BHARAT PETROLEUM CORPORATION LIMITED
KOCHI REFINERY

Best Practices in Energy Conservation

22nd Aug, 2015
• BPCL-KR Brief Profile

• Energy Conservation Measures
  • During 2013-14
  • During 2012-13 & 2011-12
  • During 2014-15
  • Measures Proposed

• Renewable Energy Initiatives

• Training & Development

• Innovative Ideas & Suggestions
Kochi Refinery
Brief Profile

- Located at Ambalamugal, Ernakulam Dist, Kerala
- Formed in 1963 as a joint sector company
- Original crude oil Refining Capacity of 2.5 MMTPA
- Capacity increased to 9.5 MMTPA in four stages
- Diversified into petrochemicals in 1989
- Subsidiary of BPCL since April, 2001
- Merged with BPCL on August 21, 2006
Refinery Flow Diagram

SPM : Single Point Mooring  FCCU : Fluidized Catalytic Cracking Unit
STF : Shore Tankfarm        ARU : Aromatics Recovery Unit
CDU : Crude Distillation Unit DHDS : Diesel Hydro Desulphurisation Unit
CCR : Cont Cat Regn Reformer VGO HDS : VGO Hydro Desulphurisation Unit

Capacity in MMTPA

20 Products
Fuel & Loss, Wt % on Crude Oil

- 2011-12: 7.96
- 2012-13: 7.12
- 2013-14: 6.63
- 2014-15: 6.35
FUEL BREAK UP

- Fuel Oil: 47.84%
- Fuel to CPP: 24.25%
- FCCU coke: 10.18%
- RLNG: 10.06%
- Naphtha: 1.00%
Specific Energy Consumption
MBTU/BBL/NRGF

2011-12: 84.53
2012-13: 79.11
2013-14: 76.63
2014-15: 76.94
Specific Green House Gas Emission
MT of CO2 eq / MT of crude

- 2011-12: 0.2498
- 2012-13: 0.228
- 2013-14: 0.1901
- 2014-15: 0.1852
# Encon Measures Implemented in 2013-14

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Scheme</th>
<th>Expenditure (Rs Lakhs)</th>
<th>Annual Power Savings (MU)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Installing Variable speed Drives for motors of 8 pumps for power savings @ 0.314 MW</td>
<td>154.403</td>
<td>2.6</td>
<td>-</td>
<td>278.71</td>
</tr>
<tr>
<td>2</td>
<td>Various steam optimization measures in process units, utilities &amp; off-sites @31 t/h</td>
<td>2.0</td>
<td>-</td>
<td>20534.4</td>
<td>7868.58</td>
</tr>
<tr>
<td>3</td>
<td>Implementing additional heat recovery from HRSG2 flue gas.</td>
<td>23.98</td>
<td>-</td>
<td>496.8</td>
<td>190.37</td>
</tr>
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</tr>
<tr>
<td>4</td>
<td>LP steam saving @ 3 T/h by isolating one column during production of SBPS</td>
<td>-</td>
<td>-</td>
<td>355.92</td>
<td>136.38</td>
</tr>
<tr>
<td>5</td>
<td>MP steam saving by preheating naphtha feed to the splitter with NSU btm. at CDU2</td>
<td>3.0</td>
<td>-</td>
<td>1324.80</td>
<td>507.65</td>
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<tr>
<td>6</td>
<td>Steam saving by APC implementation in CDU2 NSU</td>
<td>2.6</td>
<td>-</td>
<td>123.87</td>
<td>47.47</td>
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### Encon Measures Implemented in 2012-13

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<tbody>
<tr>
<td>7</td>
<td>Preheat circuit modification in CDU1 by relocation of heat exchanger</td>
<td>32.79</td>
<td>-</td>
<td>1244</td>
<td>460.74</td>
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<tr>
<td>8</td>
<td>Steam saving@ 2t/h in CDU2 ejectors</td>
<td>Nil</td>
<td>-</td>
<td>1234</td>
<td>457.29</td>
</tr>
<tr>
<td>9</td>
<td>New Anti surge controller for MAB</td>
<td>150</td>
<td>-</td>
<td>1234</td>
<td>457.29</td>
</tr>
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</tr>
<tr>
<td>10</td>
<td>Improving steam trap availability in CDU2 off-sites</td>
<td>190</td>
<td>-</td>
<td>6270</td>
<td>2198</td>
</tr>
<tr>
<td>11</td>
<td>Steam saving @ 5t/h by isolation of 16” MP steam header between CDU2 &amp; FCCU</td>
<td>Nil</td>
<td>-</td>
<td>3131</td>
<td>1160</td>
</tr>
<tr>
<td>12</td>
<td>Pre heat improvement by 7°C in DHDS, post bypassing of preheat exchangers</td>
<td>109.11</td>
<td>-</td>
<td>1193</td>
<td>442.11</td>
</tr>
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<td>--------------------</td>
</tr>
<tr>
<td>13</td>
<td>Implementation of Advanced Process Control in HGU</td>
<td>Nil</td>
<td>-</td>
<td>1878</td>
<td>623.60</td>
</tr>
<tr>
<td>14</td>
<td>Variable speed drives for motors of 16 pumps</td>
<td>108.2</td>
<td>4.458</td>
<td>-</td>
<td>221.91</td>
</tr>
<tr>
<td>15</td>
<td>Speed reduction and steam savings @ 1.9 t/h in boiler UB11 BFW turbine</td>
<td>Nil</td>
<td>-</td>
<td>1173</td>
<td>389.5</td>
</tr>
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Encon Measures Implemented in 2011-12

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<tr>
<td>16</td>
<td>Recovery of heat from flashed steam from CCR condensate and power savings due to stopping of air fin fan</td>
<td>Nil</td>
<td>0.074</td>
<td>1093</td>
<td>362.93</td>
</tr>
<tr>
<td>17</td>
<td>Step-less Control in Make Up Gas Compressor of DHDS</td>
<td>200</td>
<td>2.02</td>
<td></td>
<td>152.74</td>
</tr>
<tr>
<td>18</td>
<td>Liquid Coupled Air Pre Heater in UB6 Boiler</td>
<td>-</td>
<td>-</td>
<td>545</td>
<td>175</td>
</tr>
</tbody>
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# Encon Measures Implemented in 2011-12

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<tr>
<td>19</td>
<td>Condensate recovery from LP steam Air Pre Heaters of Crude charge heaters</td>
<td>6.0</td>
<td>-</td>
<td>224</td>
<td>74.03</td>
</tr>
<tr>
<td>20</td>
<td>Oil recovery from HSD/ATF tank farms</td>
<td>22.0</td>
<td>-</td>
<td>364</td>
<td>121</td>
</tr>
<tr>
<td>21</td>
<td>Other energy conservation initiatives</td>
<td>76.46</td>
<td>1.523</td>
<td>130</td>
<td>130.84</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1080.55</strong></td>
<td><strong>10.68</strong></td>
<td><strong>42548.8</strong></td>
<td><strong>16456.14</strong></td>
</tr>
</tbody>
</table>
Other Energy Initiatives

Implementation of EnMS ISO 50001: 2011

- M/s. PCRA was the consultant for implementation.
- Energy Policy formed.
- Energy review conducted and EnPIs selected; Objectives, Targets & Action Plans formed.
- Awareness Programs conducted by the Consultants; around 700 employees covered in the first phase.
- Internal Audit conducted.
- 3rd Party Audit and Certification by M/s. BVCI completed on 11th Mar’15.
Ongoing and Future Energy Initiatives

2. Conversion of UB11 BFW Pump and FD Fan Turbine Drives to Variable Speed
   - Steam savings of 1.7 MT/hr

3. Installation of VFDs for HT drives
   - Scheme prepared for installing VFD in 330 kW, VGO pump
   - Average saving of 117 kW expected
4. Usage of VHP steam for IREP

- Very high pressure steam of 105 kgf/cm² for driving turbines
- Eliminates condensing turbines

5. Power recovery turbines in IREP with process fluids

- 9 – 10 MW electricity generation from FCC regenerator flue gas
- 0.235 MW PRT for DHT feed pump
- 0.550 MW PRT for VGO HDT feed pump
- 0.38 MW PRT for VGO HDT amine pump
6. Improvement in steam trap availability for 1500 traps

- Steam savings of 4.1 MT/hr

7. Changing turbine drives of Wet Gas Compressor (WGC) drives to motor

- Steam savings 11 MT/hr

8. Changing MP steam driven condensing turbine of MAB to HP steam driven condensing type

- Steam savings 7.5 MT/hr
Formation of Energy Management Committee

- Monthly review of energy consumption pattern of each operating area
- Identify opportunities to reduce energy consumption
- Support & monitor implementation of identified opportunities
- Examine suitability of emerging technologies for adoption.
- Build awareness within the workforce on the need to reduce energy consumption
- Support the implementation and sustenance of ISO 50001-2011
- Ensures employee involvement in energy reduction
- Proposals with savings of Rs. 18 Crores per annum implemented
OGCF 2015 Program Highlights


- An external survey organized by Centre for High Technology (CHT) on “Steam Leak” during January, 2015.

- Awareness program conducted for the contract workers of BPCL Kochi Refinery

- All Kerala Children’s Painting Competition, VARNAM 2015, organized in which 250 students participated.
Renewable Energy Initiatives
Solar Power System

Capacity : 15 kW
Expenditure : Rs. 29 Lakhs
Year : Jan, 2012
Supplier : Team Sustain
Renewable Energy Initiatives
Solar Powered Watch Tower

Expenditure: Rs. 2.95 Lakhs
Year: Jan, 2012
Supplier: IGA TECH
Renewable Energy Initiatives
Bio Gas Plant

Capacity : 1 TPD
Expenditure : Rs. 16 Lakhs
Year : 2009
Supplier : Technology from BARC
Training & Development

- Periodic in-house training programs on energy conservation
- Training on Burner Operation, trouble shooting and maintenance by M/s. John Zink
- Steam Trap Management sessions by M/s. Forbes Marshall
- In house programs on Furnace and Boiler Operation
- Employee suggestion scheme
- Training to EMC sub-committee members from external and internal faculty
Innovative Ideas & Suggestions

- **Encon Clubs in partnership with Schools and Colleges in Kerala**
  - Over 70 Encon Clubs associated with Kochi Refinery to spread the message
  - Supported through periodic interactions, club staff coordinators and student leaders meets

- **Internal Energy Audits by group of BEE Certified Auditors**

- **External Energy Audits by third parties**
  - Solomon Benchmarking study
  - Another Energy Audit planned this year.

- **Internal competition for the best process unit in energy conservation**

- **Business Process Management and Intelligence (BPMAI)**
Best Practices

- Daily reporting of Fuel break up.
- Daily reporting of heater & boiler efficiency
- Daily reporting of steam balance
- Monthly reporting of PF&L and SEC to MoP& NG
- Burner shutdown inspection & maintenance.
Energy Audits

- Periodic Energy Audits; Steam leak survey, Insulation survey, Relief Valve survey and Setting Loss Survey
- Insulation Audit by M/s. Lloyd Insulations
- Steam Trap System Audit by M/s. Forbes Marshall
Awards/ Accolades

- The third prize in Refinery Energy Performance awards instituted by Centre for High Technology (CHT), MoPNG for Furnace/Boiler Insulation effectiveness.

- The Excellence Award 2014 from Kerala State Pollution Control Board among very large industries for making substantial and sustained efforts towards pollution control.

- The Kerala State Energy Conservation Award 2014 in the category of Large Scale Energy Consumers from the Dept. of Power, Govt. of Kerala.

- The Safety Award instituted by Factories and Boilers Dept. Govt. of Kerala for Outstanding Performance in Industrial Safety among very large factories for the year 2014 in recognition of excellent safety performance.

- The Runner up award for outstanding safety performance in the category of Very Large Size Chemical Industries instituted by National Safety Council, Kerala Chapter. KR also bagged 7 individual awards for various competitions conducted by NSC.
THANK YOU
Carbon Footprint Study

Greenhouse Gases Verification Statement
For
Bharat Petroleum Corporation Limited
Kochi Refinery, Ambalamugil,
Survey No. 206, Village Pulamoniruthu, Thalikunnam, Ambalamugil,
PIN 682302, District Ernakulam, Kerala.
For Organization boundaries covering operations of
Kochi Refinery at Ambalamugil, PIN 682302.
Stand-alone Water Supply Scheme (BWSS) water pump house at
Edamulla, PIN 682106.
And
Shell Tank Farm (STF) at Puttuvype, PIN 682508.

Bureau Veritas Certification India Private Ltd has carried out the verification of the quantity
of Greenhouse Gas emissions of the above organization as per ISO 14064-3:2006.
The Greenhouse Gas emission quantification and reporting is found to be in accordance with
the requirements of the standard detailed below.

STANDARD
ISO 14064 - 1: 2006

SCOPE OF VERIFICATION
Greenhouse Gas emissions and removals:
- Direct Emissions: 22,235.455 tons CO₂-equivalent
- Indirect Emissions: 58,628.662 tons CO₂-equivalent
- Emission due to Biomass Combustion: 49 tons CO₂-equivalent

Reporting Period: 1st April 2012 to 31st March 2013
Level of Assurance: Limited
VERIFICATION REPORT REFERENCE: INDIA-ver/23.50/2013

To check this certificate validity please call: +91 22 6696 6300
Further clarifications regarding the scope of this verification certificate and the applicability of the
ISO 14064-1:2006 requirements may be obtained by consulting the organisation.

Certificate Number: INDIA/GHG/023
Date: 09 January 2014

RAMESH KOREGAVE
General Manager
Change in Control Scheme
Steam Optimization Measures

- Discontinuation of STG operation
- Reduction of LP steam Header pressure from 4.5 kg/cm² to 3.6 kg/cm²
- Isolating redundant steam headers in offsites
- Reducing DEA circulation rates
Reverse flow capacity control by suction valve unloading

- Suction valves are kept open by means of special unloaders during the portion of discharge stroke.
- The delayed closing of the suction valves causes gas in the chamber to be pushed back into the suction line rather than being compressed.
- Then, at a precisely defined point of time, the unloader is released and the suction valve closes. Therefore only the gas remaining in the cylinder is being compressed.
ENERGY POLICY
Bharat Petroleum Corporation Limited, Kochi Refinery

We, at BPCL-Kochi Refinery, are committed to achieving excellence in energy performance by:

- Optimising and judiciously utilizing available energy resources
- Procuring energy efficient equipments and services
- Training all employees thereby creating an energy culture
- Improving energy performance continually
- Monitoring and controlling energy consumption
- Increasing energy efficiency by adopting state of the art technologies
- Systematic review of objectives, targets and action plans
- Ensuring compliance to all applicable legal and other requirements

Date: 14th August 2014
Place: Kochi

Prasad K Panicker
Executive Director (KR)
ISO 50001:2011 – Key Elements

ENERGY MANAGEMENT SYSTEM (EnMS) CONTINUAL IMPROVEMENT MODEL
BHARAT PETROLEUM CORPORATION LIMITED
KOCHI REFINERY, AMBALAMUGAL, KOCHI, INDIA.

Bureau Veritas Certification certify that the Management System of the above organization has been audited and found to be in accordance with the requirements of the management system standard detailed below.

Standard

ISO 50001:2011
Scope of certification

RECEIPT, STORAGE AND REFINING OF CRUDE OIL AND DISPATCH OF PETROLEUM AND PETROCHEMICAL PRODUCTS

Audit completion date: 11 March 2015
Certification cycle start date: 27 April 2016
Subject to the continued satisfactory operation of the organization’s Management System, this certificate expires on: 26 April 2018
Original certification date: 27 April 2015

Certificate No. INDI5.7191/En Version: 1 Revision date: 27 April 2015

Certification Authority
Ramesh KOREGAVE
General Manager, CERTIFICATION
South Asia Region

Local office: "Marina Centre" 6th Floor, Krishnaia Marzil Marg,
Opp. Aria Industrial Estate, Off Saki Vihar Road,
Andheri (East), Mumbai - 400 072, India.

Further clarifications regarding the scope of this certificate and the applicability of the management system requirements may be obtained by consulting the organization.
To check this certificate validity please call +91 22 6695 8300.
FCCU PRT

Diagram includes:
- PIC
- PDIC
- Combustor Style Regenerator
- Third Stage Separator
- Orifice Chamber
- Butterfly Valves
- Critical Flow Nozzle
- Gear Box
- Main Air Blower
- Generator
- Electrostatic Precipitator
- Flue Gas Cooler
- Expander
- Split Range
- To/From Reactor
Additional Heat Recovery from HRSG 2
CCR Condensate Recovery

From NHE-004
6"-CH-CH-1524-A22A-1H
From CRE-011
6"-CH-CH-2521-A22A-1H
From CRE-014
6"-CH-CH-2521-A22A-1H
From Cycle max
6"-CH-CH-47071-A22A-1H

CRV-030
LP CONDENSATE FLASH DRAW

10"-SL-CR-7804-A22A-1H
TO LP STEAM HEADER

R/V set pr. 6.5 kg/cm2

2" IM WATER TO UNIT

2"-CH-DR-5702-AK

CCR B/L

6"-CL-CR-7809-AAA-1H

To be fixed closer to the connection

Legend

NEW: __________
EXISTING: __________

CHECKED: DN(PME)
HAZOP APPROVED: DGK(PTJ)
SCHEME APPROVED: DDG(PME)

Scheme for routing LP steam condensate-direct to UB-11

DATE: 19/04/2011
SCHEME NO. 2867
REV. 6
6 products originally ... 

- Naphtha, MS, SKO, HSD, Furnace Oil & Bitumen

20 products currently...

- **Petroleum**
  
  LPG, Naphtha, MS, SKO, ATF, HSD, LSHF-HSD, LDO, Furnace Oil, LSHS, Bitumen, Natural Rubber Modified Bitumen, Bitumen Emulsion

- **Petrochemicals**
  
  Benzene, Toluene, Propylene

- **Specialty Products & Others**
  
  Special Boiling Point Sprit, Mineral Turpentine Oil, Sulphur, Hydrogen