Maximizing Profitability of Naphtha Complexes with UOP’s Processes and Catalysts

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African Refining Scenario

Market Drivers
- Increasing Gasoline & Diesel Demand
- Fuel specifications Changes
- Environmental Regulations Changes
- Reduce Fuel Imports
- Crude Monetization

Refinery Impact
- Octane short
- Higher severity operations
  - Feedstock changes
  - Increased throughput
  - Higher octane for motor fuel units
  - Lower sulfur Diesel

Refiner Needs
- Flexible Operation
- Improved profitability
  - Higher throughput
  - Higher C₅+ liquid yields
  - More gasoline blending components
  - More Hydrogen
  - BTX Integration

Market Trends Impact Refinery and Naphtha Block
## Solutions to Meet EURO V Equivalent Gasoline Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Limit on streams containing Sulfur</th>
<th>Remove benzene before or after reformer</th>
<th>Limit on reformate increased use of isomerate and alkylate</th>
<th>Limit on FCC Gasoline increased use of isomerate and alkylate</th>
<th>Add oxygenates MTBE, ethanol or other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur 10 wt ppm</td>
<td>Selectfining™ Unit</td>
<td>Naphtha Splitting Penex™/Par-Isom™ Unit BenSat™ Unit Extraction</td>
<td>CCR Platforming™ Unit Penex/Par-Isom Unit Alkylation Extraction</td>
<td>Penex/Par-Isom Unit Alkylation, Butamer™, InAlk™ or Ethermax™ Unit</td>
<td>Ethermax Unit</td>
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<tr>
<td>Benzene 1 vol %</td>
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<tr>
<td>Aromatics 35 vol %</td>
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<tr>
<td>Olefins 18 vol %</td>
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<tr>
<td>Oxygenates 2.7 wt %</td>
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</table>

**Optimized Solution driven by Refinery or company specific Study!**
How do UOP Process and Product Technologies enable refiners to meet these specifications?
Benzene Management

1. Pre-fractionation reduces benzene precursors in feed to reformer (meets 1 vol% limit)
2. Post-fractionation removes benzene from the reformate (no benzene in reformate)

Best solution depends on benzene and octane balance
For existing units: Reevaluate naphtha splitter and add Isomerization
**Solutions to Meet Gasoline and BTX Needs**

**Isomerization**
- **330 Units**
- **C₅ - C₆**
- **Par-Isom Unit**
- **Penex Unit**

**Reforming**
- **304 units**
- **C₆ – C₁₁**
- **Platforming Unit with Cyclemax™ III CCR**

**Hydrocarbon Recycle Option**
- **OT**
- **Recycle**
  - **DIH**
  - **DIP**
  - **Super DIH**

**Gasoline Blending**
- RONC 82
- RONC 92

**BTX and Gasoline Blending**
- RONC 93
- RONC 106+

*Multiple options and significant improvements in process, catalysts, controls and reliability to achieve desired products*
Refiners Must Adapt to the Changing Environment to be Competitive

<table>
<thead>
<tr>
<th>Regional Market Changes</th>
<th>UOP Solutions</th>
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<tbody>
<tr>
<td><strong>Growing Gasoline Market</strong></td>
<td>1. New Units</td>
</tr>
<tr>
<td>• Meeting Demand</td>
<td>2. Higher Yields – Pressure Reduction in FB Reforming and New Catalysts</td>
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<tr>
<td>• Reducing Impacts</td>
<td>3. Conversion – FB Reforming to CCR unit or Isomerization</td>
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<tr>
<td>• Monetising Crude</td>
<td>4. Asset Consolidation - Increase Capacity / Severity</td>
</tr>
<tr>
<td><strong>Clean Fuels Regulations</strong></td>
<td>5. Gasoline Blend Optimization</td>
</tr>
<tr>
<td>• Meet AFRI/EURO 4 &amp; 5 Specifications</td>
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<tr>
<td>• Maximizing $H_2$ production</td>
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</tbody>
</table>

Innovations in process, equipment, and catalysts help refiners to meet new specifications and demand for octane barrels.
Thank You