BSES Kerala Power Limited

Energy Efficiency &
Energy Conservation
Introduction

- Promotion of energy efficiency & its conservation- the strategy to provide power to all by 2012
- Least cost option to augment the gap between the demand and supply
- Nearly 25,000 MW of capacity creation through energy efficiency in the electricity sector alone has been estimated in India
- One unit saved = two units generated.
What is energy conservation?

- Practice of decreasing the quantity of energy used without affecting the process.

It’s Advantage

- Cost cutting
  - Direct
  - Indirect
- Increased economic growth
- Reduces emission
- Most economic solution to energy shortage
- Preserve our natural resources
- Make money out of energy saving - CDM
Description of the Process at BKPL

- Raw HSD → Centrifuge → Treated HSD Tank
- Raw Naphtha Tank → Centrifuge → Treated Naphtha
- DM Plant
- Pre Treatment
- Water Reservoir
- Cooling Tower
- De-Aerator
- Pre-heater
- HRSG #1 → GTG #1
- HRSG #2 → GTG #2
- HRSG #3 → GTG #3
- TO KSEB 110 KV
- Station Xmer
**Gas Turbine**

- 3 X 45 MW GE LM6000 PC NLW
- Dual Shaft Aeroderivative Gas Turbine
- Startup fuel is HSD and main fuel is Naphtha
- Design conditions:
  - Ambient Temperature  28 °C
  - Relative Humidity  70 %
  - Inlet air Temp (after chilling)  8.88 °C

**HRSG**

- Three Nos. of Dual Pressure HRSG
  - Make – Thermax Babcock and Wilcox Ltd, Pune.

**Steam Turbine**

39 MW BHEL make

- Model – HNK 71/3.2- 4
- HP – 131.2 TPH, 44.5 Kg/Cm2
- LP – 35.85 TPH, 4.5 Kg/Cm2
Achievements of BKPL in Energy Conservation
Chiller condensate recovery

Source of Water - Condensate recovered from air chilling

Quantity – 15m3/ Hr. average

Power required to pump equivalent quantity from river – 4.5 KW.

Net saving 3.5 KW
Conversion of HSF to Side Stream Filter

Recirculation rate -11300 m3/Hr
Evaporation rate - 96 m3/Hr
Makeup at 6 COC = 115.2 (96+19.2 (blow down)) m3/Hr
Makeup at 10 COC = 106.7 (96+10.7 (blow down)) m3/Hr
Net saving = 8.5 m3/Hr.
# Pump De-staging - Condensate Extraction Pump (CEP)

<table>
<thead>
<tr>
<th></th>
<th>Pump Rating</th>
<th>Flow</th>
<th>Pump Head</th>
<th>Stages</th>
<th>Power consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>KW</td>
<td>m³/Hr</td>
<td>Kg/Cm²</td>
<td>Nos.</td>
<td>KW</td>
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<tr>
<td>Before De-staging</td>
<td>180</td>
<td>195</td>
<td>15.25</td>
<td>5</td>
<td>141.75</td>
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<tr>
<td>After De-staging</td>
<td>180</td>
<td>195</td>
<td>8.46</td>
<td>3</td>
<td>92.72</td>
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</tbody>
</table>

**Saving** 49.03

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**System Overview**

[Diagram of system overview]
# Pump De-staging- LP Boiler Feed Pump (LPBFP)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Pump Rating</th>
<th>Flow</th>
<th>Pump Head</th>
<th>Stages</th>
<th>Power consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>KW</td>
<td>m³/Hr</td>
<td>Kg/Cm²</td>
<td>Nos.</td>
<td>KW</td>
</tr>
<tr>
<td>Before De-staging</td>
<td>55</td>
<td>50.65</td>
<td>25</td>
<td>5</td>
<td>35.19</td>
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<tr>
<td>After De-staging</td>
<td>55</td>
<td>50.65</td>
<td>19.32</td>
<td>3</td>
<td>24.16</td>
</tr>
</tbody>
</table>

**Saving** 11.03

**Diagram:**
- MUWH
- FROM CEP TO DEAREATOR
- FROM BFP
- CRD
- IBD
- TO SPRAY
- LP DRUM
- LP ECO
- LP BANK
- LP SH I
- LP SH II
- TO STG
- LP STEAM
# Energy Efficient Hollow FRP (Epoxy Coated) CT Fan Blades

<table>
<thead>
<tr>
<th>CT Cell No.</th>
<th>Before blade change</th>
<th>With Aerotech blade</th>
<th>Saving (KW)</th>
<th>% Saving</th>
<th>Air flow increase (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Velocity (m /s)</td>
<td>Flow (m3/s)</td>
<td>Power (KW)</td>
<td>Velocity (m /s)</td>
<td>Flow (m3/s)</td>
</tr>
<tr>
<td>1</td>
<td>7.02</td>
<td>388.49</td>
<td>74.68</td>
<td>7.35</td>
<td>407.04</td>
</tr>
<tr>
<td>2</td>
<td>8.25</td>
<td>456.60</td>
<td>70.21</td>
<td>9.89</td>
<td>547.42</td>
</tr>
<tr>
<td>3</td>
<td>8.20</td>
<td>462.10</td>
<td>70.20</td>
<td>9.90</td>
<td>547.98</td>
</tr>
<tr>
<td>4</td>
<td>9.27</td>
<td>513.65</td>
<td>92.28</td>
<td>9.27</td>
<td>513.87</td>
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<tr>
<td>5</td>
<td>7.78</td>
<td>435.98</td>
<td>83.90</td>
<td>7.88</td>
<td>441.58</td>
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<tr>
<td>6</td>
<td>8.98</td>
<td>503.11</td>
<td>83.16</td>
<td>8.60</td>
<td>476.25</td>
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<tr>
<td>7</td>
<td>7.50</td>
<td>416.70</td>
<td>71.00</td>
<td>9.50</td>
<td>526.40</td>
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</tbody>
</table>

Total Saving 123.55  7.62
Efficiency improvement of Main Cooling Water Pump

- Original design of Cooling water pump was for 2X 60% capacity
- Single pump was operated at a off design condition
- Pump efficiency was reduced to 54%
- New pump installed in place of old pump with higher flow and efficiency (86%), maintaining the same motor.
- Net gain of 243 KW due to increase in the STG vacuum.
Installation of Vacuum pump

- Steam ejectors were used to maintain condenser vacuum.
- Direct saving of 90 KW due to the saving of the steam used by ejectors.
- 45 Minutes saving in plant cold startup time
- LP steam set point could be reduced to 3.9 KSC from 4.5, resulting in a saving of 220 KW in STG.
Cooling Tower Cell interconnection

- Two cooling towers with 3 cells and 4 cells
- Heat load distribution between the two CTs are not uniform.
- Hence we interconnected the cell No 3 of 3 cell CT with the inlet of the 4 cell CT.

Expect a drop of 1°C in the cooling water inlet temperature to STG condenser, which in turn will increase the condenser vacuum and hence the STG output.
HPBFP Voith coupling cooler modification

- HPBFP discharge pressure maintained at 56 KSC to control the working oil temperature.
- Cooling water line of working oil cooler modified.
- With this the feed water pressure could be reduced to 52 KSC / 47KSC at full load and part load respectively.
- A saving of 27.5 KW at full load and 35 KW at part load could be achieved.
## Other Energy Saving Measures

<table>
<thead>
<tr>
<th>Project</th>
<th>Saving</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Rain water harvesting of STG-PCR Building</td>
<td>3171 m3/Year</td>
<td></td>
</tr>
<tr>
<td>2 Lighting Transformer (Coo lite) with energy saver option</td>
<td>4 KW</td>
<td></td>
</tr>
<tr>
<td>3 Reduction of set pressure of air compressor from 7.2 bar to 6.7 bar and attending air leakages</td>
<td>17.51 KW</td>
<td></td>
</tr>
</tbody>
</table>
Other Energy Saving Measures Contd....

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Activity</th>
<th>QTY</th>
<th>Saving (KW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CRT monitor changed to LCD Monitor for all office / Process computers</td>
<td>59</td>
<td>3.11</td>
</tr>
<tr>
<td>2</td>
<td>Total 30 Nos. of 125W sodium vapor lamp replaced by 70W metal halide lamp</td>
<td>30</td>
<td>1.65</td>
</tr>
<tr>
<td>3</td>
<td>Various circuit modification done to avoid unnecessary lighting during day and night time</td>
<td></td>
<td>1.7</td>
</tr>
<tr>
<td>4</td>
<td>Total 150 Nos. of ordinary tube light ballast replaced by electronics ballast</td>
<td>150</td>
<td>2.85</td>
</tr>
<tr>
<td>5</td>
<td>Replaced 250W MV lamp by 150W metal halide lamps</td>
<td>3</td>
<td>1.05</td>
</tr>
<tr>
<td>6</td>
<td>Replaced 400W HPSV lamp by 400W MH lamp and done various circuit modifications.</td>
<td>10</td>
<td>5.6</td>
</tr>
<tr>
<td>7</td>
<td>Replaced 400W MV lamp by 250W metal halide lamp and done lighting circuit modification to avoid unnecessary lighting</td>
<td>5</td>
<td>7.15</td>
</tr>
<tr>
<td>8</td>
<td>Replaced 600 filament indicating lamps by LED lamps.</td>
<td>600</td>
<td>1.14</td>
</tr>
<tr>
<td>9</td>
<td>150W SV Replaced with 150 Watts MH &amp; 125W MV Replaced with 70 Watts MH</td>
<td>06</td>
<td>0.33</td>
</tr>
<tr>
<td>10</td>
<td>Lighting circuit modification and installation of energy efficient lights.( 2 * 40W * 9 NOS fitting replaced by 2*36W * 7 NOS )</td>
<td>7</td>
<td>0.855</td>
</tr>
<tr>
<td>11</td>
<td>Lighting circuit modification and installation of energy efficient lights.( 2 * 40W * 12 NOS fitting replaced by 2*36W * 8 NOS )</td>
<td>8</td>
<td>0.54</td>
</tr>
<tr>
<td>12</td>
<td>Lighting circuit modification and installation of energy efficient lights (250W * 4 MV High bay Fitting replaced by Street light fitting with 70W &amp; 1 MH fittings)</td>
<td>1</td>
<td>0.93</td>
</tr>
</tbody>
</table>
THANK YOU