Agenda

Stratas Advisors Overview

Refinery Inputs and Margins

Middle Distillate and Gasoline Outlook

Petrochemicals Assessment

Syngas Insights and Live Q&A
Who We Are

• Stratas Advisors is a global consulting and advisory firm that covers the full spectrum of the energy sector and closely linked industries

• The world’s leading businesses, governments and institutions turn to us for data, analysis and insight (IOCs, NOCs, independents, energy consumers and financial entities)

• We help our clients achieve tangible results through informed strategic decision-making and implementation planning

• Key differentiators include
  – Global coverage with deep local knowledge
  – Integrated analysis across the entire energy value chain, including macro-level analysis (geopolitics, macro-economics, policies and regulations)

• Our research and consulting staff comprises some 60 professionals located on the ground in key global energy market centers

• Combined, our team brings over 500 years of combined energy industry expertise, including
  – Technical (Petroleum Engineers, Geologists, Process Engineers)
  – Economists
  – Political Scientists
  – Financial Analysts

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Dedicated Teams for Each Segment

Strategic insights across the energy value chain

**Upstream**
Drill down with a ground-level look at the fields, wells and companies involved in E&P.

**Midstream**
Move confidently in new frontiers that are being shaped by changing supply/demand dynamics coupled with investments in pipeline, rail and ship logistics.

**Downstream**
Thrive in an environment where crude oil supply dynamics and product demand trends are structurally evolving.

**Fuel & Transport**
Accelerate innovation with a comprehensive understanding of policies pertaining to petroleum-based fuels, biofuels and other alternative fuels.
What We Offer

Helping clients achieve tangible results

Services

An innovative online portal of data, information and insights across the oil & gas value chain and macro-level issues that includes GIS mapping and interactive data tools

Consulting

A full range of consulting support, allowing you to gain an external perspective on strategic matters and to respond proactively by implementing the appropriate initiatives for success

Advisory

Customized retainer arrangements with access to senior Stratas Advisors staff who will answer your questions about:

- Macro-level developments
- Energy markets
- Industry events and trends
- Investment risks and opportunities
## Service Matrix

<table>
<thead>
<tr>
<th>Upstream</th>
<th>Midstream</th>
<th>Downstream</th>
<th>Fuel &amp; Transport</th>
<th>Executive Suite</th>
<th>By Region</th>
<th>By Industry</th>
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<td>Global Alternatives Fuels</td>
<td>Global Refining &amp; Products</td>
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<td>Russia &amp; CIS</td>
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Clients

Oil & Gas Operators
- IOCs
- NOCs
- Independents
- Midstream operators
- Refiners
- Distributors
- Marketers

Petrochemical Manufacturers
Catalyst Manufacturers
Heavy Industries
Power Generators
Technology Licensors
EPC Firms

Automotive
- Light-duty
- Heavy-duty
- Off-road

Transport
- Marine
- Rail
- Air

Logistics

Finance
- Sell-side
- Asset Management
- Private equity
- Hedge Funds

Energy Traders

Service Providers
- Upstream
- Midstream
- Downstream

Government
- Agencies
- Regulators
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Analyst, Gasification
ccothran@stratasadvisors.com
Refinery Inputs and Margins

Anjani Singh
Key Insight: Crude Slate

- Over 2/3rd Asia refinery input is sour crude, indicating higher need of hydroprocessing capacity.
- The region crude input has higher fraction of heavy Naphtha and Light Naphtha, indicating naphtha available for Petrochemicals through refinery.
Refinery Input (2015) – North America

Key Insight: Crude Slate

- The contribution of light sweet in the refinery indicating the higher shale oil production to the refinery inputs.

- Gas Oil fraction contributing to the gasoline fraction through FCC and Residue Fraction contributing to the middle distillate. Majority of residue fraction sourced from Heavy Sour (Canada) and Medium Sours (middle east) crude.
Global Refinery Margins

Key Insight: Input Cost, Market Access and Refinery Configuration

- Input Costs, market access (both export and domestic) and regional refinery configurations are key to higher refinery margins.

- North America input costs are lower, while Russia, Asia and Europe margins are better due to higher demand for export and consumption in domestic market.

- Middle East and Africa would need to improve on refinery configuration to improve product quality and margins.
Catalyst Forecast

Key Insight: Hydrocracker Catalyst – Middle East

- Middle East process mostly sour medium crude. The crude is better suitable for Hydrocracking capacity expansions.

- Middle East is adding Hydrocracking capacity to meet the export demand of middle distillate to meet fuel quality.
Hydrogen Sulfur Production

Key Insight: Improving product quality

- Asia H2 production will increase at 2.5 % annually for next ten years.
- The sulfur production will increase at 3.5 % annual rate. This is due to increased need to better fuel quality and higher sulfur presence in crude. Both Naphtha reformer and steam reforming will contribute to the H2 production. Steam reformer will contribute almost 2/3rd of H2 production for hydroprocessing in Asia.
Middle Distillate and Gasoline Outlook

Petr Steiner
Middle Distillate Demand by Region

On-road diesel driving demand around the world (2014-2035)

- Asia-Pacific will drive the demand, but Africa has a potential for the fastest pace of demand growth
Global Diesel Trade Flow

2015 Diesel Trade Flow

2015 Diesel Regional Flow - million barrels per day

<table>
<thead>
<tr>
<th>Exporting region</th>
<th>To Europe</th>
<th>To Middle East</th>
<th>To Asia</th>
<th>To North America</th>
<th>To Africa</th>
<th>To Latin America</th>
<th>To Russia &amp; CIS</th>
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</table>
Capacity Additions for Middle Distillate Markets

Volume and quality improvements via conversion and hydroprocessing units

- Push for clean diesel (ultra-low-sulfur) continues around the world
- Significant volume of ULSD will come from hydrocrackers and upgraded existing hydrotreaters
Middle Distillate: Key Findings

Diesel markets will be positive in the future despite the currently slow demand

• Asia-Pacific will lead the volumetric increase in the demand, in spite of stagnating demand in OECD countries
• Stronger growth of diesel demand will be offset by fuel efficiency measures and switching to alternative fuels
• In the wake of emissions scandal, passenger fleet dieselization experienced in Europe is not expected to be replicated in other regions – heavy duty will be the main sector for growth
• Diesel markets are expected to benefit from the push for cleaner marine fuels – distillate will be replacing portion of fuel oil markets
• Quality of diesel, especially its sulfur content, continues to be the main concern in many parts of the world – significant investment will be aimed at sulfur removal
• Investment in conversion (hydrocrackers, cokers) and hydroprocessing units will be needed to satisfy volumes and quality required by the market
Global Gasoline Demand Outlook

Gasoline

- The gasoline market is still rebounding from early price increases and the economic slowdown that started in 2008. Global gasoline demand is projected to grow only 0.5% annually from 2015 to 2035.

- Gasoline demand is projected to grow at an average rate of 2.4% annually between 2014-2020, and 1.2% afterwards through 2035.

- Demand has rebounded since 2010, but grow will not continue beyond 2016 because of fuel economy measures that will be implemented over time.
Gasoline Global Supply and Trade flow Outlook

Gasoline

- Global gasoline supply is expected to grow through 2035 to meet growing product demand.

- Africa, Asia-Pacific, and Latin America regions are expected to increase gasoline production through 2035. These regions however will remain short in domestic gasoline demand and are expected to resort to gasoline imports from North America, Europe and Middle East.

- Gasoline production in North America is projected to rise steadily through 2020 as there continues to be a strong market for U.S. product exports.
## Gasoline Trade Flow 2015

### 2015 Gasoline Regional Exports

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<thead>
<tr>
<th>Exporting region</th>
<th>To Europe</th>
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## Gasoline Trade Flow 2020

### 2020 Gasoline Regional Exports

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Announced Refinery Projects

FCC and Alkylation

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<tr>
<th>Region</th>
<th>Location</th>
<th>Project</th>
<th>Capacity (b/d)</th>
<th>Status</th>
<th>Expected Completion</th>
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<td>Mumbai, India</td>
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<td>28000</td>
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<td>ASIA</td>
<td>Limay, Philippines</td>
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<td>ASIA</td>
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<td>Rayong, Thailand</td>
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- Major initiatives include large refinery expansions in Asia Pacific, North America, and the Middle East.
- FCC expansions projects are under way in Asia, Europe, Latin America, North America, and Russia & CIS. They are expected to be completed between 2018 to 2020.
- An Alkylation expansion project has been announced in Asia.
Petrochemicals Assessment

Ricardo Barragan
The Current Status
2015 Regional Ethylene Capacity Breakdown

Capacity Breakdown (2015)

- Stratas Advisors tracks world ethylene production via an up to date database of installed steam crackers.

- Asia has the largest installed capacity (44 MMtpy, 29% of Global share) followed by North America (34.76 MMtpy, 23%), Europe (27.34 MMtpy, 18%) and the Middle East (25.91 MMtpy, 17%).

Source: Stratas Advisors, 2016
The Global Ethylene demand as a whole is projected to increase from 129 Mmtpy in 2015 to 155 Mmtpy by 2035. Currently, Asia and North America are the largest ethylene consumers with a share of global demand of 24% and 42%, respectively.

North America and Asia demand will grow by 1.4 and 0.9% respectively. Whereas, Europe demand is projected to decline by an average 0.6% per year.
• In Asia, Naphtha remains the dominant feedstock. Lighter feedstock is used in several countries, where it is available from local natural gas developments. Currently, Naphtha demand of 117 MMtpy is expected to increase to 143 MMtpy by 2020. After that, demand is expected to remain flat till 2035.
Steam Cracker Projects – North America

Impact of Feedstock Availability: The Shale Gas Boom

US New Steam Cracker Projects

<table>
<thead>
<tr>
<th>Company</th>
<th>Ethylene Capacity (metric tonnes/year)</th>
<th>Location</th>
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<tr>
<td>Balands-Vinmar</td>
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<td>North Dakota</td>
<td>2020</td>
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<td>Chevron Phillips Chemical Co. LP</td>
<td>1500000</td>
<td>Cedar Bayou, Tex</td>
<td>3Q/4Q 2017</td>
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<tr>
<td>Dow Chemical Co.</td>
<td>1500000</td>
<td>Freeport, Tex.</td>
<td>2017</td>
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<td>Exxonmobil Chemical Co.</td>
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<td>Baytown, Tex.</td>
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<td>Formosa Plastics Corp. USA</td>
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<td>Point Comfort, Tex.</td>
<td>2017</td>
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<tr>
<td>Shell Chemicals Ltd.</td>
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<td>Monaca, Pa.</td>
<td>2020</td>
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<td>Shintech</td>
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<td>Total Petrochemicals</td>
<td>1000000</td>
<td>Port Arthur, Tex.</td>
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</table>

Source: Stratas Advisors, 2016

- North America will be adding 8-14 million metric tonnes/year of ethylene capacity by 2020, both through new crackers and expansions.

- The availability of cheaper ethane in North America and technological advantages makes ethylene production more attractive than the production based on naphtha, although the difference starts to fade as oil prices decline.
Stratas Advisors Syngas Capabilities

Strength Across Processes

• Understanding the key drivers, metrics, and developments across processes in the Global Syngas industry
  – Methanol, GTL & CTL, Ammonia, UCG, Direct Reduced Iron, and many more
• Evaluating projects and proponents through qualitative and quantitative metrics
  – Corporate and process analysis
• Forecasting plant developments, capacity additions, and changes in output
• Evaluating economics with consideration of production costs, CAPEX, OPEX, and potential project revenue and pricing
• Anchored by industry-leading database of syngas projects across feedstocks and outputs worldwide.
  – Natural Gas, Coal, Waste, Biomass, Residuals, coke-oven gas.
Syngas Capabilities

Key Insight: Capacity Trends

- Key driver: Chinese government priorities look to increased energy independence.
- Gas-rich countries look to increased diversification of energy mix/product slates.
- Methanol market supported with increased applications
- MTO/MTO an emerging competitor in the Chinese market.
Syngas Capabilities

Key Insight: Feedstock Trends

- Refining Residual gasification - declining trend by % share
- Coal gasification almost exclusively headed Asia’s way, with a majority in China.
- Growth will plateau by 2025, with growing application in India, Indonesia, and China.
- Industrial gasification - key driver - supplanting NG in remote China.
Syngas Capabilities

Key Insight: Potential Economics

- Pressure on China’s nascent MTO industry.
- Lower-cost naphtha production cost leaves MTO projects uneconomic.
- Water reuse and effluent treatment improvements, improved coal transport are keys.
- MTO commercialization potential (40% of China’s olefins market by 2020).
Stratas Advisors, a Hart Energy company, is a global consulting and advisory firm that covers the full spectrum of the energy sector and related industries. We can help you develop a deeper understanding of the developments that are shaping the future of oil & gas. Our support includes customized consulting that is focused on a client’s specific strategic objectives, competitive challenges and asset base. Additionally, we offer support through subscription services and comprehensive market studies.