Refinery Chemicals

Industry Study with Forecasts to 2005 & 2010

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INDUSTRY STRUCTURE

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Greater demand for refined petroleum products -- particularly gasoline and diesel fuel -- coupled with tighter environmental regulations on refiners, will drive US refinery chemical demand through 2010.

US demand to grow 5.6% per year through 2010

Refinery chemical demand is projected to grow 5.6 percent annually to $3.6 billion in 2010, driven by continued expansion of the US economy, which is fueling demand for refined petroleum products, particularly gasoline and diesel fuel. To meet these rising needs, refiners are using chemically-intensive conversion processes to boost their yields of lighter products. At the same time, tightening environmental regulations are forcing refiners to subject their products to higher levels of treatment to remove impurities.

Petroleum treatment applications fastest growing

Conversion processes are typically a refinery’s largest consumer of chemicals, particularly in catalytic cracking and hydrocracking applications. Catalytic cracking is the largest consumer of refinery chemicals by virtue of its heavy demand for zeolite catalysts. However, much faster growth in chemical consumption is expected in hydrocracking applications, which are expanding more rapidly and increasingly relying on merchant hydrogen to meet incremental gains in hydrogen demand.

To meet tightening environmental regulations, particularly the EPA’s caps on gasoline and diesel fuel sulfur content, refineries are boosting their reliance on petroleum treatment processes, which will be the fastest growing application for refinery chemicals through 2010.

Especially strong gains are expected for chemicals used in hydrotreating, which in 2005 was the largest petroleum treatment application for refinery chemicals. Chemicals used in water treatment applications, such as corrosion inhibitors and biocides, are expected to post strong gains going forward, in part due to the growing popularity of internal water recycling.

Merchant hydrogen to see double-digit gains

Continued innovations boosting reactivity and operating lifetimes are increasing the effectiveness of catalysts, contributing to somewhat restrained demand gains despite higher hydrocarbon runs in key catalyst consuming applications.

Much faster growth is expected for merchant hydrogen, which is experiencing double-digit gains due to rising hydrogen demand from hydrotreating and hydrocracking processes and the preference of refiners to meet excess hydrogen needs via merchant purchases rather than on-site generation. Steady gains are expected for corrosion inhibitors and pH adjusters, which are used in a variety of applications in petroleum refineries, most prominently in water treatment but also to protect equipment and catalysts from damage by contaminants in hydrocarbon streams. Solvent consumption is also increasing, primarily because of the product upgrades that can be achieved via solvent extracting, dewaxing and deasphalting.
APPLICATIONS

Conversion Processes

Demand for refinery chemicals used in conversion processes is projected to increase from $2.7 billion in 2005 to $3.6 billion in 2010. Increasing demand and rising prices for lighter products such as gasoline and diesel are driving refineries to aggressively pursue methods that will increase the yields of these high value products, including expanding conversion processes. The expansions, in particular the rising hydrogen needs accompanying them, are driving chemical consumption levels in conversion applications to new heights.

The typical barrel of crude oil, upon fractionation, does not yield a set of finished petroleum products in balance with market demand. For example, crude oil tends to distill into a product mix with excess heavy oils and insufficient gasoline relative to demand. To combat these and other imbalances, refineries convert hydrocarbon streams into higher value products. This is typically done by breaking the carbon to carbon bonds in heavy, large hydrocarbon molecules, thus splitting them into multiple smaller molecules with lower densities and boiling points. The process not only enables refineries to boost their yield of high value light products, but also to increase their overall output, as these conversion processes increase the total volume of the finished products by producing less dense hydrocarbon streams.

Among conversion processes, catalytic cracking is the largest consumer of refinery chemicals by virtue of its heavy demand for zeolite catalysts. However, much faster growth in chemical consumption is expected in hydrocracking applications, which are expanding more rapidly and increasingly relying on merchant hydrogen to meet incremental gains in hydrogen demand. Strong gains in chemical consumption are also expected to meet the needs of expanding isomerization applications, which like hydrocracking are resorting to merchant hydrogen to meet...
**COMPANY PROFILES**

**Nalco Holdings LLC**
1601 West Diehl Road
Naperville, IL  60563
630-305-1000
http://www.nalco.com

Sales: $3.3 billion (2005)
US Sales:  $1.5 billion (2005)
Employment:  10,900 (2005)

Key Products:  corrosion inhibitors, antifoulants, slurry settling aids, reverse emulsion breakers, hydrogen sulfide scavengers and various water treatment chemicals

Nalco Holdings is the holding company for Nalco Company (Naperville, Illinois), a leading worldwide provider of integrated water treatment and process improvement services, chemicals and equipment programs for industrial and institutional applications. Nalco Company operates in four segments: Industrial and Institutional Services, Energy Services, Paper Services and Other.

The Company is involved in the refinery chemicals industry through the Energy Services segment, which had 2005 sales of $897 million. Through this segment, Nalco supplies a full range of technology-driven solutions to the global petroleum, natural gas and petrochemical industries. Among these operations, the Energy Services segment includes the Company’s Downstream Refinery business, which offers a broad range of chemicals and services for use in petroleum refineries. In particular, the business’ offerings are designed to enhance refinery plant efficiency and the useful lives of related equipment, while also

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### TABLE IV-5
**ACID CATALYST DEMAND IN REFINING**
(million dollars)

<table>
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</thead>
<tbody>
<tr>
<td>Refinery Output (mil bbl)</td>
<td>5887</td>
<td>6397</td>
<td>6610</td>
<td>7125</td>
<td>7500</td>
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<tr>
<td>lb catalyst/000 bbl</td>
<td>1050</td>
<td>1075</td>
<td>1164</td>
<td>1196</td>
<td>1215</td>
</tr>
<tr>
<td>Acid Catalyst Demand (mil lb)</td>
<td>6179</td>
<td>6977</td>
<td>7692</td>
<td>8521</td>
<td>9114</td>
</tr>
<tr>
<td>Sulfuric Acid</td>
<td>6090</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrofluoric Acid</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Acids</td>
<td>63</td>
<td></td>
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<tr>
<td>$/lb</td>
<td>0.027</td>
<td></td>
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<tr>
<td>Acid Catalyst Demand By Type:</td>
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</tr>
<tr>
<td>Sulfuric Acid</td>
<td>137</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Hydrofluoric Acid</td>
<td>17</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Other Acids</td>
<td>10</td>
<td></td>
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<td>By Application:</td>
<td></td>
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<tr>
<td>Alkylation</td>
<td>143</td>
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<tr>
<td>Other Applications</td>
<td>21</td>
<td></td>
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<tr>
<td>% acid</td>
<td>19.0</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Catalyst Demand</td>
<td>865</td>
<td>1010</td>
<td>1170</td>
<td>1385</td>
<td>1610</td>
</tr>
</tbody>
</table>

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“Demand for acid catalysts in refining applications is expected to increase 3.2 percent annually to $260 million in 2010. In volume terms, consumption is projected to reach 8.5 billion pounds in the same year. Growth will result from increased use in petroleum alkylation processes, which accounts for the bulk of refinery acid catalyst use, brought on by the ongoing phase-out of MTBE gasoline additives, which will spark demand for alkylates. The MTBE phase-out notwithstanding, the heightened demand for gasoline will cause refiners to continue looking to alkylates to increase yields.”

--Section IV, pg. 119
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