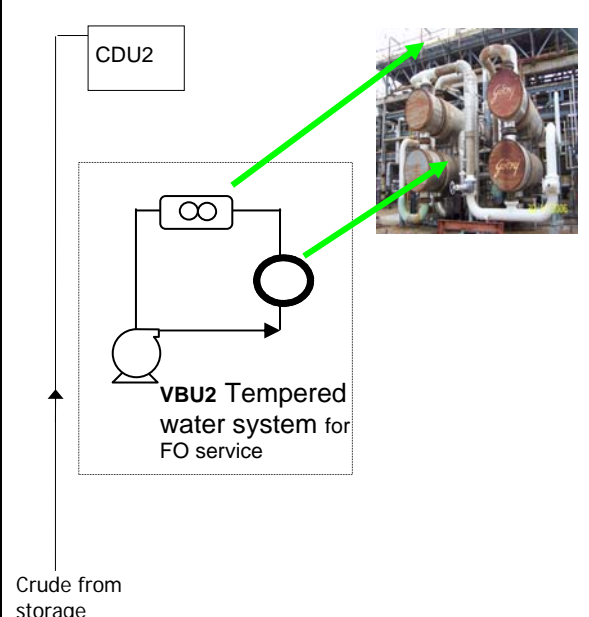
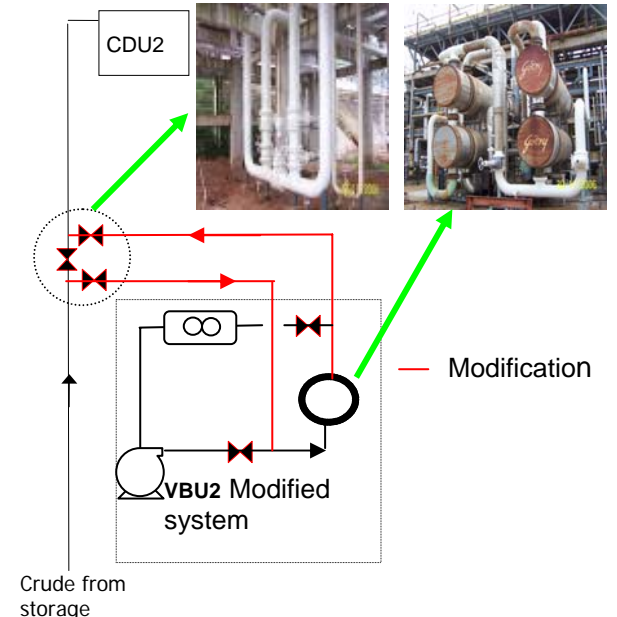


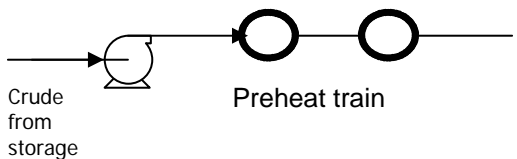
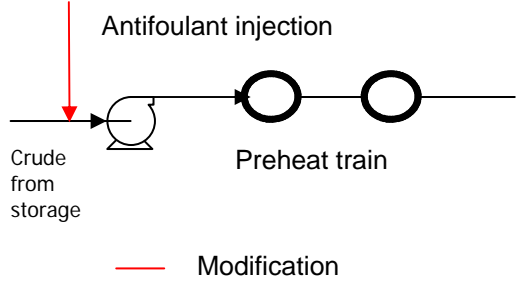
Energy Conservation Measure implemented in 2006-2007

| | | |
|---|---|---|
| ID to be filled by BEE | Title of the measure “Crude Preheating by Visbreaker Fuel Oil Product at ph2” | Sector ... Refinery |
| Year to be filled by BEE | | Technology.... Waste heat recovery |
| <p>Description of the energy conservation measure:</p> <p>In VBU2, Fuel Oil product was being cooled by tempered water system. That system consists of tempered water circulation pump & fin fans. Cold crude feed was fed from OM&S to CDU2 through a pipeline which was at a distance of ~ 200m from this unit. This crude was initially preheated with LP Steam & finally with fired heater before entering the atmospheric column.</p> <p>The system was studied for utilizing waste heat from VBU2 FO to preheat CDU2 crude. Since the Crude pipeline is nearby, additional length of crude pipeline was smaller.</p> <p>The modification was carried out. Crude line was cut at the Northwest corner of VBU2 & routed to VBU2 via manifold. Near the tempered water cooler (2 nos), crude line was connected to tempered water line.</p> <p>After commissioning of the system, Tempered water system in VBU2 has been stopped & LP Steam consumption in CDU2 has come down.</p> <p>Economics:</p> <p>Thermal Energy savings at CDU2: ~10.7MT/h LPSteam ~ 5006 SRFT/year ~ Rs.743.9 Lakh/year Electrical Energy savings at VBU2: ~208 KW power ~ 1667 MWH/year ~ Rs.75.1 Lakh/year Total savings : ~16.5 SRFT/day ~ 5511SRFT/Year ~ Rs. 819 Lakh/year Investment : 31 Lakhs Payback : ~ 15 days.</p> | | |
| Picture/ sketch/ drawing before modification (if available) | Picture/ sketch/ drawing after modification | |
|  |  | |

Agency that executed the project (with complete address and email): In house

| | | | | | |
|---|-------------|---------------------------------|------------------------|--|--------------------------------|
| Total investment, Rs.: 31 lakhs | | Year of implementation: 2006-07 | | | |
| First year energy cost savings, Rs.: 819 lakhs | | | | | |
| First year other savings, Rs.: 0 lakhs | | | | | |
| On annual basis | kWh 000' | Coal (Tons) | Gas Nm ³ | Oil (kL) LSHS | Other (LP Steam) MT/year |
| Energy consumption before | 6168 | ---- | ----- | | 122524 |
| Energy consumption after | 4501 | | | | 36924 |
| Energy tariff, Rs/ kWh/ Ton/ Nm³/kL ... | 4.50 | | | | 869 |
| Company complete address: Mangalore Refinery & Petrochemicals Ltd, Kuthethoor post, Mangalore - 575030 Contact person who could be contacted for more information: V Ramasubramanian – 0824 2219430 | | | | We authorize Bureau to use this information for dissemination Signature Date | |

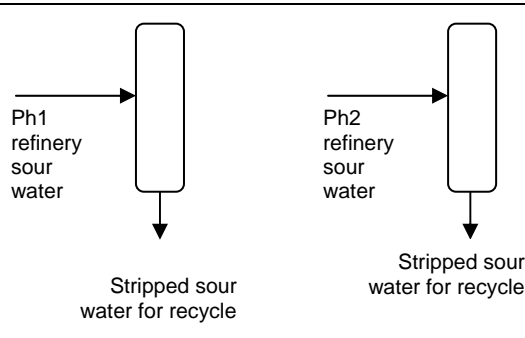
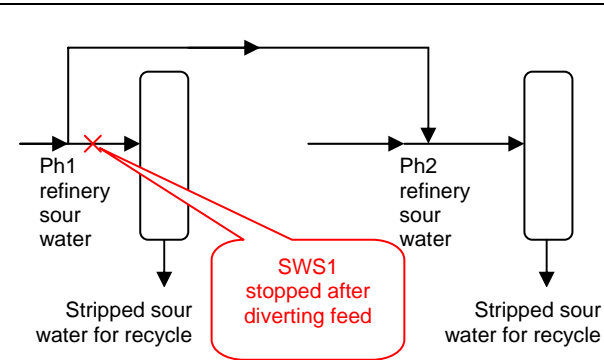
Energy Conservation Measure implemented in 2006-2007

| | | |
|---|---|---|
| ID to be filled by BEE | Title of the measure “Antifoulant Injection” | Sector ... Refinery |
| Year to be filled by BEE | | Technology Preheat maximization |
| <p>Description of the energy conservation measure:</p> <p>In CDU1, preheat exchanger's Fouling rate was high due to more of Mumbai High crude processing. To minimize this exchanger's fouling rate, Antifoulant injection was started on a trial basis on 23/07/2006. This experiment has been found successful.</p> <p>Economics:</p> <p>Thermal Energy savings : ~ 1277 SRFT/year ~ Rs 190 Lakh/year</p> <p>Chemical cost : Rs. 62 Lakh/year</p> <p>Investment : Negligible</p> <p>Net savings in 2006-07 : ~ 128 Lakh/ year</p> | | |
| Picture/ sketch/ drawing before modification (if available) | Picture/ sketch/ drawing after modification | |
|  <p style="text-align: center;">Crude from storage</p> <p style="text-align: center;">Preheat train</p> |  <p style="text-align: center;">Crude from storage</p> <p style="text-align: center;">Preheat train</p> <p style="text-align: center;">— Modification</p> | |

| | |
|--|---------------------------------|
| Agency that executed the project (with complete address and email): In house | |
| Total investment, Negligible | Year of implementation: 2006-07 |

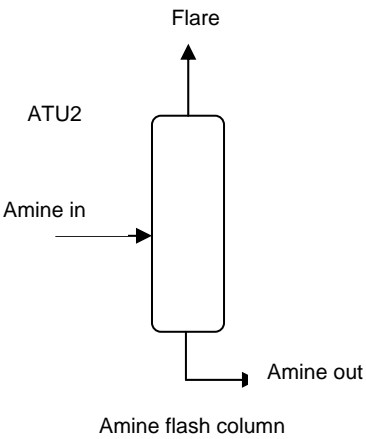
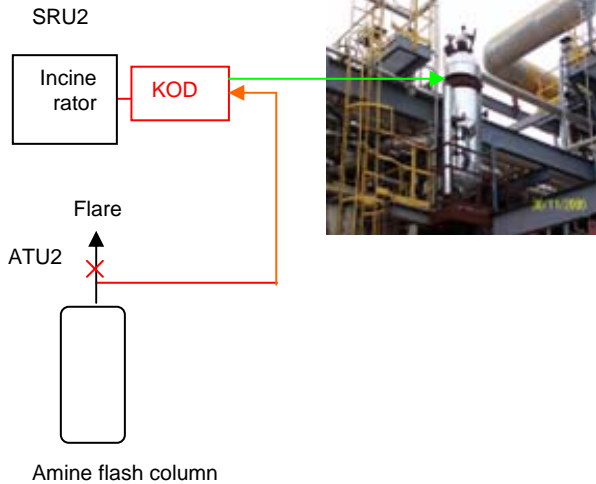

| | | | | | |
|---|-------------|----------------|------------------------|---|--------------------------------|
| First year energy cost savings, Rs.: 180 lakhs from 23.07.2006 till 31.03.2007 | | | | | |
| First year other savings, Rs.: - 60 lakhs of chemical cost | | | | | |
| On annual basis | kWh 000' | Coal (Tons) | Gas Nm ³ | Oil (kL) LSHS equivalent | Other (LP Steam) MT/year |
| Energy consumption before | --- | ---- | ----- | 63780 | ---- |
| Energy consumption after | | | | 62420 | |
| Energy tariff, Rs/ kWh/ Ton/ Nm ³ / kL ... | | | | 15200 | |
| Company complete address: Mangalore Refinery & Petrochemicals Ltd, Kuthethoor post, Mangalore - 575030 Contact person who could be contacted for more information: V Ramasubramanian – 0824 2219430 | | | | We authorize Bureau to use this information for dissemination Signature X Date | |

Energy Conservation Measure implemented in 2006-2007

| ID to be filled by BEE | Title of the measure “Optimization of Refinery Sour water stripper Operation” | Sector ... Refinery | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|-------------------------------------|--------|--------|--|--------|--------|--------|--------|------------------|----|----|-----|----|-----|--|----|--|----|---------|--|---|--|-----|---|--|
| Year to be filled by BEE | | Technology Optimization | | | | | | | | | | | | | | | | | | | | | | | | |
| Description of the energy conservation measure: | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>A study was carried out to check the feasibility of optimizing Refinery SWS operation. Earlier both Refinery SWS1 & Refinery SWS2 units were in operation catering to phase 1 & 2 units respectively. An in-house study revealed that phase 2 SWS unit alone could take the entire refinery sour water.</p> <p>Accordingly SWS1 load was shifted to SWS2 & SWS1 unit was stopped. This mainly results in saving of reboiler steam & power savings. The overview comparison is as shown in the attached table.</p> <p>Economics:</p> <p>Thermal Energy savings~ 1965 SRFT/year ~ Rs 292.0 Lakh/year</p> <p>Electrical power savings~ 469 MWH/year ~ Rs 21.1 Lakh/year</p> <p>Total Energy Savings ~ 2107 SRFT /year ~ 313.1 Lakh /year</p> <p>Investment Zero</p> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">M3/h</th> <th colspan="2">Ph1</th> <th colspan="2">Ph2</th> </tr> <tr> <th>Design</th> <th>Actual</th> <th>Design</th> <th>Actual</th> </tr> </thead> <tbody> <tr> <td>Earlier, Average</td> <td>51</td> <td>27</td> <td>103</td> <td>55</td> </tr> <tr> <td>Max</td> <td></td> <td>33</td> <td></td> <td>68</td> </tr> <tr> <td>Present</td> <td></td> <td>0</td> <td></td> <td>~90</td> </tr> </tbody> </table> | M3/h | Ph1 | | Ph2 | | Design | Actual | Design | Actual | Earlier, Average | 51 | 27 | 103 | 55 | Max | | 33 | | 68 | Present | | 0 | | ~90 | <p>could take the entire refinery sour water.</p> | |
| M3/h | | Ph1 | | Ph2 | | | | | | | | | | | | | | | | | | | | | | |
| | Design | Actual | Design | Actual | | | | | | | | | | | | | | | | | | | | | | |
| Earlier, Average | 51 | 27 | 103 | 55 | | | | | | | | | | | | | | | | | | | | | | |
| Max | | 33 | | 68 | | | | | | | | | | | | | | | | | | | | | | |
| Present | | 0 | | ~90 | | | | | | | | | | | | | | | | | | | | | | |
| Picture/ sketch/ drawing before modification (if available) | Picture/ sketch/ drawing after modification | | | | | | | | | | | | | | | | | | | | | | | | | |
|  |  | | | | | | | | | | | | | | | | | | | | | | | | | |
| Agency that executed the project (with complete address and email): In house | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Total investment, Zero | Year of implementation: 2006-07 | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | |
|---|--------------------|----------------|------------------------|--|--------------------------------|
| First year energy cost savings, Rs.: 306.3 lakhs | | | | | |
| First year other savings, Rs.: Zero | | | | | |
| On annual basis | kWh 000' | Coal (Tons) | Gas Nm ³ | Oil (kL) LSHS equivalent | Other (LP Steam) MT/year |
| Energy consumption before | 7647 | ---- | ----- | ----- | 521428 |
| Energy consumption after | 7178 | | | | 487833 |
| Energy tariff, Rs/ kWh/ Ton/ Nm ³ / kL ... | 4503 Rs/1000KWH | | | | 869 Rs/MT |
| Company complete address: Mangalore Refinery & Petrochemicals Ltd, Kuthethoor post, Mangalore - 575030 Contact person who could be contacted for more information: V Ramasubramanian – 0824 2219430 | | | | We authorize Bureau to use this information for dissemination Signature Date | |

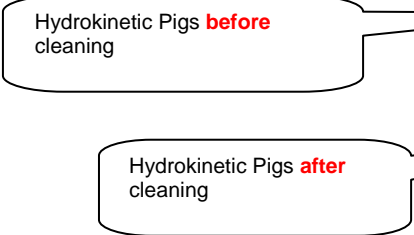
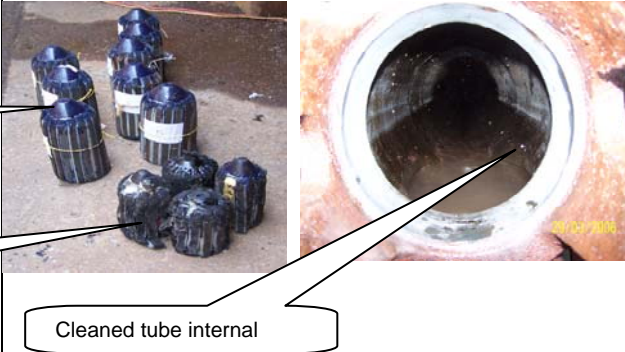
Energy Conservation Measure implemented in 2006-2007

| | | |
|--|--|--|
| ID to be filled by BEE | Title of the measure “Routing of Amine Flash Column Off Gas to Sulfur Recovery Unit’s Incinerator” | Sector ... Refinery |
| Year to be filled by BEE | | Technology Waste heat Recovery |
| <p>Description of the energy conservation measure:</p> <p>An in house modification was done to recover heat from flash column off-gases, which was earlier directly sent to flare, as this gas consists of mainly lighter Hydrocarbons and the flash column is operates at a very low pressure of 0.7Kg/cm².</p> <p>With this modification the amine flash column off gases are now routed to SRU2 incinerator. In incinerator it was burnt-off & the heat was recovered by the production of steam or by reducing the fuel gas consumption in the incinerator to maintain the minimum required temperature.</p> <p>An off-gas KOD was put in the line at SRU2 to knock-off any traces of liquid, for the process safety.</p> <p>Another line to SRU3 incinerator along with a KOD is being planned to utilize the flash gas heat even during shutdown of SRU2 unit</p> <p>Economics:</p> <p>Thermal Energy savings ~ 969 SRFT/year ~ Rs 144 Lakh/year</p> <p>Investment ~ Rs.10.24 Lakh</p> <p>Pay back ~ 27 days</p> | | |
| Picture/ sketch/ drawing before modification (if available) | Picture/ sketch/ drawing after modification | |
|  | <div style="display: flex; align-items: center;"> <div style="margin-right: 20px;">  </div>  </div> | |

| | |
|--|---------------------------------|
| Agency that executed the project (with complete address and email): In house | |
| Total investment, Rs.10.24 lakhs | Year of implementation: 2006-07 |

| First year energy cost savings, Rs.: 143 lakhs | | | | | |
|---|-------------|--------------------|----------------------------|--|--------------------------------|
| First year other savings, Rs.: Zero | | | | | |
| On annual basis | kWh 000' | Coal (Ton s) | Gas 1000Nm ³ | Oil (kL) LSHS equivalent | Other (LP Steam) MT/year |
| Energy consumption before | ---- | ---- | 2127 | ----- | ----- |
| Energy consumption after | ---- | | 1216 | | ----- |
| Energy tariff, Rs/ kWh/ Ton/ 1000Nm ³ / kL... | ---- | | 15883 | | ----- |
| Company complete address: Mangalore Refinery & Petrochemicals Ltd, Kuthethoor post, Mangalore - 575030 Contact person who could be contacted for more information: V Ramasubramanian – 0824 2219430 | | | | We authorize Bureau to use this information for dissemination Signature Date | |

Energy Conservation Measure implemented in 2006-2007

| | | | | | |
|---|---|--------------------------------------|--|------------------|-------------------------|
| ID to be filled by BEE | Title of the measure “Heater Decoking by Hydrokinetics” | Sector ... Refinery | | | |
| Year to be filled by BEE | | Technology Hydrokinetics | | | |
| <p>Description of the energy conservation measure:</p> <p>Earlier Decoking was being carried out in traditional method of burning with air. This was consuming energy as well as time & during decoking time heater was not possible.</p> <p>By the Hydrokinetics technology, Decoking was carried out without burning of the coke, instead it was removed using pigging Technology, by Hydrokinetics. This eliminated the usage of utilities, time & shutdown period.</p> <p>Decoking was carried out by this technology at VDU1 & 2 heaters in the year 2006-07</p> <p>Economics:</p> <p>Total Energy consumption in normal decoking : ~ Rs 46 Lakh/decoking</p> <p>Total Energy consumption in decoking by Hydrokinetics: ~ Rs 0 Lakh/decoking</p> <p>Project cost :~ Rs. 27.50 Lakh/decoking</p> <p>Net savings :~Rs. 18.50 Lakh/ decoking</p> <p>Net savings in 2006-07 (2 units) :~ Rs. 37 Lakh/ year</p> | | | | | |
| Picture/ sketch/ drawing before modification (if available) | Picture/ sketch/ drawing after modification | | | | |
|  |  | | | | |
| Agency that executed the project (with complete address and email): Vendor | | | | | |
| Total investment: Nil | Year of implementation: 2006-07 | | | | |
| First year energy cost savings, Rs.: 45.5 lakhs | | | | | |
| First year other savings, Rs.: -27.5 Lakhs for Hydrokinetics cleaning | | | | | |
| On annual basis | kWh 000' | Coal (Tons) | Gas Nm ³ | Oil (kL) LSHS | Other (LP steam, MT) |
| Energy consumption before | 53.28 | ---- | ----- | 120.4 | 3072 |
| Energy consumption after | ~0 | | | 0 | 0 |
| Energy tariff, Rs/ kWh/ Ton/ Nm ³ / kL ... | 4.50 RS/KWH | | | 15200 Rs/KL | 869 Rs/MT |
| Company complete address: | | | We authorize Bureau to use this information for dissemination | | |
| Mangalore Refinery & Petrochemicals Ltd, Kuthethoor post, Mangalore - 575030 Contact person who could be contacted for more information: V Ramasubramanian – 0824 2219430 | | | Signature X Date | | |

Energy Conservation Measure implemented in 2006-2007

| | | | | | | | | | | | | | | | | | | |
|---|---|--|----------------|-----------|-------------------------|----------|----------------|---------|----------------|----------|-------------------------|---------------|-------------|----------------|-------------------------------------|----------------|----------------|-----------------|
| ID to be filled by BEE | Title of the measure “Trap Survey repair & Maintenance” | Sector ... Refinery | | | | | | | | | | | | | | | | |
| Year to be filled by BEE | | Technology Hydrokinetics | | | | | | | | | | | | | | | | |
| <p>Description of the energy conservation measure:</p> <p style="text-align: center;">Steam Trap survey is a regular activity. A dedicated team is formed for the steam trap survey, repair & Maintenance. Trap Man meter is being used for the identifying of the passing traps.</p> <p style="text-align: center;">The statistics of the year 2006-07 is given below:</p> <table style="width: 100%; border: none;"> <tr><td style="width: 60%;">Traps surveyed</td><td style="text-align: right;">15917 Nos</td></tr> <tr><td>Faulty Traps identified</td><td style="text-align: right;">2589 Nos</td></tr> <tr><td>Traps Repaired</td><td style="text-align: right;">431 Nos</td></tr> <tr><td>Traps replaced</td><td style="text-align: right;">1229 Nos</td></tr> <tr><td>Reduction in steam loss</td><td style="text-align: right;">47740 MT/year</td></tr> <tr><td>Cost saving</td><td style="text-align: right;">~ 415 Rs. Lacs</td></tr> <tr><td>Expenditure (New Trap and Spares) -</td><td style="text-align: right;">20.40 Rs. Lacs</td></tr> <tr><td>Man Power cost</td><td style="text-align: right;">- 1.35 Rs. Lacs</td></tr> </table> <p style="text-align: center;">In addition to the above, 40 numbers of TD3 traps in MP steam and HP steam lines were replaced with TD62 (30 TLV and 10 SPIRAX MARSHALL) traps for better performance.</p> | | | Traps surveyed | 15917 Nos | Faulty Traps identified | 2589 Nos | Traps Repaired | 431 Nos | Traps replaced | 1229 Nos | Reduction in steam loss | 47740 MT/year | Cost saving | ~ 415 Rs. Lacs | Expenditure (New Trap and Spares) - | 20.40 Rs. Lacs | Man Power cost | - 1.35 Rs. Lacs |
| Traps surveyed | 15917 Nos | | | | | | | | | | | | | | | | | |
| Faulty Traps identified | 2589 Nos | | | | | | | | | | | | | | | | | |
| Traps Repaired | 431 Nos | | | | | | | | | | | | | | | | | |
| Traps replaced | 1229 Nos | | | | | | | | | | | | | | | | | |
| Reduction in steam loss | 47740 MT/year | | | | | | | | | | | | | | | | | |
| Cost saving | ~ 415 Rs. Lacs | | | | | | | | | | | | | | | | | |
| Expenditure (New Trap and Spares) - | 20.40 Rs. Lacs | | | | | | | | | | | | | | | | | |
| Man Power cost | - 1.35 Rs. Lacs | | | | | | | | | | | | | | | | | |
| Picture/ sketch/ drawing before modification (if available) | | Picture/ sketch/ drawing after modification | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

| | | | | | |
|---|-------------|---------------------------------|------------------------|--|----------------------|
| Agency that executed the project (with complete address and email): In house | | | | | |
| Total investment: Rs 21.75 Lacs | | Year of implementation: 2006-07 | | | |
| First year energy cost savings, Rs.: 410 lakhs | | | | | |
| First year other savings | | | | | |
| On annual basis | kWh 000' | Coal (Tons) | Gas Nm ³ | Oil (kL) LSHS | Other (steam, MT) |
| Energy consumption before | ----- | ---- | ----- | ----- | 74457 |
| Energy consumption after | | | | | 26717 |
| Energy tariff, Rs/ kWh/ Ton/ Nm ³ / kL ... | | | | | 869 Rs/MT |
| Company complete address: Mangalore Refinery & Petrochemicals Ltd, Kuthethoor post, Mangalore - 575030 Contact person who could be contacted for more information: V Ramasubramanian – 0824 2219430 | | | | We authorize Bureau to use this information for dissemination Signature Date | |