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# A Rising Tide of Product Imports May Derail a Potential Recovery for US Refineries

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# A Rising Tide of Product Imports to the United States

We live in the midst of a rapidly changing world. Like it or not, led by the tremendous expansions in China and India, the world's economic and geopolitical focus is shifting from the Atlantic Basin to the countries of the Pacific Basin. These changes are leading to significant shifts in oil demand and global refining capacity, which have important implications for both the United States (U.S.) and European refining industries.

From an economic perspective, we can think of the world as being divided into two general categories--the mature and developed Organization for Economic Co-operation and Development (OECD) countries, and the developing non-OECD countries. The OECD countries, which include the U.S., most of Europe, and a handful of Pacific-based nations, are characterized by slow or declining oil demand per capita growth. The rapidly developing non-OECD countries are seeing significant increases in per capita oil consumption, as living standards and personal income rise substantially. Not surprisingly, new refineries are being built largely in the non-OECD world, especially China, India, and the Middle East, while many refineries in OECD countries are shutting down or reducing capacity. Given recent announcements of refinery closures in the U.S., it is difficult to remember that only a few short years ago, President Bush had declared the need for new refining capacity in the country, and had made old military bases available as potential new refining sites!

The rapid run-up in oil prices in 2008, followed by the global financial crisis, changed the patterns of world oil demand. Increased and mandatory use of renewable fuels, continued concern over carbon emissions, improved vehicle efficiencies, and economic recession combined with high unemployment, have combined to reduce per capita oil consumption in many OECD countries and hasten the end of the "Golden Age" of refining. Meanwhile, continued growth in many non-OECD nations has led to the construction of many refineries to meet burgeoning local demand, as well as export markets. Many of these are large, complex, and modern facilities with the capability of processing heavy sour crude oils and producing products that meet OECD specifications. One of the key questions facing traditional Atlantic Basin product suppliers is the extent to which the new non-OECD refiners, which are primarily "East of Suez," will seek to capture a share of the still large Atlantic Basin products market and upset the historical patterns of product supply. The degree to which the Atlantic Basin refineries can be economically competitive in their home markets may well determine the future long-term structure of the U.S. and European refining industries. This paper seeks to quantify some of the issues surrounding this potentially growing shift in global refining through addressing the following critical questions:

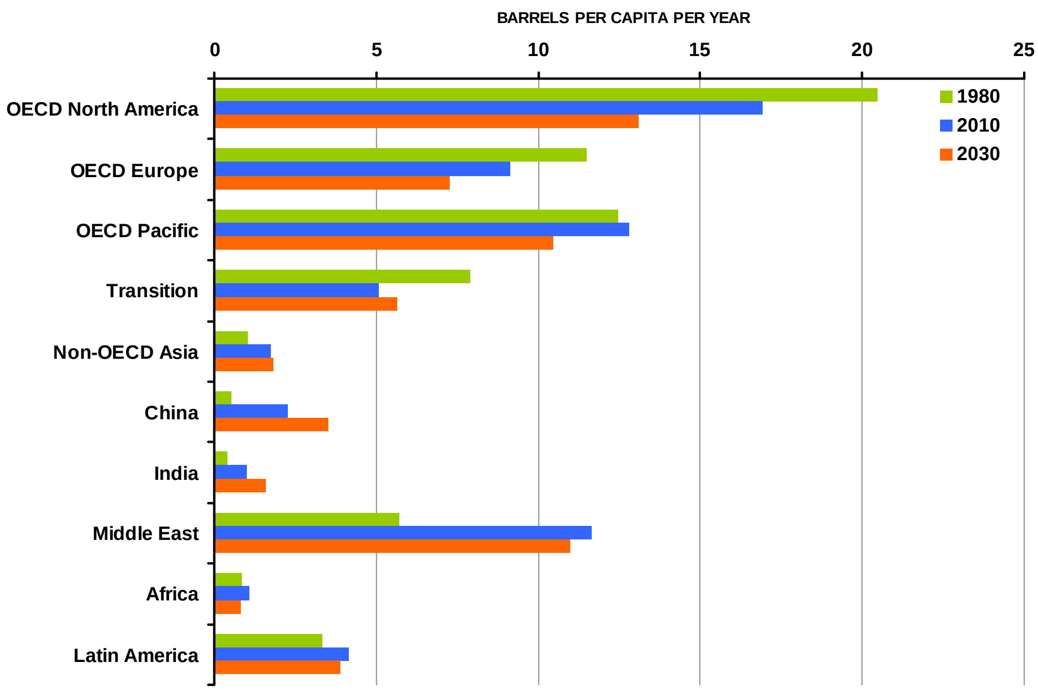
- Where will any incremental product demand be sourced in the future?

- Will the new East of Suez refineries have a competitive advantage over some U.S. refineries?
- Which U.S. product markets are most at risk from imports?
- What are the critical factors that will affect survivability of the vulnerable U.S. refineries?

## Oil Intensity – Change in World Patterns

As shown in Figure 1 below, oil intensity, defined herein as barrels of oil consumption per capita, has been declining, and is expected to continue declining, in many OECD countries for the foreseeable future. On the other hand, oil intensity in most of the non-OECD world is expected to continue increasing, and there is tremendous potential for it to do so when one considers how much lower it is compared to OECD countries. This increase in oil intensity, combined with population growth, means that the rate of growth of oil demand in non-OECD countries can be expected to far exceed that in the OECD. In fact, demand in OECD countries is expected to remain flat or decline, meaning that much of the world's future demand growth will be in non-OECD areas.

***Figure 1 - Oil Intensity by Region***

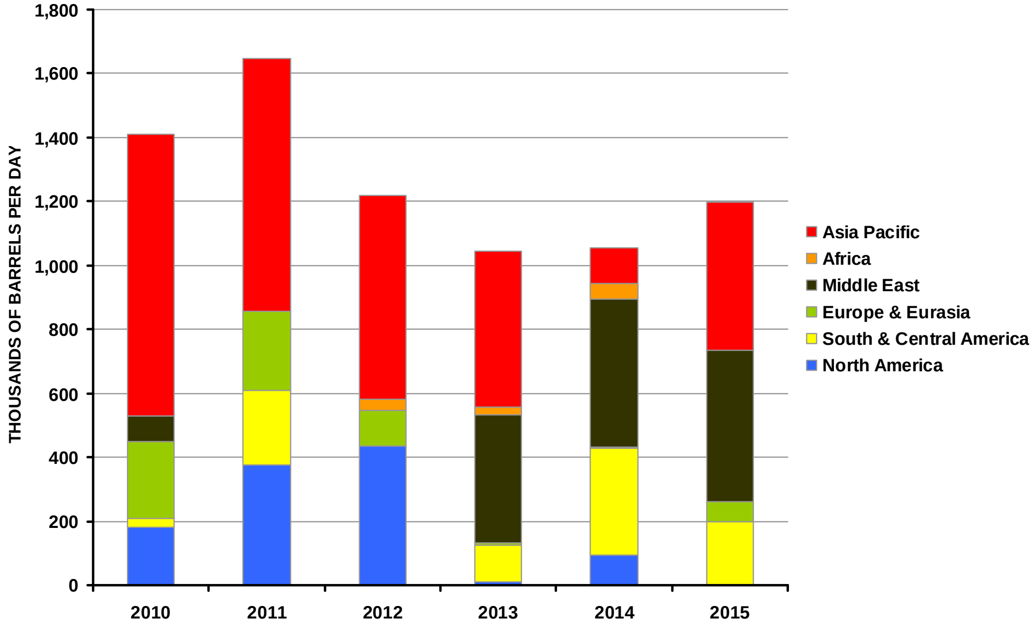



SOURCE: U.S. IEA, Baker & O'Brien analysis

## New Refinery Construction – Moving East

Burgeoning local demand in non-OECD countries is leading to a proliferation of new refinery construction. Just as in previous decades in the U.S., when expansions of refining capacity would occur as the U.S. economy grew, non-OECD countries are expanding refineries to keep up with their growing and increasingly oil intensive economies. As shown in Figure 2 below, refinery expansions in North America are mostly absent after 2012, with most of the expansions occurring in the Middle East and Asia. It is not anticipated that every announced refinery or expansion will necessarily take place. Therefore, the chart represents the actual announcements tempered by a subjective view of the probability for each particular project/region.

***Figure 2 - Worldwide Refinery Capacity Additions 2010-2015***




SOURCE: Baker & O'Brien

It should come as no surprise that most of the new refinery capacity, as well as the additions to capacity, involve large, complex, and sophisticated projects. Two examples, which will have the potential to export products to Europe or the U.S. are:

- The Reliance refinery in Jamnagar, India, is the single largest grassroots refinery ever built in the world, with over one million barrels per day of combined capacity. This refinery can process a variety of heavy crudes and enjoys a high degree of process complexity, including coking, catalytic cracking, and hydrocracking. The products are marketed worldwide and, as will be discussed later, are increasingly being delivered into North American markets.

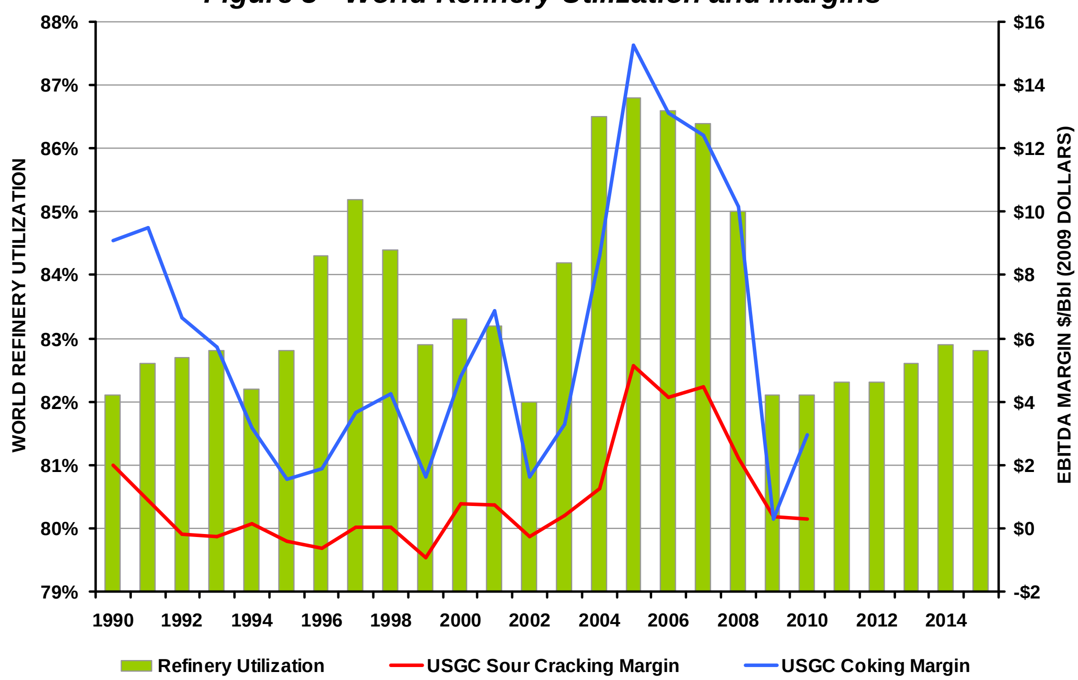
- Saudi Arabia has announced plans to construct several new refineries, including a 400,000 barrel per day refinery on the Red Sea that is announced to become operational in 2015. This refinery will be very complex and will be able to meet U.S. or European product specifications.

By 2015, it is expected that the Middle East and India will have approximately 5 million barrels per day of export capacity, over and above their domestic needs. To put this in perspective, this is approximately equivalent to the entire light product demand of South America. It is likely that such East of Suez refineries in these regions will operate at high utilization rates, despite the current surplus of global refining capacity. This is because of their tremendous economies of scale, relatively low energy costs, and their government or quasi-government status.

### World Refinery Utilization and Margins

Many of the announced refinery projects in non-OECD areas will be completed despite the current, and relatively low, world refinery utilization rate of about 80 percent (%). Thus, as shown in Figure 3 below, using modest economic recovery scenarios, global refining percent utilization is expected to remain in the low 80's, notwithstanding the announced shutdown of some 2 million barrels per day of capacity and the likely shutdown of another 2 million barrels per day within the next few years. Such low utilization is expected to generally inhibit any sustained increase in refinery margins over the next few years.

***Figure 3 - World Refinery Utilization and Margins***




SOURCE: Baker & O'Brien

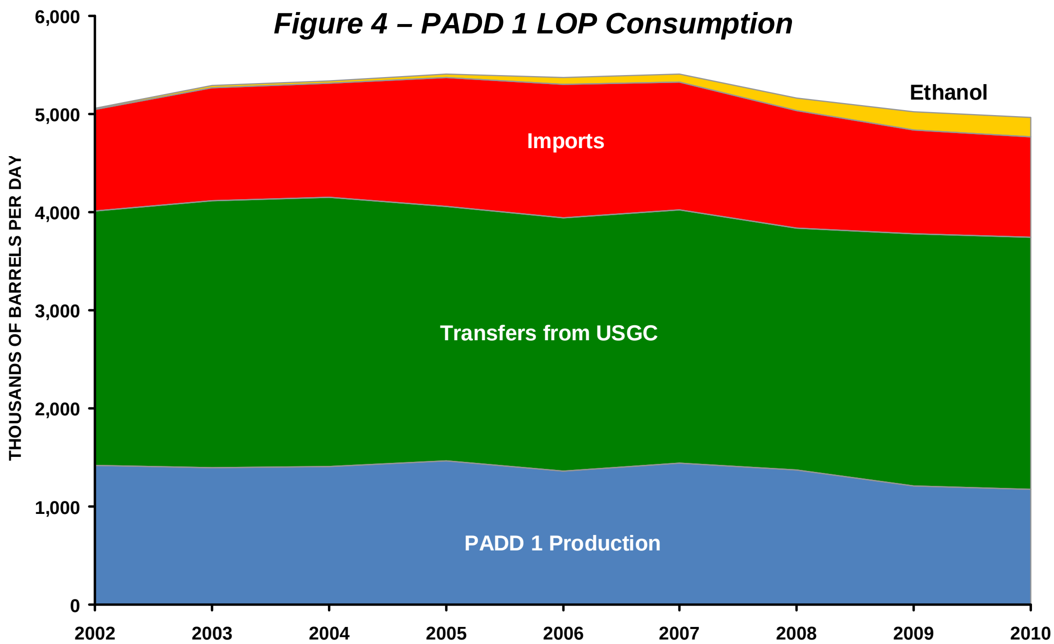
Lower complexity refineries that are capable of processing only higher-priced, light, sweet crude are generally most vulnerable to economic driven reductions in utilization. However, some refineries that fall into this category will continue to be profitable due to geographical or specialty market "niches" that provide product price protection or access to low-cost feedstocks. On the other hand, some high complexity refineries with higher imbedded operating costs can sometimes experience negative margins when the price spread between heavy, sour crudes and lighter crudes is narrow, as tends to occur during times of excess crude, as experienced in 2009.

## Product Imports to the U.S. – Change is Underway

The U.S. has historically imported some level of light oil products (LOP), comprising gasoline and middle distillates, to satisfy total product demand. The level of product imports is primarily driven by the difference in LOP prices between the U.S. and traditional exporting countries, plus the impact of U.S. refinery utilization. Over the past few years, approximately 82%[1] of all U.S. LOP imports have been received into the U.S. East Coast–Petroleum Administrative Defense District (PADD) 1.[2] A much smaller volume has been delivered to the U.S. Gulf Coast–PADD 3 (8%) and the U.S. West Coast–PADD 5 (9%). Although the U.S. Gulf and West Coasts are expected to continue to receive some imports, these areas are in much closer balance with domestic supply than is the East Coast–PADD 1. Therefore, PADD 1 refineries are expected to feel the largest impact from the shift in global refining.

As shown in Figure 4, PADD 1 LOP consumption is approximately 5 million barrels per day, with only about 1.5 million barrels per day produced in PADD 1. Thus, PADD 1 is a likely target market for new and expanding refining capacity from East of Suez. Some of this potential product may even impact PADD 3 supplies that flow by pipeline or marine vessels from the U.S. Gulf Coast to PADD 1.

*Figure 4 – PADD 1 LOP Consumption*




SOURCE: U.S. EIA

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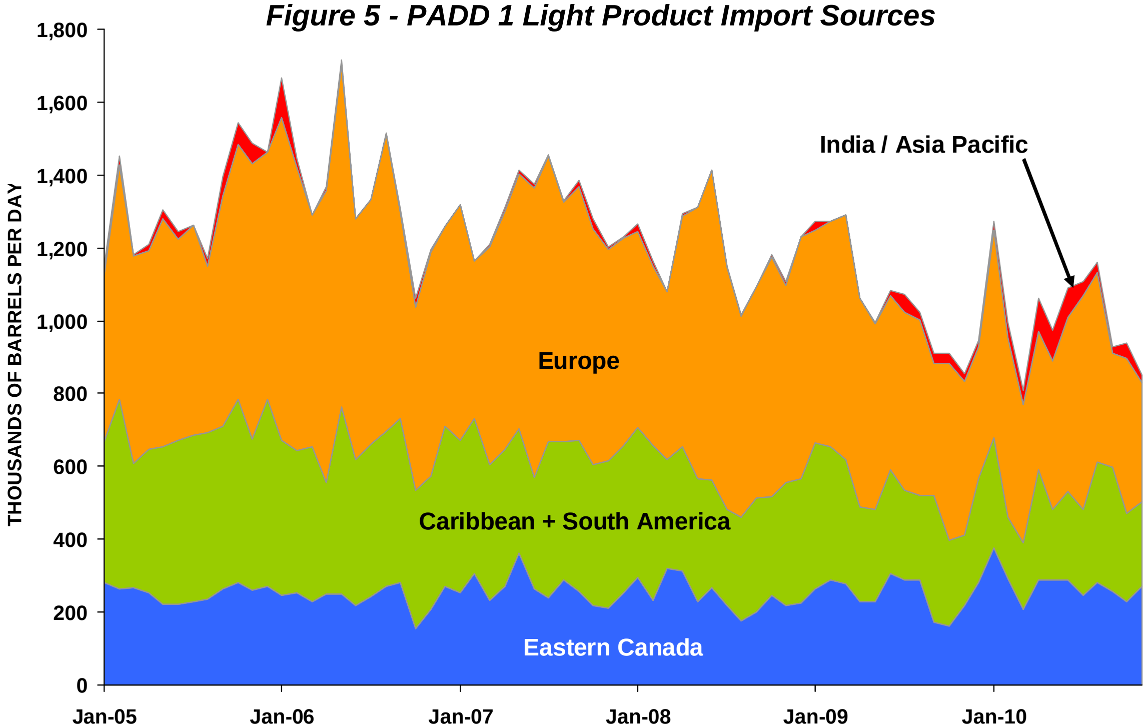
[1] Average percentage LOP imports into PADD 1 out of total U.S. from 2006 through 2009.
[2] The U.S. PADD 1 comprises 17 states, the District of Columbia and the entire eastern seaboard from Maine to Florida.

Figure 5 shows the historical imported LOP imports into PADD 1, which have traditionally been from Eastern Canada, Europe, and Latin America. Recently, however, products from India and Asia-Pacific have been delivered in increasing quantities.

With PADD 1's exposure to diverse and competing supply sources, PADD 1 refinery margins should reflect continued pressure. Over time, the expanding volume of ethanol also will impact PADD 1 refining margins and gasoline imports.

***Figure 5 - PADD 1 Light Product Import Sources***

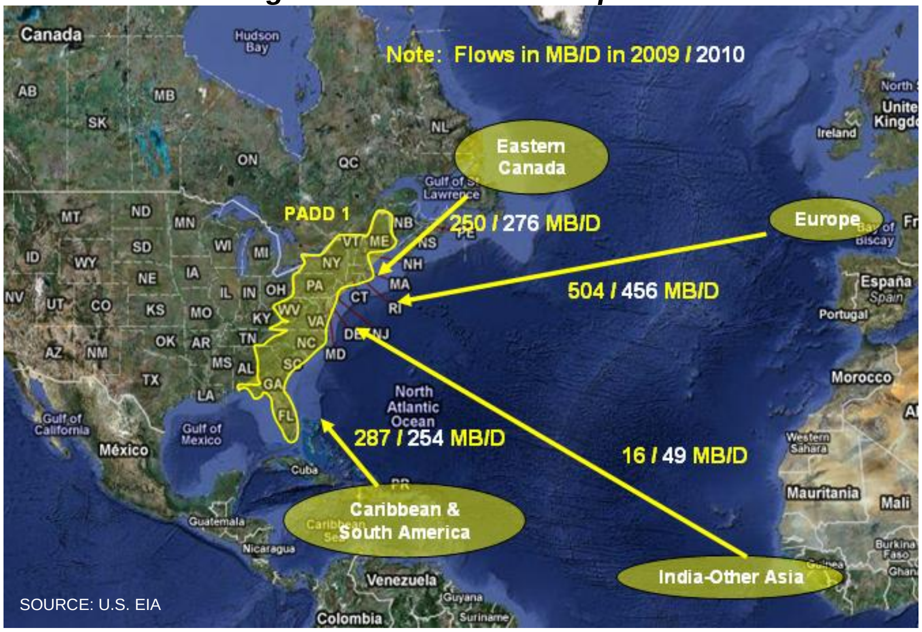



SOURCE: U.S. EIA

Although continued rationalization of refining capacity in Europe could somewhat curtail European supplies, imports to PADD 1 from East of Suez refineries have already begun. Imports from Canada and Latin America should maintain their recent market shares, due to the freight advantages these locations enjoy.

Figure 6 shows that the New York harbor area has traditionally been the leading destination for LOP imports. As noted above, East of Suez refineries have not been traditional import sources to the New York harbor, but this pattern is changing. Recent East of Suez refinery expansions, with large economies of scale, complex and efficient facilities, and large cargo sizes have improved economic incentives for East of Suez refineries.

***Figure 6 - PADD 1 LOP Imports***




Although New York harbor will continue to be the trading point for many fungible cargoes, the expanded capability of the BORCO[3] deepwater terminal in the Bahamas is expected to provide new and economically attractive options for large, waterborne cargos destined for PADD 1. The latest owners have announced plans to refurbish and expand the terminal to accommodate LOP deliveries from East of Suez refineries, plus blending, trading, and re-shipment. PADD 1 ports may now be accessed with appropriately sized cargo ships or barges from BORCO with "milk-runs" to selected destinations.

***Figure 7 - BORCO Terminal***

SOURCE: Buckeye Partners Investor Presentation, 20 December 2010

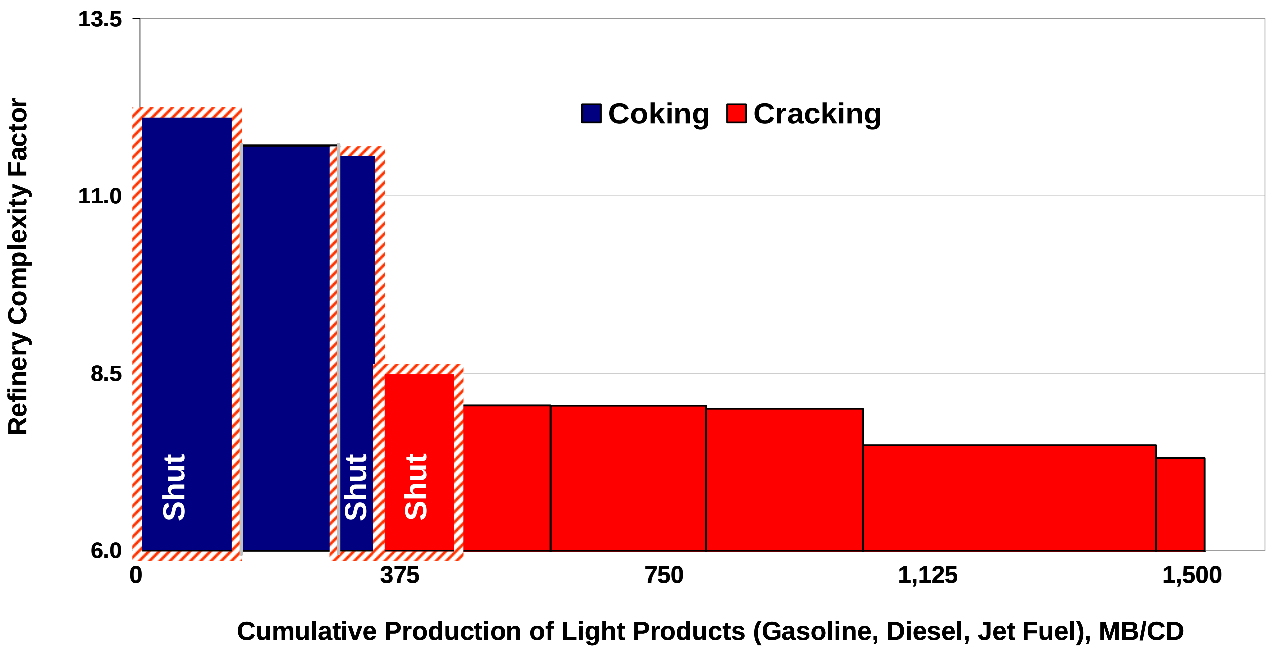
[3] The BORCO terminal name is from a previous owner, the Bahamas Oil Refining Company.

### How Competitive are PADD 1 Refineries?

To investigate the potential impact of East of Suez supplies, we modeled the competitive position of East Coast refineries (including eastern Canadian refineries) using *PRISM*.™ The *PRISM* modeling system is a tool used for analysis of refineries and related supply chains. For this analysis, we relied on the *PRISM* database that includes configurations of all relevant U.S., Canadian, and European refineries.

Traditionally, refineries with higher complexities may upgrade feedstocks more effectively and capture higher operating margins than lower complexity refineries. Figure 8 shows refinery complexity factor[4] versus the cumulative LOP output from PADD 1 refineries. It is interesting to note that three of the recently shut down refineries in PADD 1 were among the most complex. This indicates that factors other than size and complexity affect refinery survivability.

***Figure 8 - Regional Refinery Complexity versus Light Product Capacity***



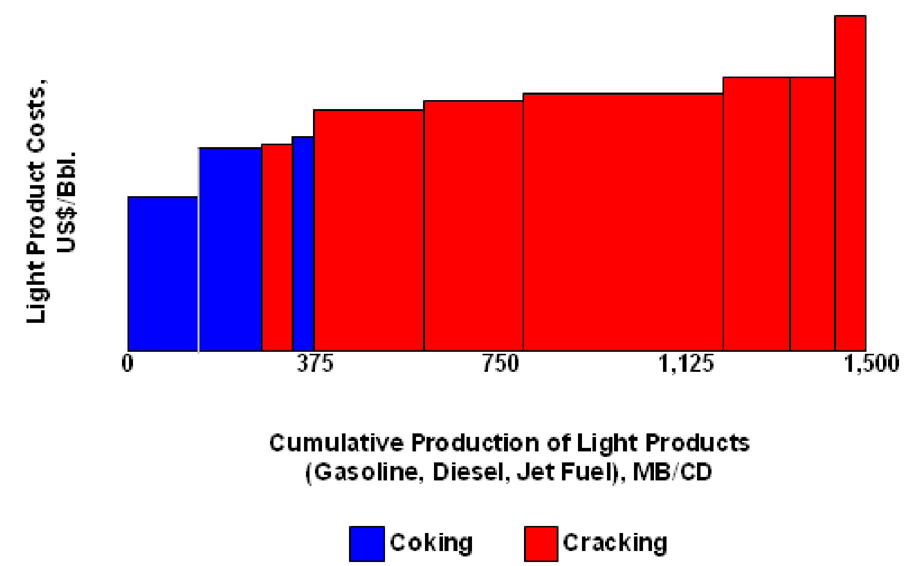

SOURCE: Baker & O'Brien estimates using *PRISM*

To investigate refinery competitiveness in more detail, we modeled the LOP curve for 2008, a year during which product margins were more robust as shown in Figure 9 below. The costs to produce LOP at each refinery are represented on the vertical axis, while the corresponding

[4] Baker & O'Brien's refinery complexity factors are a summation of the complexity of individual units. More complex units e.g., hydrocracking units, have higher factors than more simple units like distillation units.

produced volumes are represented on the horizontal axis.[5] As expected, the more complex refineries were generally the most cost competitive.

***Figure 9 - Regional Light Products Cost Curve***
***Wide "Light-Heavy" Spread During 2008***

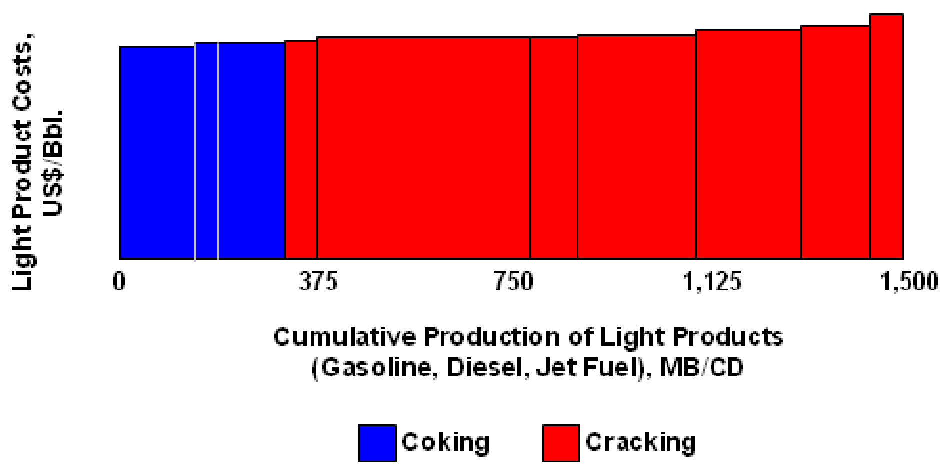



SOURCE: Baker & O'Brien estimates using *PRISM*

Next, we modeled the LOP cost curve for 2009, a year during which product margins had declined and the light-heavy crude oil differential was narrow. The light-heavy crude oil differential ("spread") is a typical measure of the value of upgrading low quality, less expensive crude oil.[6] The resulting cost curve, as shown in Figure 10, is much "flatter," meaning that the cost competitiveness of the more complex refineries was closer to the less complex refineries. During such periods, the margin advantage typically enjoyed by coking refineries can largely disappear. Without strong competitive margins, other factors, such as requirements for large environmental investments or maintenance capital, may influence the decision to shut down or reduce throughput.

[5] *PRISM* appropriates specific by-product credits to the LOP costs for each refinery.
[6] The "Light to Heavy" spread is calculated as difference in price of Light Louisiana Sweet crude and heavy sour Maya crude from Mexico. In 2008, this spread was at a healthy $18.39 per barrel, reduced to $7.77 per barrel in 2009, and recovered to $12.29 per barrel in 2010.

***Figure 10 - Regional Light Products Cost Curve***
***Narrow "Light-Heavy" Spread During 2009***



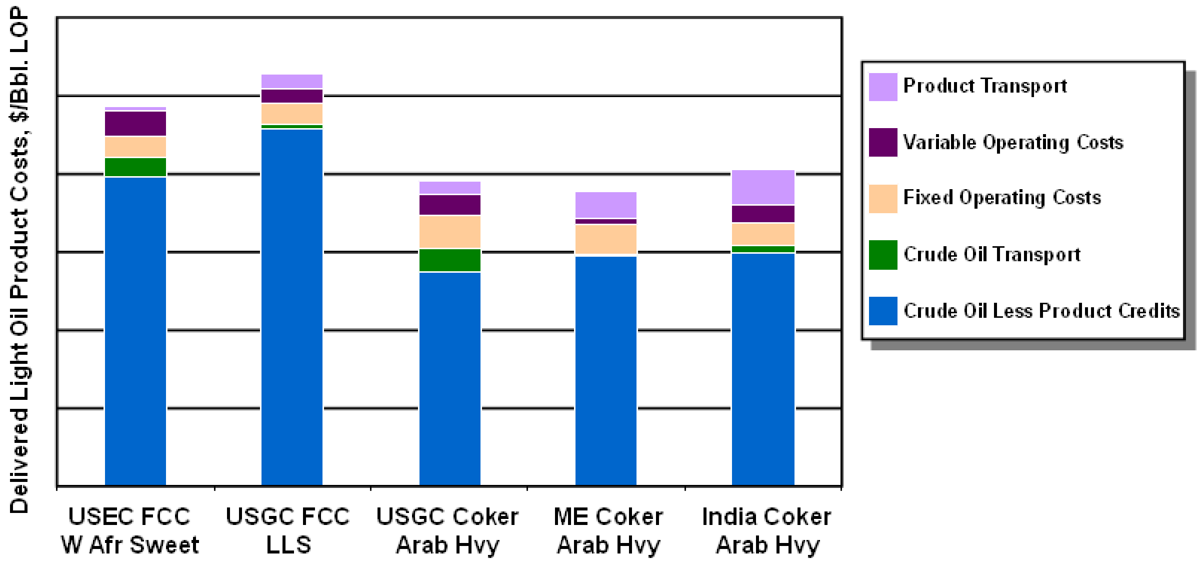

SOURCE: Baker & O'Brien estimates using *PRISM*

To further investigate potential global influences on PADD 1 refiners, we calculated the cost competitiveness of a typical PADD 1 refinery to outside sources of LOP including product transportation costs to PADD 1. Since the majority of the refineries in PADD 1 are "cracking," not "coking," refineries, we compared a PADD 1 cracking refinery to the following representative refineries in the U.S. and globally:

1. A cracking refinery in the U.S. Gulf Coast processing LLS crude;
2. A coking refinery in the U.S. Gulf Coast processing Arab Heavy crude;
3. A coking refinery in the Middle East processing Arab Heavy crude; and
4. A coking refinery in India processing Arab Heavy crude.

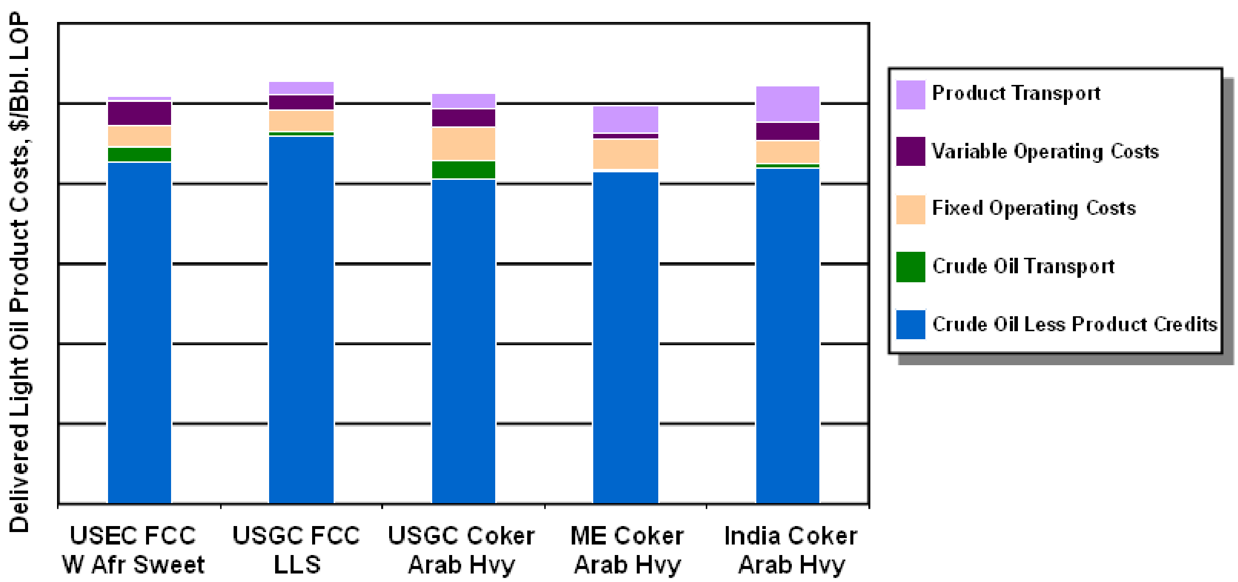
Figures 11 and 12 show the results of delivered LOP costs in both the second quarter (Q2) of 2010 and 2009 into the New York harbor. In both charts, the U.S. Gulf Coast sweet refinery is the highest cost supplier. During Q2 2010, the next highest cost supplier is the PADD 1 cracking refinery, but during 2009, when margins were low and the light-heavy spread was narrow, cost differences between all the competing refineries were almost indistinguishable.

***Figure 11 - New York Harbor Delivered Cost Analysis (2010 Q2)***




NOTE: Scale from 40-100 (increments of 10)
SOURCE: Baker & O'Brien estimates using *PRISM*™

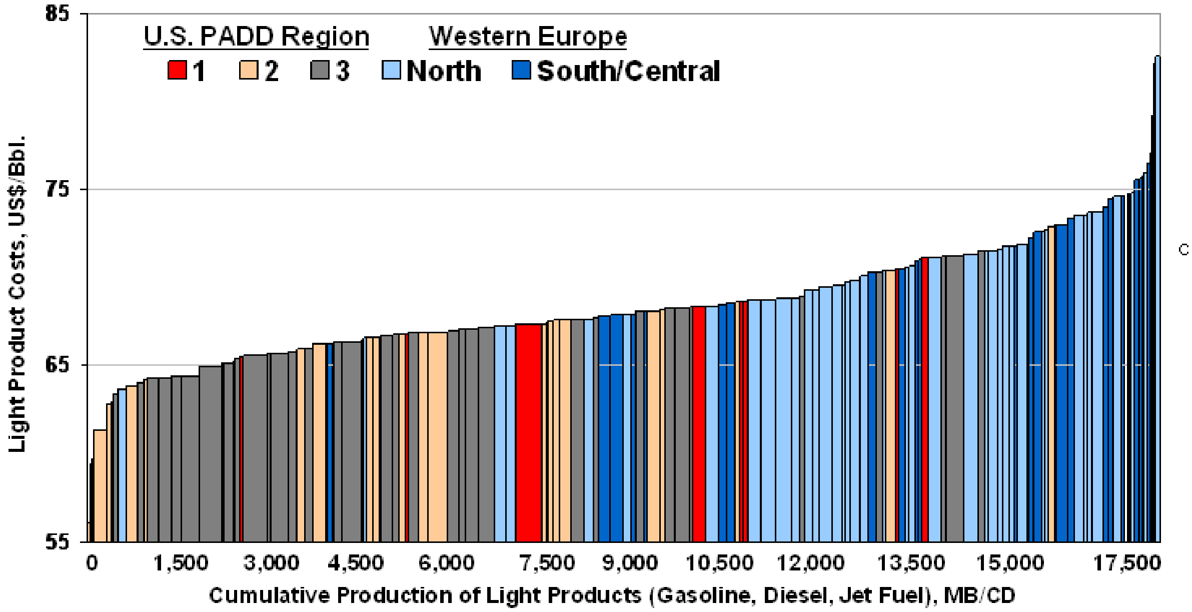
***Figure 12 - New York Harbor Delivered Cost Analysis (2009)***




NOTE: Scale from 20-80 (increments of 10)
SOURCE: Baker & O'Brien estimates using *PRISM*™

Finally, to help assess the relative positions of Atlantic Basin refiners outside of PADD 1, we compared the LOP costs of 151 refineries in the U.S., Canada, and Europe in a single 2010 cost curve using the *PRISM* modeling system. Figure 13 shows that many of the large complex refineries in PADDS 2 and 3, enjoy the lowest costs, while the lower complexity European refineries are generally the higher cost competitors. PADD 1 refineries are in the middle portion of the curve.  Thus, certain European refineries appear at even greater risk from new non-OECD refiners than do many U.S. refiners.

***Figure 13 - Consolidated Cost Curve of Atlantic Basin Refineries***




SOURCE: Baker & O'Brien estimates using *PRISM*™

These charts indicate the relative rankings of refineries using historical pricing and costs. However, the actual future competitiveness of any single refinery will be dependent on many factors in existence at the time of the assessment, including potential synergies among refining systems in a particular company.  Although certain refinery assets may have been profitable in the past, new global competitive forces should be considered in long-term asset decisions.  Once a competitive ranking model is constructed, it is a simple matter to modify the model using different pricing scenarios to calculate the relative competitive positions of any single refinery.

### Outlook

It is apparent that maturing demands in many OECD countries, along with competitive pressures from new highly complex refineries, are providing the impetus for changes in the refining industry. The greatest impact is being felt in those refineries serving Atlantic Basin markets, especially ones on the higher end of the cost curve or with the need for significant capital investment.  Given various commodity pricing scenarios, it could be expected that additional refineries may shut down or will possibly be consolidated into larger, more cost-efficient portfolios.