Energy Conservation Opportunities in Steam & Condensate Network
ENERGY CONSERVATION at Indian Refineries
Various utilities & their cost in refineries

<table>
<thead>
<tr>
<th>Utility</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam</td>
<td>55</td>
</tr>
<tr>
<td>Power</td>
<td>26</td>
</tr>
<tr>
<td>Raw Water</td>
<td>3</td>
</tr>
<tr>
<td>DM-Water</td>
<td>2</td>
</tr>
<tr>
<td>Cooling Water</td>
<td>9</td>
</tr>
<tr>
<td>Compressed Air</td>
<td>5</td>
</tr>
</tbody>
</table>
Priority Triangle – Matching today’s scenario

- **Monitoring the Utilities**
  - Metering for steam & condensate for each individual sub-unit/plant
  - Managing the compressive system data base of entire Plants with help of Forbes Marshall Ever Sense Package

- **Optimising Process Condensate Evacuation and Recovery System**
  - Focus in process application in terms of steam consumption
  - Optimized the flash & condensate recovery from the process application
  - Objective to reduce the gap between existing and possible condensate recovery
  - Correct the level pot system for process condensate evacuation

- **Stop Wastage**
  - **Most important** - Correct trapping for steam distribution network, steam tracing network and process heating applications
  - Rectify the incorrect selection of the traps, application wise, pressure temperature wise
THE STEAM SYSTEM LOSSES

Distribution Losses

Steam leaks you? How much are they costing

25 mm valve stem 8 barg annum

3.5 kg/h Rs 44000 per annum

2 mm hole, steam at 7 barg

9 kg/h Rs 113000 per annum
Areas of Improvement

- Steam Trap System Management
- Condensate Recovery System Re-Engineering & Improvement
- Condensate Recovery System Design
- Boiler Blow down Heat Recovery
- Hot Insulation Study & Rectification
Forbes Marshall role – in Steam & Condensate Management...

Savings of 75TPH (85Cr’s)

1. Steam Trap Management
2. Steam Trap Audit
3. Product Supply
4. Steam Trap system turnkey projects (implementation & Sustenance)
5. Bench marking/Performance Guarantee/Savings

(Savings of 300TPH (50Cr’s))

1. Condensate recovery Management
2. Steam Trap/Condensate network Audit
3. Product Supply
4. Condensate system turnkey projects (implementation & Sustenance)
5. Bench marking/Performance Guarantee/Savings
Boiler blowdown heat recovery

- Condensate
- Steam
- Boiler
- Feed pump
- Blowdown valve
- Flash vessel
- Heat exchanger
- Trap
- Deaerator Head
- Hot well
- Cold make-up
- To drain
Case Studies
# STSM Completed

<table>
<thead>
<tr>
<th>Refineries</th>
<th>Steam Traps</th>
<th>Steam Savings Achieved (Kg/hr)</th>
<th>Initial Trap working Status</th>
<th>Final Trap working Status</th>
<th>Contract Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPCL Mumbai - DHDS+LRE</td>
<td>1500</td>
<td>2990</td>
<td>55%</td>
<td>98%</td>
<td>1 year</td>
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<tr>
<td>IOCL BGR – 1st Contract</td>
<td>4400</td>
<td>3300</td>
<td>70%</td>
<td>99%</td>
<td>18 months</td>
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<tr>
<td>IOCL BGR – 2nd Contract</td>
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<td>5700</td>
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<td>99%</td>
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<td>IOCL Panipat – Offsite Areas</td>
<td>3600</td>
<td>7500</td>
<td>37%</td>
<td>81%</td>
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<tr>
<td>BPCL Mumbai – 1st Contract – CDU+FPU+BBU</td>
<td>1546</td>
<td>4416</td>
<td>45%</td>
<td>97%</td>
<td>1 year</td>
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<tr>
<td>BPCL Mumbai – 2nd Contract DHDS Block+CDU3+FCCU</td>
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<tr>
<td>BPCL Kochi – 1st Contract</td>
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<tr>
<td>IOCL –Digboi – 1st Contract</td>
<td>3300</td>
<td>2970</td>
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<td>-</td>
<td>6 months</td>
</tr>
<tr>
<td>NRL – 1st Contract</td>
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<td>1729</td>
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<tr>
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<td>-</td>
<td>6 months</td>
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<tr>
<td>IOCL, Guwahati</td>
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<td>62%</td>
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<tr>
<td>IOCL Gujarat</td>
<td>19900</td>
<td>17000</td>
<td>66%</td>
<td>95%</td>
<td>2 year</td>
</tr>
<tr>
<td>CPCL, Chennai</td>
<td>4000</td>
<td>9400</td>
<td>40%</td>
<td>96%</td>
<td>1 year</td>
</tr>
<tr>
<td>Refineries</td>
<td>Steam Traps</td>
<td>Progress</td>
<td>Steam Savings Achieved (Kg/hr)</td>
<td>Initial Trap working Status</td>
<td>Final Trap working Status</td>
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<tr>
<td>IOCL – Digboi – 2nd Contract</td>
<td>3300</td>
<td>Sustenance</td>
<td>5070</td>
<td>69%</td>
<td>99%</td>
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<td>NRL – 2nd Contract</td>
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<tr>
<td>HPCL Vizag 2nd Contract</td>
<td>4000</td>
<td>Sustenance</td>
<td>5600</td>
<td>64%</td>
<td>96%</td>
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<td>BPCL-Kochi 2nd Contract</td>
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<td>Sustenance</td>
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<td>97%</td>
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<tr>
<td>IOCL - BGR 3rd Contract</td>
<td>5700</td>
<td>Sustenance</td>
<td>2100</td>
<td>81%</td>
<td>97%</td>
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</tbody>
</table>
Methodology

Audit – Complete comprehensive audit of Steam Trap applications, creating a database, Quantification of Steam Loss, Analysis of Failed Traps, Identification of Areas of Improvement and Detailed BOQ with complete rectification Plan.


Sustenance – Sustaining achieved Steam Trap Performance above 95% & maintaining the Steam Leaks to minimal level through day to day monitoring. Designing schedule for routine maintenance based on priorities & implementing system improvement suggestions. Creating awareness and sharing knowledge through regular training programs.
Steam Trap Performance Chart - IOCL (GR)

- Achieved Performance Rate %
- Achieved Reduction In Steam Loss
- Projected Performance
- Projected Reduction in Steam Loss %

IOCL Report FY 13-14
Gujarat Refinery Savings
8220MT - Fuel = Rs 32 Cr

Forbes Marshall Pvt Ltd
IOCL Digboi STSM - 2017

IOCL Digboi Refinery Updated Performance Chart

Performance Rate %

Achieved Per Rate %
Projected Per Rate %

Achieved Reduction in Steam Loss
Projected reduction in Steam Loss

Ste1m Loss (Kg/hr)
Steam Trap Performance Rate & Steam Loss Status Chart - (CDU/VDU, MSB, HCU-DHDT, HGU, CPP & UBH)

Performance Rate %

Achieved Per Rate %

Projected Per Rate %

Achieved Reduction in Steam Loss

Projected reduction in Steam Loss

Jan-17 Feb-17 Mar-17 Apr-17 May-17 Jun-17 Jul-17 Aug-17 Sep-17 Oct-17 Nov-17 Dec-17

Steam Loss [Kg/hr]

6829.5

96.64

97.7

97.83

3279.2

1651.4

1146.2

1133.9

1043.0

850.0

700.0

100.0

0.0

100

90

80

70

60

50

40

71

49
Steam Trap Performance Chart - BPCL MUMBAI REFINERY

- Achieved Performance Rate %
- Projected Performance Rate %
- Achieved Reduction in Steam Loss
- Projected Reduction in Steam Loss %

Jan-17 Feb-17 Mar-17 Apr-17 May-17 Jun-17 Jul-17 Aug-17 Sep-17 Oct-17 Nov-17 Dec-17 Jan-18

Steam Loss (kg/hr)

- 7723.64
- 97.34
- 190.93

Steam Trap Performance Rate %

- 60.7
## Condensate Recovery Projects Completed

<table>
<thead>
<tr>
<th>Refineries</th>
<th>Condensate Savings Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOCL, Bongaigaon</td>
<td>8000 Kg/hr</td>
</tr>
<tr>
<td>IOCL, Guwahati</td>
<td>2500 Kg/hr</td>
</tr>
<tr>
<td>IOCL Haldia</td>
<td>20000 kg/hr</td>
</tr>
<tr>
<td>IOCL Panipat</td>
<td>39500 kg/hr</td>
</tr>
<tr>
<td>ESSAR OIL</td>
<td>15000 kg/hr</td>
</tr>
<tr>
<td>HPCL Vizag</td>
<td>5000 kg/hr</td>
</tr>
<tr>
<td>BPCL KR</td>
<td>5000 kg/hr</td>
</tr>
<tr>
<td>BPCL MR</td>
<td>6000 kg/hr</td>
</tr>
<tr>
<td>BORL</td>
<td>5000 kg/hr</td>
</tr>
</tbody>
</table>
BPCL MR-CPP condensate recovery

Earlier scenario: MP & LP condensate drained, hence 0 savings

Improved scenario: MP & LP condensate recovered, leading to ₹80 Lakhs savings

Energy saved through:
- Flash steam recovery
- Heating DM water
- Pumping hot condensate
Phase wise CRS implementation in IOCL BGR

Phase Wise CRS Implementation & Average Condensate Recovery

Total Make Water Reduction 64000 MT/Annum
BPCL MR-Bitumen tank condensate recovery

Condensate savings: 3.4 tph
Flash steam recovery: 0.3 tph
Monetary savings @ 1.04 cr’s/annum
BPCL MR-Bitumen tank condensate recovery

Forbes Marshall Pvt Ltd
BORL SRU CRS

Steam savings of Rs 3.6cr/annum!!!

Condensate savings of Rs 36 lacs/annum
Efficient Condensate & Flash Steam Recovery Recommendations

Total Savings Potential = 94.5

MP Condensate
177 Kg/hr
TO LP HEADER
17 lacs

Condensate from Tracing Traps
250 Kg/hr
2 Lacs

LP Condensate
5000 Kg/hr

HP Condensate
60 G
Kg/hr

HP-40 Bar G
850 Kg/hr

30.9 lacs
IP 4.5 Bar G
1172 Kg/hr
TO LP HEADER

322 Kg/hr

30/120 Kcal/hr
44.5 Lacs
### IOCL PANIPAT – Blow down heat recovery

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Equipment</th>
<th>Pressure (Kg/cm²)</th>
<th>CBD Quantity (TPH)</th>
<th>Flash Vessel</th>
<th>Flash Vessel Pressure (kg/cm²g)</th>
<th>Flash Steam (TPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CBD From five Boiler Drum</td>
<td>125</td>
<td>Max. 15 Min. 12</td>
<td>11-V-7303</td>
<td>16.5</td>
<td>MAX. 4.7 MIN.3.8</td>
</tr>
</tbody>
</table>

- **Total MP Flash Steam to MP Header**
  - MAX: 4.7 TPH
  - MIN: 3.8 TPH
  - PRESSURE: 16.5 BAR G

- **MP Flash Vessel**
  - 11-V-7303

- **MP CBD from 11-V-7303**
  - MAX: 10.3 TPH
  - ACTUAL: 8.2 TPH
  - PRESSURE: 16.5 BAR G

- **CW I/L**

- **CW O/L**
Subject: To identify and debottlenecking cause of discrepancy of steam gap of 4-4.3 Tph between PNCP and ISRL battery limits.

The key findings are:

- Steam saving of 57.7 TPD (21% of total 273 TPD) is estimated by implementing proposals detailed in this report.
- Annual savings to the tune of Rs. 630 Lac (21% of total fuel bill) can be achieved by reduction in steam bill.
- Investment required to implement the proposals is Rs. 77.3 Lac.
- Simple payback period of 2 months.
“Resulted in reduction in condensation loss by 80%”
THANK YOU