td>
</tr>
<tr>
<td>NRGF</td>
<td></td>
<td>4.2178 - 10.259</td>
</tr>
<tr>
<td>MBN</td>
<td>MMBTU / Barrel / NRGF</td>
<td>50.9986 (High η )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>99.895 (Low η )</td>
</tr>
<tr>
<td>SEC</td>
<td>kCal/liter</td>
<td>524 - 1042</td>
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Kochi Refinery : PAT Target

<table>
<thead>
<tr>
<th></th>
<th>Crude Throughput Th.Bbls</th>
<th>NRGF</th>
<th>Target MBN</th>
<th>MBN Reduction</th>
<th>% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBN</td>
<td>78.3944</td>
<td>78496</td>
<td>4.2178</td>
<td>73.1011</td>
<td>5.29</td>
</tr>
</tbody>
</table>

Based on sectorial target reduction of 5.97%

BEE Calculation

MBN - Million British Thermal Unit per Thousand barrels per Energy Factor

\[ \text{MBN} = \frac{\text{MMBTU} / \text{Barrel} / \text{NRGF}}{\text{NRGF}} = (\text{Fuel} + \text{Loss}) \]

NRGF - Complexity of the refinery

Reference:
Energy Conservation Opportunities - Process

- Optimization of heat sources and using for product pre-heating;
- Optimization of valves position as well process parameters and improving yields;
- Additional power generation sources (instead of pressure drops);
- Optimization of reaction parameters and improve yields;

Energy Conservation Opportunities - Utility

- Power generation in place of PRDS;
- Vapour Absorption System (VAM) in place of vapour compressor system;
- Optimum sizing of impellers/pumps and operating practices;
- Use of variable speed drives (both HT/LT) for capacity control;
- Optimizing boiler capacity utilization and steam consumption;
- Reactive power management and use of energy efficient motors
Barriers for EC Implementation

- Reliability of operations – Running equipment in part load;
- OEMs approval for modifications;
- Space constraints for implementation;
- Continuous operations (Restricted Shut down);
- Budget Limitations;

Meeting PAT Target

- Minimizing losses (flaring etc.,);
- Capacity enhancement of Refinery;
- Use of external fuels (Natural gas, etc.,);
- Crude composition;
- Technology improvement options;
Conclusion

- Potential exists for improving energy efficiency and energy conservation in refineries with no cost and low cost measures;
- Review of steam economy on continuous basis;
- High priority to implement process improvement measures and high investment proposals (with attractive payback period);
- Use of latest technology in energy monitoring systems.

THANK YOU

Save Energy. Save our Planet