Achieving Zero discharge - Panipat Refinery and Petrochemical Complex

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INDIAN OIL – A paragon in the sector

Nation’s largest refiner
* 65.7 MMTPA capacity
* 30.5% of domestic refining capacity

Country-wide network
* Over 11,000 KM crude oil, products & natural gas pipelines

Domestic market leader
* 48.2 % market share
* Over 39,400 touch-points

R&D – among the best
* Pioneer in lube & refining technologies
* New focus on Alternate and Renewable energy

The highest ranked Indian Company in Fortune-500, 2013 listing: 88
INDIAN OIL – A paragon in the sector...

Petrochemicals – moving ahead
* 2nd largest domestic player
* 2.25 MMTPA capacity

Natural gas
* 8.2% domestic market share
* Aggressive infrastructure plans

Exploration & Production
* First-ever revenue from equity oil
* Discovery in three wells

Sustainable development
* 25 MW wind capacity added since last year
INTRODUCTION TO PR & PNC
INTEGRATED POLICY ON TPM, QUALITY, HEALTH, SAFETY & ENVIRONMENT

We are committed to:-

1. **Customer’s Delight** by meeting & exceeding their requirements & expectations.
2. **Commitment to Health and Safety** of people including prevention of injury and ill health.
3. **Environment Protection** by minimizing pollution and optimizing the use of natural resources.
4. **Compliance** of all Statutory & Regulatory requirements.
5. **Continual Improvement** to maximize wealth creation through Teamwork, Innovation, Technology, Skill and Competence.
6. **Spreading Awareness** on TQSHE among employees, contractors and interested parties.
7. **Strive to eliminate every type of loss** by implementing TPM Methodology.
8. **Reducing Direct and Indirect Emissions** of greenhouse gases in the atmosphere for Sustainable development
FEATURES OF PANIPAT REFINERY & NAPHTHA CRACKER

- 7th Indian Oil Refinery
- 15 MMTPA Refinery
- Amongst the largest Integrated Refinery & Petrochemical complex in S.E. Asia.
- 4222 Acres area (including Township & 756 Acres for PNC)
Features of Panipat Refinery

❖ Fuel refinery + Aromatic + Olefinic Complex
❖ Township and Hospital at 7Km Distance
❖ Highest share in processing high sulphur crude among other IOCL Refineries including heavy crude
❖ Lowest Manpower amongst IOCL refineries.
REFINING PROCESSES

Configuration of Refinery dictates type of crude processing

Crude

Low Sulphur - $ 111.0 / BBL.
High Sulphur – $ 104.5 / BBL.

Distillate → Treatment

Heavy Distillate → Secondary Processing

Residue → Thermal Cracking

FCC → HCU

Final Marketable Products

VBU, DCU
<table>
<thead>
<tr>
<th>UNIT</th>
<th>PROCESS LICENSOR</th>
<th>CAPACITY, MMTPA</th>
<th>COMMISSIONING DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric &amp; Vacuum Distillation Unit (AVU-I)</td>
<td>EIL</td>
<td>7.5</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Oct’98</td>
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<tr>
<td>Continuous Catalytic Reforming Unit (CCRU)</td>
<td>Axens</td>
<td>0.65</td>
<td>29&lt;sup&gt;th&lt;/sup&gt; Dec’98</td>
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<tr>
<td>Resid Fluidised Catalytic Cracking Unit (RFCCU)</td>
<td>SWEC</td>
<td>0.85</td>
<td>28&lt;sup&gt;th&lt;/sup&gt; Jan’99</td>
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<tr>
<td>Hydrogen Generation Unit (HGU)</td>
<td>HTAS</td>
<td>1*38,000 MT/yr</td>
<td>11&lt;sup&gt;th&lt;/sup&gt; Feb’99</td>
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<tr>
<td>Once Through Hydro Cracking Unit (OHCU)</td>
<td>UOP</td>
<td>1.9</td>
<td>26&lt;sup&gt;th&lt;/sup&gt; April’99</td>
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<tr>
<td>Diesel Desulphurisation Unit (DHDS)</td>
<td>IFP</td>
<td>0.7</td>
<td>12&lt;sup&gt;th&lt;/sup&gt; July’99</td>
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<td>Sulphur Recovery Unit</td>
<td>Black &amp; Veatch</td>
<td>115* 2 TPD</td>
<td></td>
</tr>
<tr>
<td>Visbreaker Unit (VBU)</td>
<td>EIL</td>
<td>0.4</td>
<td>29&lt;sup&gt;th&lt;/sup&gt; Oct’98</td>
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<tr>
<td>Merox</td>
<td>UOP</td>
<td>0.17</td>
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<td>UNIT</td>
<td>PROCESS LICENSOR</td>
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<td>COMMISSIONING DATE</td>
</tr>
<tr>
<td>-------------------------------------------</td>
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<tr>
<td>Atmospheric &amp; Vacuum Distillation Unit (AVU-2)</td>
<td>EIL</td>
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<td>Delayed Coker Unit (DCU)</td>
<td>ABB, LUMMUS</td>
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<td>Hydrogen Generation Unit (HGU)</td>
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<td>2*70,000 MT/yr</td>
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<td>Diesel Hydrotreating Unit (DHDT)</td>
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<td>Hydro Cracking Unit (HCU)</td>
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<td>Sulphur Recovery Unit</td>
<td>Black &amp; Veatch</td>
<td>3*225 TPD</td>
<td>8th Aug’06</td>
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</tbody>
</table>
AROMATIC COMPLEX

PX BLOCK
Capacity: 363 kTPA
Licensor: M/s UOP, USA

PTA BLOCK
Capacity: 553 kTPA
Licensor: M/s Invista, UK
**REFINERY-PRODUCT PATTERN**

- **HSD-III**: 38%
- **HSD-IV**: 12%
- **MS-III**: 7%
- **MS-IV**: 2%
- **ATF**: 9%
- **SKO**: 7%
- **PNC Naphtha**: 9%
- **LPG**: 4%
- **FO**: 1%
- **Bitumen**: 2%
- **Benzene**: 0%
- **Pet Coke**: 6%
- **PNT Naphtha**: 3%

*Image credits: IndianOil*
Crude import

Crude Transport
(Pipeline 1 & 2)

Refinery

Crude processing rate: 15 MMTPA (300000 BPD)

Rail/Road under Marketing

- Pipeline 50%
- Rail 18%
- Road 32%
MPPL: Dedicated PPL. for PR, HS only, now handling new indigenous crude “Mangla”

FY12-13
IOC % HS: 50%, PR % HS: 78%
AREAS FED BY PANIPAT REFINERY

8 States + 1 UT
PNC PROCESS OVERVIEW

NCU

Naphtha → Cracking → Ethylene

Ethylene → Oxidation → MEG Unit

Ethylene → Polymerization → HDPE Unit

Ethylene → Polymerization → SWING Unit

Propylene → Polymerization → PP Unit

Glycols

Polymers
<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Plant</th>
<th>Capacity, KTA</th>
<th>Licensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NCU &amp; AU</td>
<td>800</td>
<td>CBI Lummus, USA</td>
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<tr>
<td>2</td>
<td>MEG</td>
<td>300</td>
<td>Scientific Design, USA</td>
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<tr>
<td>Sr. No</td>
<td>Plant</td>
<td>No of Lines</td>
<td>Capacity, KTA</td>
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<tr>
<td>--------</td>
<td>---------------------</td>
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</tr>
<tr>
<td>1</td>
<td>Polypropylene</td>
<td>2</td>
<td>300</td>
</tr>
<tr>
<td>2</td>
<td>Dedicated HDPE</td>
<td>1</td>
<td>300</td>
</tr>
<tr>
<td>3</td>
<td>HDPE/LLDPE Swing</td>
<td>1</td>
<td>350</td>
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</table>

**Polypropylene Plant**

**Dedicated HDPE Plant**

**Swing Plant**
CRACKER-REFINERY INTEGRATION

30 MW Power sharing

Naphtha —> C4H
Naphtha Feed for Cracker

C3’s —> C7-C8
C3’s Feed for Cracker

RLNG —> C9+
Natural Gas as Fuel

RLNG

C9+
HSD Component

C7-C8
MS Component

PFO —> Nitrogen, Hydrogen
Low ‘S’ Fuel Oil

Nitrogen, Hydrogen

Amine

Panipat Refinery & Petrochemical Complex
Fuelling India’s Growth
OFFSITE & UTILITIES – PR & PNC

- Feed & Product Tanks: 163 (130 + 33)
- Horton Spheres: 16 (9 + 7)
- Mounded Bullets: 10 (4 + 6)
- Cryogenic Tanks: 4 (0 + 4)
- N2 Plant: 2 + 1 (BOO)
- Cooling Towers: 8 (5 + 3)
- DM/RO Plants: 4 (3 + 1)
<table>
<thead>
<tr>
<th>CAPTIVE POWER PLANTS – PR &amp; PNC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PR</strong></td>
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<tr>
<td>- Boiler: 3 x 160 MT/hr</td>
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<tr>
<td>- Boiler: 2 x 220 MT/hr</td>
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<tr>
<td>- STG: 3 x 25 MW</td>
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<tr>
<td>- GT(with HRSG): 5 x 30 MW</td>
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<td>- Total Steam: 920 MT/hr.</td>
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<tr>
<td>Power: 225 MW</td>
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<tr>
<td><strong>PNC</strong></td>
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<tr>
<td>- Boilers: 2 x 410 MT/hr</td>
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<tr>
<td>- STG: 3 x 37 MW</td>
</tr>
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<td>- GT(with HRSG): 5 x 25 MW</td>
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<tr>
<td>- Total Steam: 820 MT/hr.</td>
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<tr>
<td>Power: 236 MW</td>
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</table>
ENVIRONMENT MANAGEMENT-HARMONY WITH NATURE

Zero discharge: Total Recycling of treated effluents & storm water

PR Complex Initiatives

Green Belt / Herbal Park

Real-time monitoring & public display

Reduction in Carbon Footprints

Compliance w.r.t. revised norms of effluent & emission standards

Rain water harvesting

Panipat Refinery & Petrochemical Complex

IndianOil
SOME STARTLING FACTS ABOUT WATER

- Planet Earth is unique amongst the other known celestial bodies in the galaxy-‘It has WATER’

- Water is a Critical resource for economic development and livelihood of every human being.

- The ever increasing population coupled with urbanization and rapid industrialization has resulted immense pressure on water resources.

- One of the greatest challenges facing human development is the conservation and equitable distribution of our limited fresh water.

- Water Management is inextricably intertwined with future growth and poverty alleviation.
WHERE IS EARTH'S WATER LOCATED?
Distribution of Earth’s Water

- **Oceans**: 96.5%
- **Total global water**
- **Freshwater**:
  - Saline groundwater: 0.93%
  - Saline lakes: 0.07%
  - Freshwater: 2.5%
- **Groundwater**: 30.1%
  - Glaciers and ice caps: 68.6%
- **Surface water and other freshwater**: 73.1%
  - Ice and snow: 73.1%
  - Lakes: 20.1%
  - Surface water and other freshwater: 1.3%
- **Atmospheric water**: 0.22%
- **Biological water**: 0.22%
- **Rivers**: 0.46%
- **Swamps and marshes**: 2.53%
- **Soil moisture**: 3.52%

REASONS FOR WATER SCARCITY

1. Population
2. Increased Urbanization
3. High Level Consumption
4. Climate Change
SIX CHARACTERISTICS OF WATER

1. Is unitary in nature
2. Water is not distributed equally over the globe
3. Water is a diversified sector in terms of both supply and demand
4. Has a highly multidimensional institutional framework
5. Is not a simple economic good
6. Water has very important cultural, religious, and political dimensions
Solutions to water problems require the consideration of cultural, educational, communication and scientific aspects.

- Plant Trees
- Avoid Pollution
- Conserve water
- Technologies and Innovations
- Water Purification Systems
- Seawater desalination
- Water Footprint
SUSTAINABLE WATER MANAGEMENT—WHAT IS IT?

➢ To Manage our Water Resources while taking into account the needs of present & future Users

➢ Activity of planning, developing, distributing & managing the optimum use of water resources under defined water policies & regulations

➢ To manage Industrial water, sewage or waste water & water treatment
SWM-BASED ON PHILOSOPHY

1. REDUCE
2. REUSE
3. RECYCLE

- Prevention
- Minimisation
- Reuse
- Recycling
- Energy recovery
- Disposal
REFINING & PROCESSING

During the course of refining & processing of Crude Oil, besides the desired products following hazardous streams are generated:

- Gas emissions
- Liquid effluents
- Hazardous waste like sludge and spent catalyst
LIQUID EFFLUENT TREATMENT PROCESS

- Sources of effluent from oil industry are:
  a) Sour Water from Process units
  b) Desalter effluent from Process units
  c) Oily Water drained from Storage Tanks

The sour water is treated in sour water stripping units to remove excess loads of sulfides and ammonia prior to routing to waste water treatment plant or Effluent Treatment Plant.
LIQUID EFFLUENT TREATMENT PROCESS

Primary treatment:
- Tilted Plate Interceptor (TPI): Removal of free oil & grease and TSS.
- Flash Mixing tank ($H_2O_2$): Removal of sulfides and phenols.
- Dissolved Air Floatation separator (DAFS): Removal of emulsified oil.

Biological Treatment (Secondary Treatment):
- Aeration Tank with Surface Aerators: BOD and COD reduction.

Final treatment:
- Clarifier: Turbidity removal.
- Dual Media filters: Further Removal of TSS.
- Granular Activated Carbon Filters: Odor & colour improvement.
## Treated Effluent Lab Results

<table>
<thead>
<tr>
<th>Parameter</th>
<th>MINAS</th>
<th>Typical range</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.0 - 8.5</td>
<td>6.6 - 7.1</td>
</tr>
<tr>
<td>Oil &amp; Grease mg/lt.</td>
<td>5.0</td>
<td>3.0 - 5.0</td>
</tr>
<tr>
<td>Phenol, mg/lt.</td>
<td>1.0</td>
<td>0.02 - 0.03</td>
</tr>
<tr>
<td>Sulphides, mg/lt.</td>
<td>0.5</td>
<td>0.20 - 0.29</td>
</tr>
<tr>
<td>BOD, mg/lt.</td>
<td>15.0</td>
<td>8.0 - 15.0</td>
</tr>
<tr>
<td>TSS, mg/lt.</td>
<td>20.0</td>
<td>12.0 - 20.0</td>
</tr>
</tbody>
</table>

From IS 7968 to IS 2490 to MINAS
- Ultra - filtration

- Reverse Osmosis

- Reduce, Reuse and Recycle

✓ Treated effluent ex- ETP is routed thru series of ROs and DM plant to produce water of BFW quality.

✓ Treated effluent is recycled as CT make-up & elsewhere in process.
TERTIARY TREATMENT PLANT AT PANIPAT REFINERY

RO FEED TANK

UF
8 skid
@197 m3/hr

DMF
7 skid
@230 m3/hr

1250 m3/hr
Ex ETP

Start

Micro Filtration
8 skid @ 156 m3/hr

RO-I MODULE
7 STREAMS
@156 m3/hr

80% FEED RECOVERY

REJECT

RO-I MODULE
7 STREAMS
@150 M3/HR

RO-II MODULE
2 STREAMS
@177 m3/hr

RO-III MODULE
2 STREAMS
@177 m3/hr

FEED 65% RECOVERY

REJECT

For reuse in Coke Yard

PERMEATE

90% RECOVERY

PERMEATE

PERMEATE

REJECT

RO PERMEATE TANK

TO DM Water
Tank suitable
for BFW

80% FEED RECOVERY

RO plant inlet / outlet stream condition

Panipat Refinery
& Petrochemical Complex

IndianOil

Fuelling India's Growth
EFFLUENT MANAGEMENT

ETPs & RO plant:


- **Refineries ETP (PR & PRE)**
  - ETP-1: 400 m³/hr
  - ETP-2: 400 m³/hr
  - STP in Township: 110 m³/hr
  - RO plant: 900 m³/hr (3 Modules)

- **Petrochemical ETPs (PX-PTA & PNC)**
  - ETP-3: 275 m³/hr
  - ETP-4: 200 m³/hr
  - RO plant: 871 m³/hr (2 Modules)
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parameter</th>
<th>Limit</th>
<th>Unit</th>
<th>ETP-I G/P</th>
<th>ETP-II G/P</th>
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<tbody>
<tr>
<td>1</td>
<td>pH</td>
<td>6.0-8.5</td>
<td></td>
<td>7.36</td>
<td>7.06</td>
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<tr>
<td>2</td>
<td>O&amp;G</td>
<td>5.0</td>
<td>ppm</td>
<td>4.40</td>
<td>4.20</td>
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<tr>
<td>3</td>
<td>S²</td>
<td>0.50</td>
<td>ppm</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
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<tr>
<td>4</td>
<td>Phenol</td>
<td>0.35</td>
<td>ppm</td>
<td>0.19</td>
<td>0.22</td>
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<tr>
<td>5</td>
<td>COD</td>
<td>125</td>
<td>ppm</td>
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<td>6</td>
<td>BOD</td>
<td>15</td>
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<td>10.93</td>
<td>11.22</td>
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<td>TSS</td>
<td>20</td>
<td>ppm</td>
<td>16</td>
<td>14</td>
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<td>8</td>
<td>CN⁻</td>
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<td>9</td>
<td>NH₃(N₂)</td>
<td>15.0</td>
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<td>10</td>
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<td>&lt;0.01</td>
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<td>&lt;0.01</td>
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<tr>
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<td>V</td>
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<td>19</td>
<td>Hg</td>
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<td>Ppm</td>
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<td>NA</td>
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<tr>
<td>1</td>
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<td>7.5</td>
<td>7.05</td>
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<tr>
<td>3</td>
<td>S²</td>
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<td>ppm</td>
<td>ND</td>
<td>&lt;0.2</td>
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<tr>
<td>4</td>
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<tr>
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<td>93.69</td>
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<td>6</td>
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<td>50</td>
<td>ppm</td>
<td>5.7</td>
<td>12.29</td>
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<tr>
<td>7</td>
<td>TSS</td>
<td>100</td>
<td>ppm</td>
<td>6.0</td>
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<tr>
<td>8</td>
<td>Fluoride as F</td>
<td>5</td>
<td>Ppm</td>
<td>0.70</td>
<td>1.60</td>
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<tr>
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<td>&lt;0.01</td>
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<tr>
<td>13</td>
<td>Total Cr</td>
<td>2.0</td>
<td>ppm</td>
<td>NA</td>
<td>&lt;0.01</td>
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</tbody>
</table>
EFFLUENT BALANCE: ETP-1 & ETP-2

ETP-1:
- 400 m3/hr.
- Filter Backwash: 8 m3/hr.
- Cooling Tower: 120 m3/hr.
- Storm Water
- RO Plant: 272 m3/hr.

ETP-2:
- 400 m3/hr.
- Filter Backwash: 8 m3/hr.
- Cooling Tower: 60 m3/hr.
- Storm Water
- RO Plant: 332 m3/hr.
EFFLUENT BALANCE: PTA- ETP & RO

PTA-ETP

- 275 m³/hr.

- Filter Backwash: 6 m³/hr.

- Storm Water

Polishing Pond

- 219 m³/hr.

- Cooling Tower: 50 m³/hr.

Green Belt

- 27 m³/hr.

Thirana Drain (Maximum Allowable Limit: 255 m³/hr.)

- 192 m³/hr.

Source

- ETP-1: 400 m³/hr.
- ETP-2: 300 m³/hr.
- Filter Blow Down: 50 m³/hr.
- Px-PTA Cooling Tower Blow Down: 272 m³/hr.
- Blending Tank (TPP RO) Design
- 900 m³/hr.
- Raw Water: 800 m³/hr.

DM Plant

- 13 m³/hr.

RO Plant

- 713 m³/hr.

Degasing

- 700 m³/hr.

RO Reject

- 187 m³/hr.

POLISHING POND

- Green Belt

IndianOil

Panipat Refinery & Petrochemical Complex

Fuelling India's Growth
C T-1 BLOW DOWN: 308 m³/hr.
CT-2 BLOW DOWN: 253 m³/hr.
CT-3 BLOW DOWN : 130 m³/hr.
BLOW DOWN FROM CPP BOILER: 15 m³/hr.
ETP RECYCLE : 150 m³/hr
CPU WASTE : 15 m³/hr
RAW WATER BACK UP : NIL.
YEAR-WISE RAW WATER CONSUMPTION

Raw Water m3/hr

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998-99</td>
<td>1324.9</td>
<td>1324.9</td>
</tr>
<tr>
<td>1999-00</td>
<td>1250</td>
<td></td>
</tr>
<tr>
<td>2000-01</td>
<td>1095.2</td>
<td></td>
</tr>
<tr>
<td>2001-02</td>
<td>1228.4</td>
<td></td>
</tr>
<tr>
<td>2002-03</td>
<td>1130.6</td>
<td></td>
</tr>
<tr>
<td>2003-04</td>
<td>1532.8</td>
<td>1532.8</td>
</tr>
<tr>
<td>2004-05</td>
<td>2747.1</td>
<td>2747.1</td>
</tr>
<tr>
<td>2005-06</td>
<td>2511.9</td>
<td>2511.9</td>
</tr>
<tr>
<td>2006-07</td>
<td>1967.6</td>
<td>1967.6</td>
</tr>
<tr>
<td>2007-08</td>
<td>1897.8</td>
<td>1897.8</td>
</tr>
<tr>
<td>2008-09</td>
<td>1811.9</td>
<td>1811.9</td>
</tr>
<tr>
<td>2009-10</td>
<td>1835</td>
<td>1835</td>
</tr>
<tr>
<td>2010-11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012-13</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FRESH WATER CONSUMPTION PER THOUSAND MT OF CRUDE

m3 water/TMT Crude

- **Actual**
- **Design**

- **1998-99**: 2580.3
- **1999-00**: 2644.5
- **2000-01**: 1647.8
- **2001-02**: 1763.8
- **2002-03**: 2044.7
- **2003-04**: 1709.9
- **2004-05**: 2550.7
- **2005-06**: 1721
- **2006-07**: 1246.7
- **2007-08**: 1266.2
- **2008-09**: 1217.2
- **2009-10**: 1026.8
- **2010-11**: 1066
- **2011-12**: 1206.8
- **2012-13**: 1066
1. Improving efficiencies and minimizing losses
2. Recharging ground water
3. Abatement and treatment of water pollution
4. Reuse and recycling of waste water
1. Reduce
2. Recycle
3. Recharge
4. Reuse
ACTION TAKEN FOR WATER FOOTPRINT REDUCTION

Reduce
1. Replaced Service water being used as bearing cooling water with cooling water
2. Reduction in Drinking water consumption – reduction in supply hrs, self closing water taps
3. Replaced raw water with storm water in fire water system
4. Increasing COC of the cooling tower / reducing fresh water make up
5. Producing DM water from RO instead of ion exchange
6. Installation of Air fin coolers
RAW WATER TO DRINKING WATER IN M3/HR

- Refinery
- Township
- Total

Year 2002-03: Refinery 41.7, Township 4.2, Total 45.9
Year 2003-04: Refinery 42.2, Township 4.2, Total 46.4
Year 2004-05: Refinery 48.6, Township 4.2, Total 52.8
Year 2005-06: Refinery 95.5, Township 4.2, Total 100.7
Year 2006-07: Refinery 218.6, Township 4.2, Total 222.8
Year 2007-08: Refinery 150.7, Township 4.2, Total 154.9
Year 2008-09: Refinery 172.9, Township 4.2, Total 177.1
Year 2009-10: Refinery 202.9, Township 4.2, Total 207.1
Year 2010-11: Refinery 157, Township 4.2, Total 161.2
Year 2011-12: Refinery 163, Township 4.2, Total 167.2
Year 2012-13: Refinery 211, Township 4.2, Total 215.2
ACTION TAKEN FOR WATER FOOT PRINT REDUCTION

Recycling & Reuse

✓ Raw water treatment plant clarifloculator drain routed to Raw water pond to recycling of around 146000 m3 of water per annum.
✓ Recycling of bearing cooling water drain in Process units
✓ Enhancing of reuse of stripped sour water
✓ Use of domestic effluent for irrigation purpose after treatment
✓ use of storm water as Cooling tower make up water after treatment
✓ Using WWTP(ETP) effluent as Cooling tower make up water
Recycling & Reuse

- Using storm water as fire water after treatment.
- Reduction of Fresh Water through waste water treatment
  Modernization for better treated effluent quality.
- Steam Condensate Recovery & recycle.
- Reverse Osmosis for treatment of high TDS effluent e.g.
  WWTP (ETP) effluent, DM plant effluent. Installed three stage
  Reverse Osmosis Plant.
- Advanced Cooling Water and Effluent treatment to improve COC.
- Use of Domestic Effluent after treatment.
RAW WATER TO RO, M3/HR

Year       | RAW WATER (M3/HR)
------------|-------------------
2006-07     | 26.9              
2007-08     | 193               
2008-09     | 49.9              
2009-10     | 63.9              
2010-11     | 97.9              
2011-12     | 45.4              
2012-13     | 142               

Panipat Refinery & Petrochemical Complex
Fuelling India's Growth
CPP CT MAKEUP WATER M3/HR
RAW WATER MAKE UP TO PR COOLING TOWER M3/HR

![Graph showing raw water make up to PR cooling tower M3/HR from 2000-01 to 2012-13. The graph compares actual and design values. The actual values are represented by blue squares, and the design values are represented by red squares. The values fluctuate over the years, with a peak in 2002-03 and a significant drop in 2007-08. The values range from 246 M3/HR in 2000-01 to 91 M3/HR in 2012-13.]
RAW WATER MAKE UP TO PRE COOLING TOWER

- Actual
- Design

Graph showing the raw water make-up from 2005-06 to 2012-13 with actual and design values.

Key values:
- 2005-06: 319.5
- 2006-07: 1023.5
- 2007-08: 1077.3
- 2008-09: 867.6
- 2009-10: 912.5
- 2010-11: 863.8
- 2011-12: 869.3
- 2012-13: 182
ACTION TAKEN FOR WATER FOOT PRINT REDUCTION

Regenerate

1. Use of storm water

2. Installation recharge well/ rain water harvesting
   - 16 nos. of recharge well of dia. 8 inch.
   - Total recharging capacity (during rain time) is 201.6 m³/hr.
Rain Water Harvesting

- Recharge Wells-
  - 17 Nos in Township
  - 9 Nos in Refinery
RAW WATER CONSUMPTION IN M3/HR

Panipat Refinery & Petrochemical Complex

Fuelling India’s Growth
RAW WATER CONSUMPTION PATTERN

Category wise raw water consumption
2002-03

Category wise raw water consumption
2007-08

Category wise raw water consumption
2012-13

Panipat Refinery & Petrochemical Complex
Fuelling India’s Growth
• To reduce fresh water consumption 1500 m3/hr (7.85 GPD) each both for Refinery & Petrochemicals.

• Installation of RO & Multiple Effect Evaporator for gainful utilization of Green Belt water from PTA ETP (269 m3/hr) and RO rejects (264.5 m3/hr).

• Utilization of STP water in Refinery (Approx. 50 m3/hr)

• To cover all the plant buildings for rain water harvesting.
Thank You!
Definition:

- The water footprint of a nation shows the total volume of water that is used to produce the goods and services consumed by the inhabitants of the nation.

- The water footprint of an individual refers to the sum of his or her direct and indirect fresh water use.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>TTP Inlet</th>
<th>RO 2 permeate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow (m3/Hr)</td>
<td>900</td>
<td>711</td>
</tr>
<tr>
<td>pH</td>
<td>6.0-8.5</td>
<td>4.5-8.0</td>
</tr>
<tr>
<td>Temperature(deg C)</td>
<td>Amb</td>
<td>Amb</td>
</tr>
<tr>
<td>Total suspended solids(TSS) mg/L</td>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>Total dissolved solids(TDS) mg/L</td>
<td>1786</td>
<td>&lt;5</td>
</tr>
<tr>
<td>Condutivity micromho/cm</td>
<td>4000</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Oil and Grease mg/L</td>
<td>10</td>
<td>NA</td>
</tr>
<tr>
<td>BOD mg/L</td>
<td>&lt;10</td>
<td>NA</td>
</tr>
<tr>
<td>COD mg/L</td>
<td>&lt;150</td>
<td>Traces</td>
</tr>
<tr>
<td>Total hardness mg/L</td>
<td>220</td>
<td>0.07</td>
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<tr>
<td>Calcium hardness as CaCO3 mg/L</td>
<td>150</td>
<td>0.03</td>
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<tr>
<td>Magnesium hardness as CaCO3 mg/L</td>
<td>70</td>
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<td>Chlorides as CaCO3 mg/L</td>
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<td>Sodium as Na mg/L</td>
<td>400</td>
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<tr>
<td>Phosphate+Nitrates as NO3 mg/L</td>
<td>&lt;25</td>
<td>1.41</td>
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<tr>
<td>Ammonia mg/L as NH4</td>
<td>&lt;20</td>
<td>Traces</td>
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<tr>
<td>Reactive Silica mg/L</td>
<td>98</td>
<td>-</td>
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<tr>
<td>Colloidal Silica as SiO2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Turbidity NTU</td>
<td>50</td>
<td>Nil</td>
</tr>
<tr>
<td>Silt Density Index (SDI)</td>
<td>Out of Range</td>
<td>NA</td>
</tr>
<tr>
<td>M-Alkalinity as CaCO3</td>
<td>100</td>
<td>0.26</td>
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<tr>
<td>Potassium as K</td>
<td>40</td>
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<tr>
<td>Iron as Fe</td>
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<td>Nil</td>
</tr>
<tr>
<td>Sulphates as SO4</td>
<td>500</td>
<td>0.1</td>
</tr>
<tr>
<td>PRODUCT</td>
<td>YIELD AS % OF CRUDE PROCESSED</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------</td>
<td></td>
</tr>
<tr>
<td>LPG</td>
<td>3.5</td>
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</tr>
<tr>
<td>MOTOR GASOLINE</td>
<td>8.3</td>
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</tr>
<tr>
<td>SUPERIOR KEROSENE OIL</td>
<td>6.9</td>
<td></td>
</tr>
<tr>
<td>ATF</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td>HIGH SPEED DIESEL</td>
<td>45.0</td>
<td></td>
</tr>
<tr>
<td>PETROCHEMICAL FEED</td>
<td>11.2</td>
<td></td>
</tr>
<tr>
<td>HEAVY ENDS</td>
<td>10.0</td>
<td></td>
</tr>
</tbody>
</table>
1. **Petrochemical Feed: 11.2%**
   A) 2.9% PX Feed
   B) 8.3% Naphtha Cracker feed

2. **Heavy Ends: 10.0%**
   A) Coke – 5.3%
   B) Sulfur – 1.0%
   C) HPS - 1.4%
   D) Bitumen – 2.3%
A VIEW OF GREEN BELTS
A VIEW OF HERBAL PARK IN TOWNSHIP:
Tree Plantation

Nos of trees planted

- Tree Planted upto 30.09.2013 : 7850 Nos.
A VIEW OF STP PROCESS IN REFINERY TOWNSHIP

An overview of STP

Clarifiers in STP