

The Future of the Gulf Coast Refining Industry

Executive Summary: 'Issues Awaiting Decision'

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After decades of financial distress, the Gulf Coast Refining Industry has experienced three years of record profitability. With renewed prosperity has come an unaccustomed spotlight. Outside the political limelight for years, U.S. refining suddenly finds itself the subject of congressional legislation and public comments by OPEC ministers. A host of issues confront industry executives, while political leaders of all varieties increasingly try to influence their decisions.

The principal decisions confronting Gulf Coast refiners concern new investment. After struggling for years with spare capacity, U.S. Refining now runs 'flat out'. With profits high, market conditions would suggest that expanding refining capacity might be an easy decision. Industry executives are not convinced that this is so. For reasons discussed below, there is concern that U.S. Refining's improved profitability merely reflects better 'cyclical conditions' rather than an improved industry structure. Many of today's top refining executives suffered through decades of low single digit or even negative returns. They have known many moments where even a small amount of spare refining capacity undermined the industry's margin structure. They also know that refining investments are capital intensive and thus require 10-20 years of adequate margins if acceptable returns are to be achieved. These facts provide context for the first issue confronting the Gulf Coast Refining Industry: ***1) What capacity additions and types of projects are economically justified under the conditions likely to prevail beyond the present industry upcycle?***

To date, the industry's answer to this question has conveyed caution. No new 'grassroots' refinery complex is under construction. Two major expansions, a 280 kbd project at Motiva's Port Arthur plant, and the second at Marathon's Louisiana site have been announced but not yet approved (Motiva is a Shell/Saudi Aramco JV). Other refiners have announced plans for projects focused on adding heavy/sour crude runs: i.e. debottlenecks of conversion capacity and desulphurization. As discussed below, the cumulative sum of all of these projects will not end U.S. reliance on refined product imports. It would thus seem fair to characterize the Gulf Coast refiners' posture towards new investment as 'cautious'.

This caution is now attracting attention. Saudi Arabia's oil minister has publicly argued that refining bottlenecks, particularly the shortage of capacity to run heavy/sour crude, are partly responsible for high gasoline prices. A raft of press commentary has pointed out that no new U.S. refinery has been constructed in twenty years. The Federal Energy Bill passed in 2005 sought to streamline new refinery permitting, even as it eased certain product specification regulations to make supplies more fungible across U.S. markets. The need for such waivers was dramatically underscored by 2005's Gulf Coast hurricanes. Then, the industry scrambled, successfully as it turned out, to locate emergency supplies in Europe and the Middle East. Collectively these events point to several unresolved issues: ***2) To what extent are high U.S. oil prices a function of refining shortages rather than tight crude oil supplies?*** And ***3) What risks are posed for the U.S. economy if its marginal source of refined products remains Europe, Russia and the Middle East?***

The longer oil prices remain high, the more efforts will be devoted to developing new technologies that better meet strong demand for products. These technology initiatives can take two forms. One path works with existing industry processes; these endeavors seek to improve refining yields, lower costs, and improve capabilities for converting heavy materials into desirable lighter products. Certain technologies could also enable conventional refining sites to become locations for manufacturing motor fuels using non-hydrocarbon raw materials. If successful, these technology advances could improve refining economics and perhaps enable companies to conclude that adding capacity is attractive. The second path involves technologies outside the conventional refining plant. Attracted by high prices and margins, these alternative energy endeavors seek to compete with refining site manufacturing. This technology competition thus poses additional complications for the existing industry's investment decisions: **4) Will new refining technologies help foster adequate new investment? Or 5) Will new technologies in biofuels and other alternatives depress demand for conventional refined products, thereby undermining the economics of new refinery investment?**

A final set of issues is specific to Gulf Coast refining and concerns physical security of supply. The central concern here is rather straightforward. U.S. Refining's concentration on the Gulf Coast involves exposure to physical disruption from both natural disasters and a terrorist strike. U.S. refining executives have made clear that expansions of existing plants, not the construction of new sites, constitute the most economic means to boost U.S. capacity. Economics thus suggest that the industry, left on its own, will deepen the concentration of refining on the Gulf Coast: **6) Is an intensified concentration of U.S. refining on the Gulf Coast an acceptable security risk? And 7) If not, how should adequate alternative sources of refined products be assured?**

Potential answers to this last question are numerous, and vary from establishing a strategic reserve in refined products to the government providing incentives for or even owning and expanding refining capacity outside the Gulf Coast. This leads to our final conference question: **8) Which refined products security option would be best from a public policy viewpoint and which, if any, is likely to emerge from the electoral contests of 2006/08?**

UH-GEMI's Conference, The Future of Gulf Coast Refining, brings together speakers both from within and outside the industry to address the issues highlighted above. The objective is to surface the conflicts weighing upon the industry at this time. There is the heavy economic legacy of poor past returns that weighs on prospects for new investment. There is the increasingly obvious supply and security risks posed by both the shortage of U.S. refining capacity and its concentration on the Gulf Coast. There is the potential for technology and/or public policy to ease or exacerbate these dilemmas. Finally, there is the potential for an industry focused on shareholder returns, and the government, concerned with immediate security issues, to think and act at cross-purposes. By exploring these issues, UH-GEMI aims to have the Conference clarify the specific matters in dispute and help identify whether good options exist for moving forward.

To these ends, the attached background paper provides additional information on:

- Structural causes of poor past U.S. Refining results, and
- Causes of recent improvement in industry margins and returns on capital

This information is supplemented by attachments covering:

1. Size and regional distribution of U.S. Refining capacity
2. Current utilization of U.S. and Global refining capacity
3. Current sources of 'offshore' supplies for specific U.S. markets
4. History of global refining margins, by major geographic center
5. Recent cost and return history for a major U.S. Refiner plus margin history for U.S. industry

Readers are encouraged to consider the implications of this material for the 'cyclical versus structural improvement' debate. Consideration should also be given to weighing the risks to the U.S. economy of the implied dependence on foreign-based refining.

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'Reference Case' Statement

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This paper summarizes a general hypothesis regarding the 'Case for New Investment' in the Gulf Coast Refining Industry. This hypothesis is intended to provide a starting point for discussions at the November 3, 2006 UH-GEMI Conference, and is not put forward as a finished product of academic research.

The basic hypothesis is that established participants in the Gulf Coast Refining Industry consider their business to have a fragile profitability structure. Consequently, the industry approaches the case for new investment with a well founded caution. New Gulf Coast refining investment will thus be limited, the product of specific circumstances, such as: 1) changes in the crude supply barrel; 2) expansion strategies by foreign players; or 3) integrated investments tied to upstream heavy crude production. This hypothesis also points to potential difficulties for the U.S. economy on fuel supply security. The U.S. economy has become, and will remain, partially dependent on imported product supplies from distant locations. This situation involves physical supply security and price risks that the public sector will have to address.

The Case for New Investment

The case for new investment in Gulf Coast refining has to overcome a multi-decade legacy of poor financial performance.

Refining's financial performance indices, such as gross margin per product barrel and Return on Capital Employed (ROCE) suggest an industry that has struggled for over three decades to earn its cost of capital. This condition led to the drying up of major expansion projects. While U.S. refining capacity did grow via 'creep' expansions, large increments of new capacity were not added. The last major U.S. refining expansion occurred in the early 1980's. So long as demand for U.S. motor fuels was only growing at 1-2% p.a., creep expansion was sufficient to maintain a balanced or even a surplus of refining capacity in the North American market. This was the condition that prevailed from the mid-1980's until 2003. Periodically it was worsened by bouts of global spare capacity, such as characterized Asia from 1997 through 2002.

The North American market is the proper context within which to analyze the condition of the Gulf Coast industry. This market comprises not only U.S. refineries, but also Canada and Mexico, plus export refineries in the Caribbean (Aruba, Curacao, St. Croix) and Venezuela. The U.S. Refining & Marketing industry optimizes economics across all of these refineries and incorporates imported gasoline and cracker feed from more distant locations when it is economic to do so. The 'steady state' position of the Gulf Coast during the late 1980's and 1990's was a situation with the following characteristics:

- Canadian refineries exported product to the U.S.
- Mexico imported products from the U.S. Gulf Coast
- East Coast U.S. imported gasoline from Europe
- Gulf Coast & East Coast refineries imported cracker feeds from the Caribbean and Europe
- West Coast markets imported small amounts of product from Asian refineries
- The presence of economic product imports from Caribbean/Venezuelan refineries and from Europe left Gulf Coast refiners with a chronic layer of spare capacity

Consequently, U.S. refining margins for simple (hydroskimming) plants averaged less than \$3/b*, which is not sufficient to earn a double digit ROCE for an average cost industry player.

During this period, Gulf Coast refiners became impressed with the fragile structure of industry margins. Relatively small amounts of spare capacity seemed repeatedly to engender destructive price competition; this was especially so among refiners with similar cost structures, but refiners with leading scale and complexity was also adversely impacted.

Several factors accounted for the fragility of refining margins. Refiners found themselves continuously confronted with the ‘tyranny of marginal economics’. Faced with spare capacity and prevailing prices that offered positive cash margins relative to marginal cost, refiners constantly were tempted to maximize their own production. The cumulative effect was to create surplus supplies that encouraged buyers to pit sellers against each other. This tendency towards destructive price competition was then intensified by customers’ actions; over time retailers, distributors and industrial customers developed potent means to consolidate buying power. This was especially the case with discount retailers such as Raceway and also with ‘big box’ and hyper-marketers who decided to install gas pumps as a means of attracting motorists to their stores. Refiners found themselves facing larger and more frequent auction situations for the disposal of their marginal production. These auctions set low prices, which an increasing price transparency rapidly communicated throughout the market. A chronic condition of poor structural profitability for U.S. refiners was the result.

In a broader context, massive expansions of refining capacity took place in the protected markets of India, Thailand and Korea in the mid-1990s. When the “Asian ‘flu’” infected Asian economies in the late 1990s, spare capacity in Asia were diffused globally, infecting margins first in the Middle East, then on to Europe and finally, through increased availability of European product for US markets, on to the Gulf Coast.

The combination of poor U.S. refining results and even more severe conditions outside this hemisphere helped refashioned supply patterns into North America. Starting in the mid-1990’s, U.S. motor fuels demand began to accelerate. With minimal new capacity appearing on the Gulf Coast and buyers geared to find cheap product from any source, the volume of product imports began to swell. Tightening fuel specifications and the legislated withdrawal of MTBE from the market further reduced the available volume and fungibility of Gulf Coast production. Reliance on refined product imports thus intensified further.

While the late 1990’s were difficult for Gulf Coast refiners, the difficulties noted above also were laying the groundwork for a recovery. Because of the presence of imports from Caribbean

refineries, the North American market already possessed an ‘import-parity’ structure. Within such structures, imported product tends to set prices for the whole market. This structure benefits domestic refiners by setting prices at levels adequate to pay for transportation from more distant locations. So long as the marginal import source was Venezuela or Curacao, this ‘transportation differential’ was relatively small. However, as U.S. demand grew in the 1990’s, growing volumes of imported product began to arrive from more distant sources. This developed first on the west coast. Constrained by tight environmental rules and geared economically to run only Alaskan and Californian crude, west coast refiners had expanded minimally; this market is logistically remote from the Caribbean and not well connected by pipeline to the Gulf Coast. As a result, products from Asian refineries began to arrive into this highly constrained market. West coast prices rose to levels that would attract long distance imports into a bottlenecked logistical structure; unsurprisingly, west coast prices also reached levels well above those in other U.S. regions.

What happened first on the west coast became a more general phenomenon by 2003.

Transportation fuel product demand was now growing at 3-4% p.a. First east coast and then Gulf Coast refining found its spare capacity sopped up. Product and residual fuel imports from Western and Eastern Europe, Russia and even North Africa began to accelerate. Meanwhile product demand growth in India and China was accelerating, consuming Asian spare capacity, and reversing trends that had weakened global refining margins in the 1990s.

This transition to import-parity and minimal domestic spare capacity had an especially significant effect on heavy crude economics. Owners of complex refineries found that in a tight crude supply market, less-complex refineries were forced to compete for a finite pool of light sweet crudes their sites could process. This had the effect of driving light crude prices up relative to heavier crudes; this was most notable for global benchmark crudes like WTI and Brent,. What spare crude production capacity remained in the global supply chain was now heavy and/or sour. Complex refiners – those whose sites possessed ample catalytic crackers, hydrocrackers and cokers, discovered price discounts for heavy/sour crudes reaching large and even record levels versus the benchmark crudes. This gave complex refiners every incentive to run their conversion units full, until U.S. conversion capacity became fully utilized.

The effects of these market changes were threefold:

- The marginal supply situation became as follows: **heavy/sour crude production was spare, but mismatched against less-complex spare refining capacity**
- **Less-complex refineries bidding for light/sweet crudes became the marginal supply source** and thus the market price setting mechanism
- Consequently, complex refining profitability soared, as **light/heavy crude differentials and clean/dirty spreads widened to levels not seen in decades**

It was this configuration of market events which prompted Saudi spokesmen to argue that ‘refining bottlenecks’ were a major cause of the high crude prices and resulting motor fuels prices. This diagnosis was spelled out by Dr. Adnan Shihab-Eldin, writing on behalf of the OPEC Secretary General in *World Energy Magazine*, Volume 8, Number 2, 2005:

“Now the focus is on downstream, where growth in refining capacity lags behind demand, leading to bottlenecks...downstream investment is primarily the responsibility of the consuming countries and international oil companies (IOC’s). The recent large revenue increases in the IOC’s over the last two years have not yet been visibly translated into substantial additional investments, particularly in the downstream. On Sept. 25, 2005, the Washington Post indicated that the United States, as a result of the most recent increase in the price of gasoline, crude producers are gaining around 45% over their take of the year before, while refiners have gained more than 250% in the same period. While this may, indeed, be a ‘snapshot’ in one location on a particular day, the overall picture nevertheless remains valid.”

Distilled to its essence, the Saudi comments attribute much of the responsibility for high benchmark crude prices to the IOC’s reluctance to invest in needed refining capacity. Clearly, any such assessment would encompass the large refining concentration on the U.S. Gulf Coast.

In response to such a critique, the IOC’s would likely make the following rebuttal points:

- Although new grassroots facilities have not been built, U.S. Gulf Coast refining capacity has been continuously expanded. Moreover, this ‘creep’ expansion will not only continue, but is possibly accelerating as some major expansions have been announced.
- It is appropriate for the industry to be careful not to overbuild. Bitter experience has shown how easy it is for the industry to miscalculate the amount of capacity needed and to discover, yet again, that relatively small miscalculations have large adverse margin impacts.
- And finally, time should be allowed for the market to work. Indeed, high prices are already working to dampen demand and encourage technology and adaptations that will reduce the need for new refining capacity.

Said differently, the IOC’s would argue that the U.S. energy market is very dynamic. High prices are already encouraging motorists to think about both better mileage vehicles and shifting from gasoline to diesel, hybrids or bio-fuels. It is a brave market forecaster who, in the face of all these ‘moving parts’, believes he can assess the net demand for gasoline in 2016. Yet it is exactly that kind of energy forecast which would be relevant to the economics of a major refinery expansion project launched today.

The Risks of Dependence on Imported Products

While the IOC’s may have valid forecasting and economic reasons for exercising caution, their reluctance to invest does leave the U.S. economy more dependent on product imports from more distant locations. It also leaves the same economy highly dependent on the existing industry’s concentration on the Gulf Coast. Are these structural exposures serious risks or merely the global energy market at work?

The hypothesis here is as follows: if it is accepted that bottlenecks in U.S. refining and conversion capacity currently contribute to high crude prices, then it follows that this same situation exposes the general economy to both potential supply shocks and even higher prices.

The specifics behind this hypothesis are the following. Dependence on foreign refining capacity located outside the North American tributary zone means dependence on capacity which is:

- a) not exclusively dedicated to this market, and therefore may be unavailable if/when a US emergency need arises;
- b) is partially located in countries either prone to political risks (Middle East) or whose foreign policies may not be aligned with America's (Russia); and
- c) is in the hands of companies who regard the US as a 'swing' market, rather than one for which capacity is coordinated and customized

Thus the risks are real that when/if a supply shock occurs in the US, compensatory supplies either may not be available in the form needed for this market or may not be available at all.

Having said this, it must be acknowledged that the US industry handled the Katrina supply shock with minimal disruption. Adequate import supplies were organized and rerouted in a timely manner to the east coast market. However, success in this case is no guarantee that the exposures just noted will not continue to intensify, thereby becoming more serious constraints in the next supply crisis.

The U.S. has for decades hedged its exposure to a crude oil supply shock by compiling a Strategic Petroleum Reserve. No such reserve exists in refined products. If the U.S. continues to be short of refining capacity, no amount of crude oil reserve will compensate for a major refining outage. The crude may be in Texas and Louisiana, but the available refining capacity will be overseas.

This window of vulnerability on fuel product supply may be finite. The industry is probably right that high prices will work their adjustment process over time. In-roads from ethanol may combine with flattening demand and some major U.S. refining expansions to restore a more comfortable position down the road. Already there is evidence of some refiners moving to expand facilities on the basis of integrated economics with new heavy crude production. Petrobras bought into a Pasadena refinery recently with the announced intention of doubling its capacity to accommodate heavy crude imports from Brazil. ConocoPhillips followed this by announcing a joint venture with Encana that will channel new Canadian tar sands production into two upgraded mid-west refineries. These developments could be the leading edge of a more complete adjustment process.

For the moment however, the U.S. has an exposure. Congress is aware of it and has begun to consider options for hedging both fuel product supply and price risks. Among the options under consideration are:

- Using term contracts for the purchase of fuel for the military to foster the construction of new refining capacity, and
- Some form of Strategic Fuel Product Reserve

Outside the halls of Congress, various journalists, consultants and academics have called for significant increases in motor fuel sales taxes (with proceeds going to fund a Strategic Reserve and/or subsidies or price supports for alternative energy facilities) and such steps as the reduction in tariffs on imported ethanol and/or reducing the excise tax break on domestic ethanol. These latter actions, while likely unpopular in farm belt states, would strengthen the opportunity for Caribbean sugar islands to enter the ethanol export business.

Whether any of these is a good option for improving supply security remains to be proven. Surveying all the potential changes that could divert current trends in new directions, one is inclined to be more understanding of the Refining industry's caution. The number of moving parts is large. The industry's ability to see how they will settle out is limited. The weight of history is considerable – a history reminding the industry that high prices typically lead to flat demand, oversupply and poor margins for extended periods.

Public policy should probably be developed based on the assumption that the industry will remain cautious; most likely, the Gulf Coast industry will only build such capacity as it absolutely needs to accommodate changing crude quality and product specifications or whose economics are driven by integration with production upstream. Those responsible for the U.S. economy should not assume that the industry's natural dynamics will close the window of supply vulnerability in the next couple of years. On the other hand, they should remember the mistakes of ill-judged legislation in the past such as the wasteful and ineffective small refiner bias of the 1970s.

Thus there is room for Public Policy to supplement what U.S. refiners will accomplish on their own. Whether that action will be timely or effective needs to be examined and remains to be determined.

* Exact hydroskimming margins varied materially by individual producer depending upon their disposition alternatives for residual fuel oil.